EXH. AEB-39C
DOCKETS UE-240004/UG-240005 et al.
2024 PSE GENERAL RATE CASE
WITNESS: ANN E. BULKLEY

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY,** **Respondent.**	**Docket UE-240004** **Docket UG-240005** **(*consolidated)***
In the Matter of the Petition of **PUGET SOUND ENERGY** **For an Accounting Order Authorizing deferred accounting treatment of purchased power agreement expenses pursuant to RCW 80.28.410**	**Docket UE 230810** **(*consolidated*)**

TWENTIETH EXHIBIT (CONFIDENTIAL) TO THE
PREFILED REBUTTAL TESTIMONY OF

ANN E. BULKLEY

ON BEHALF OF PUGET SOUND ENERGY

SHADED INFORMATION IS DESIGNATED AS
CONFIDENTIAL PER PROTECTIVE ORDER IN
DOCKETS UE-240004/UG-240005 ET AL.

SEPTEMBER 18, 2024

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Blue Chip Financial Forecasts®

Top Analysts' Forecasts Of U.S. And Foreign Interest Rates, Currency Values And The Factors That Influence Them

Vol. 43, No. 6, May 31, 2024

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Docket No. 23-11-02

Date Submitted: February 27, 2024

RRU-402 Q:

(FI-CREDIT RATING AGENCIES) Provide a summary exhibit with the credit ratings of CNG from January 1, 2022, to present.

a. If CNG's ratings changed since the Company's last rate case, explain why.
b. If applicable, explain how these rating changes have impacted the Company's cost of debt and its access to capital markets both for the Company's debt and any equity issuance, with supporting documentation.

RRU-402 A:

Please see response to RRU-398 subpart (c) for a summary exhibit with CNG credit ratings.

(a) CNG was upgraded by Moody's to A2 from A3 in July 2021, primarily due to the Company's strong financial performance, supported by robust cost recovery provisions for capital and operating expenses. S&P upgraded CNG to A from A- in May 2023 for similar reasons, citing consistently strong financial performance. Not long after, in September 2023, S&P revised CNG's outlook to negative with a possibility of a downgrade over the next 12 to 18 months if they revise downward their assessment of the Connecticut regulatory jurisdiction. They mention recent rate orders and legislative developments in the state that indicate the regulatory construct may be becoming less supportive for credit quality. Please see RRU-398 CNG Attachment 1 for the S&P rating reports referencing the rating upgrade and subsequent revision to negative outlook.

(b) CNG does not access the equity capital markets. As an investment grade issuer (i.e., ratings of BBB- or better) CNG has had, and continues to have, access to the debt capital markets. That being said, the Company did experience difficulties in attracting adequate subscription levels for debt issuances that closed in December 2023, and the bonds priced at a higher coupon rate than anticipated.

Specifically, Avangrid attempted to place a bond issuance for five of its operating affiliates, two of which were CNG and SCG for amounts of $55 million and $60 million, respectively. The debt issuance was a private offering in which four banks served as lead placement agents and worked with the Company to market the transaction to investors in advance of pricing. On the day of pricing, November 15th, the subscriptions sought for CNG and SCG were only 65% and 50% fulfilled, respectively. This compares to the offering for one of the other Avangrid utilities which was more than two-times subscribed. After some additional negotiation, the banks were able to get one investor to fill the remaining portions of the issuance sought for CNG and SCG and the full transaction priced on the following day; however, the credit spreads were wider than anticipated across the Avangrid

Connecticut utilities, raising the financing cost by approximately 10-15 basis points. The bankers informed Avangrid that the difficulty in fulfilling the necessary subscription levels and the wider credit spreads attracted were caused in part by the limited interest to invest in Connecticut utilities due to concerns over the regulatory environment and potential impacts to current ratings.

Prior Referenced Response

RRU-398 A:

a. and b. Please refer to the attachments described below:

RRU-398 CNG Attachment 1 – CNG Credit Rating Reports

RRU-398 CNG Attachment 2 – Avangrid Credit Rating Reports

c. Please refer to RRU-398 CNG Attachment 3 for the requested ratings from January 1, 2022 to present.

d. The rating agencies never provide steps that "guarantee" a particular credit rating. They do customarily provide commentary on what could positively or negatively impact current ratings. For example, see pages 2, 40 and 74 in RRU-398 CNG Attachment 1 for the most recent such commentary from Moody's, S&P, and Fitch, respectively.

e. The agencies publish ranges for certain metrics that map to a rating category in their methodologies. The commentary referenced in part (d) of this response indicates the key metrics that each agency is focused on and the threshold for possible ratings changes.

f. As noted in response to parts (d) and (e), achievement of particular metrics does not necessarily result in a ratings change. The Company expects that the rate structure proposed in its rate application would be supportive of current ratings at Moody's, S&P, and Fitch, with ratios in the relevant metrics ranges, but upgrades seem unlikely. Other factors such as rating agency assessments of the regulatory jurisdiction could also impact ratings.

g. Please see response to parts (d) and (e) above.

h. See attachments as described below:

RRU-398 CNG Attachment 4 – S&P Ratings Corporate Methodology, Ratios & Adjustments Criteria, Group Rating Methodology, and Key Credit Factors for the Regulated Utilities Industry

RRU-398 CNG Attachment 5 – Moody's Rating Methodologies for Regulated Electric and Gas Utilities and Financial Statement Adjustments in Analysis of Non-Financial Corporations

RRU-398 CNG Attachment 6 – Fitch Corporate Rating Criteria and Sector Navigator Addendum for North American Utilities

i. Please see RRU-398 CNG Attachment 7 for the investor relations costs. These costs are reflected on Schedule C-3.18, Corporate Service Charge Expense.

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[redacted]

Using Analysts' Growth Forecasts to Estimate Shareholder Required Rates of Return

Robert S. Harris

Robert S. Harris is a member of the faculty of the University of North Carolina at Chapel Hill. He is also an Associate Editor of Financial Management.

I. Introduction

Shareholder required rates of return play key roles in establishing economic criteria for resource allocation in many corporate and regulatory decisions. Theory dictates that such returns should be forward-looking return requirements that take into account the risk of the specific equity investment.

Estimation of such returns, however, presents numerous and difficult problems. Although theory clearly calls for a forward-looking required return, investigators, lacking a superior alternative, often resort to averages of historical realizations. One primary example is the determination of equity required return as a "least risk" rate plus a risk premium where an equity risk premium is calculated as an average of past differences between equity returns and returns on debt instruments. The historical studies of Ibbotson *et al.* [9] have been used frequently to implement this approach.[1] Use of such historical risk premia assumes that past realizations are a good surrogate for future expectations and that risk premia are roughly constant over time. Additionally, the choice of a time period over which to average data under such a procedure is essentially arbitrary. Carleton and Lakonishok [3] demonstrate empirically some of the problems with such historical premia when they are disaggregated for different time periods or groups of firms.

Recently Brigham, Shome, and Vinson [2] surveyed work on developing *ex ante* equity risk premia with particular emphasis on regulated utilities. They presented their own risk premia estimates, which make use of financial analysts' forecasts as surrogates for investor expectations.

The current paper follows an approach similar to Brigham *et al.* and derives equity required returns and risk premia using publicly available expectational

Thanks go to Ed Bachmann, Rich Harjes, and Hamid Mehran for computational assistance and to Bill Carleton, Pete Crawford, and Steve Osborn for many discussions. I gratefully acknowledge financial support from the UNC Business Foundation and the Pogue Foundation and thank Bell Atlantic for supplying data for this project. Finally, I thank colleagues at UNC for their helpful comments.

[1]Many leading texts in financial management use such historical risk premia to estimate a market return. See for example, Brealey and Myers [1]. Often a market risk premium is adjusted for the observed relative risk of a stock.

Exhibit 7. Changes in Equity Risk Premia Over Time — Entries are Coefficient (t-value)

Regression	Intercept	i_{20}	σ_g	$i_c - i_{20}$	R^2
A. SP500: Dependent Variable is Equity Risk Premium*					
1.	0.140	−0.632			0.43
	(8.15)†	(−4.95)†			
2.	0.118	−0.660	0.754		0.58
	(7.10)†	(−5.93)†	(3.32)†		
3.	0.069	−0.235		1.448	0.57
	(3.44)†	(−1.76)		(4.18)†	
4.	0.030	−0.177	0.855	1.645	0.79
	(2.17)†	(−2.07)†	(4.68)†	(7.63)†	
Regression	Intercept	i_{20}	σ_g	$i_u - i_{20}$	R^2
B. SPUT: Dependent Variable is Equity Risk Premium*					
1.	0.110	−0.510			0.37
	(7.35)†	(−4.41)†			
2.	0.101	−0.543	0.805		0.41
	(6.28)†	(−4.68)†	(1.42)		
3.	0.051	−0.259		1.432	0.80
	(5.54)†	(−4.05)†		(8.87)†	
4.	0.049	−0.287	0.387	1.391	0.80
	(5.15)†	(−3.87)†	(0.75)	(8.14)†	

*All variables are defined in Exhibit 1 and graphed in Exhibit 6. Regressions were estimated for the 36 month period January 1982–December 1984 and were corrected for serial correlation using the Prais-Winsten method. For purposes of this regression variables are expressed in decimal form, *e.g.*, 14% = 0.14.

†Significantly different from zero at 0.05 level using two-tailed test

cause of lower variability over time in the dispersion of FAF for utility stocks as compared to equities in general. The yield spread between utility and government bonds is significantly positively related to utility equity risk premia. And, as in the case of stocks in general, introduction of this spread substantially reduces the independent effect of interest rate levels on equity risk premia.

Given the short time series (36 months), tests for the stability of the relationships found in Exhibit 7 present difficulties. As a check, the relationships were reestimated dividing the data into two 18-month periods. For stocks in general (SP500), coefficients on σ_g and $(i_c - i_{20})$ were positive in all regressions and significantly so, except in the case of $(i_c - i_{20})$ for the second 18-month period. The coefficient of i_{20} was significantly negative in both periods. This confirms the general findings for the SP500 in Panel A of Exhibit 7. For utility stocks, results for the subperiods also matched the entire period results. The coefficients of $(i_u - i_{20})$ were significantly positive in both subperiods while those of σ_g were insignificantly different from zero. The level of interest rates (i_{20}) had a significant negative effect in both subperiods.

In summary, the estimated risk premia change over time and the patterns of such change are directly related to changes in proxies for the risks of equity investments. Risk premia for both stocks in general and utilities are inversely related to the level of government interest rates but positively related to the bond yield spreads which proxy for the incremental risk of investing in equities rather than government bonds. For stocks in general, risk premia also increase over time with increases in the general level of disagreement about future corporate performance.

VI. Conclusions

Notions of shareholder required rates of return and risk premia are based in theory on investors' expectations about the future. Research has demonstrated the usefulness of financial analysts' forecasts for such expectations. When such forecasts are used to derive equity risk premia, the results are quite encouraging. In addition to meeting the theoretical requirement of using expectational data, the procedure produces estimates of reasonable magnitude that behave as economic theory would predict. Both over time and across stocks, the risk premia vary directly with the perceived riskiness of equity investment.

The approach offers a straightforward and powerful aid in establishing required rates of return either for corporate investment decisions or in the regulatory arena. Since data are readily available on a wide range of equities, an investigator can analyze various proxy groups (*e.g.*, portfolios of utility stocks) appropriate for a particular decision. An additional advantage of the estimated risk premia is that they allow analysis of changes in equity return requirements over time. Tracking such changes is important for managers facing changing economic climates.

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Investor growth expectations: Analysts vs. history

Analysts' growth forecasts dominate past trends in predicting stock prices.

James H. Vander Weide and Willard T. Carleton

For the purposes of implementing the Discounted Cash Flow (DCF) cost of equity model, the analyst must know which growth estimate is embodied in the firm's stock price. A study by Cragg and Malkiel (1982) suggests that the stock valuation process embodies analysts' forecasts rather than historically based growth figures such as the ten-year historical growth in dividends per share or the five-year growth in book value per share. The Cragg and Malkiel study is based on data for the 1960s, however, a decade that was considerably more stable than the recent past.

As the issue of which growth rate to use in implementing the DCF model is so important to applications of the model, we decided to investigate whether the Cragg and Malkiel conclusions continue to hold in more recent periods. This paper describes the results of our study.

STATISTICAL MODEL

The DCF model suggests that the firm's stock price is equal to the present value of the stream of dividends that investors expect to receive from owning the firm's shares. Under the assumption that investors expect dividends to grow at a constant rate, g, in perpetuity, the stock price is given by the following simple expression:

$$P_S = \frac{D\,(1 + g)}{k - g} \qquad (1)$$

where:

P_S = current price per share of the firm's stock;

D = current annual dividend per share;

g = expected constant dividend growth rate; and

k = required return on the firm's stock.

Dividing both sides of Equation (1) by the firm's current earnings, E, we obtain:

$$\frac{P_S}{E} = \frac{D}{E} \cdot \frac{(1 + g)}{k - g} \qquad (2)$$

Thus, the firm's price/earnings (P/E) ratio is a non-linear function of the firm's dividend payout ratio (D/E), the expected growth in dividends (g), and the required rate of return.

To investigate what growth expectation is embodied in the firm's current stock price, it is more convenient to work with a linear approximation to Equation (2). Thus, we will assume that:

$$P/E = a_0(D/E) + a_1 g + a_2 k. \qquad (3)$$

(Cragg and Malkiel found this assumption to be reasonable throughout their investigation.)

Furthermore, we will assume that the required

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rate of return, k, in Equation (3) depends on the values of the risk variables B, Cov, Rsq, and Sa, where B is the firm's Value Line beta; Cov is the firm's pretax interest coverage ratio; Rsq is a measure of the stability of the firm's five-year historical EPS; and Sa is the standard deviation of the consensus analysts' five-year EPS growth forecast for the firm. Finally, as the linear form of the P/E equation is only an approximation to the true P/E equation, and B, Cov, Rsq, and Sa are only proxies for k, we will add an error term, e, that represents the degree of approximation to the true relationship.

With these assumptions, the final form of our P/E equation is as follows:

$$P/E = a_0(D/E) + a_1 g + a_2 B + a_3 Cov + a_4 Rsq + a_5 Sa + e. \quad (4)$$

The purpose of our study is to use more recent data to determine which of the popular approaches for estimating future growth in the Discounted Cash Flow model is embodied in the market price of the firm's shares.

We estimated Equation (4) to determine which estimate of future growth, g, when combined with the payout ratio, D/E, and risk variables B, Cov, Rsq, and Sa, provides the best predictor of the firm's P/E ratio. To paraphrase Cragg and Malkiel, we would expect that growth estimates found in the best-fitting equation more closely approximate the expectation used by investors than those found in poorer-fitting equations.

DESCRIPTION OF DATA

Our data sets include both historically based measures of future growth and the consensus analysts' forecasts of five-year earnings growth supplied by the Institutional Brokers Estimate System of Lynch, Jones & Ryan (IBES). The data also include the firm's dividend payout ratio and various measures of the firm's risk. We include the latter items in the regression, along with earnings growth, to account for other variables that may affect the firm's stock price.

The data include:

Earnings Per Share. Because our goal is to determine which earnings variable is embodied in the firm's market price, we need to define this variable with care. Financial analysts who study a firm's financial results in detail generally prefer to "normalize" the firm's reported earnings for the effect of extraordinary items, such as write-offs of discontinued operations, or mergers and acquisitions. They also attempt, to the extent possible, to state earnings for different firms using a common set of accounting conventions.

We have defined "earnings" as the consensus analyst estimate (as reported by IBES) of the firm's earnings for the forthcoming year.[1] This definition approximates the normalized earnings that investors most likely have in mind when they make stock purchase and sell decisions. It implicitly incorporates the analysts' adjustments for differences in accounting treatment among firms and the effects of the business cycle on each firm's results of operations. Although we thought at first that this earnings estimate might be highly correlated with the analysts' five-year earnings growth forecasts, that was not the case. Thus, we avoided a potential spurious correlation problem.

Price/Earnings Ratio. Corresponding to our definition of "earnings," the price/earnings ratio (P/E) is calculated as the closing stock price for the year divided by the consensus analyst earnings forecast for the forthcoming fiscal year.

Dividends. Dividends per share represent the common dividends declared per share during the calendar year, after adjustment for all stock splits and stock dividends). The firm's dividend payout ratio is then defined as common dividends per share divided by the consensus analyst estimate of the earnings per share for the forthcoming calendar year (D/E). Although this definition has the deficiency that it is obviously biased downward — it divides this year's dividend by next year's earnings — it has the advantage that it implicitly uses a "normalized" figure for earnings. We believe that this advantage outweighs the deficiency, especially when one considers the flaws of the apparent alternatives. Furthermore, we have verified that the results are insensitive to reasonable alternative definitions (see footnote 1).

Growth. In comparing historically based and consensus analysts' forecasts, we calculated forty-one different historical growth measures. These included the following: 1) the past growth rate in EPS as determined by a log-linear least squares regression for the latest year,[2] two years, three years, . . ., and ten years; 2) the past growth rate in DPS for the latest year, two years, three years, . . ., and ten years; 3) the past growth rate in book value per share (computed as the ratio of common equity to the outstanding common equity shares) for the latest year, two years, three years, . . ., and ten years; 4) the past growth rate in cash flow per share (computed as the ratio of pretax income, depreciation, and deferred taxes to the outstanding common equity shares) for the latest year, two years, three years, . . ., and ten years; and 5) plowback growth (computed as the firm's retention ratio for the current year times the firm's latest annual return on common equity).

We also used the five-year forecast of earnings per share growth compiled by IBES and reported in mid-January of each year. This number represents the consensus (i.e., mean) forecast produced by analysts from the research departments of leading Wall Street and regional brokerage firms over the preceding three months. IBES selects the contributing brokers "because of the superior quality of their research, professional reputation, and client demand" (IBES *Monthly Summary Book*).

Risk Variables. Although many risk factors could potentially affect the firm's stock price, most of these factors are highly correlated with one another. As shown above in Equation (4), we decided to restrict our attention to four risk measures that have intuitive appeal and are followed by many financial analysts: 1) B, the firm's beta as published by Value Line; 2) Cov, the firm's pretax interest coverage ratio (obtained from Standard & Poor's Compustat); 3) Rsq, the stability of the firm's five-year historical EPS (measured by the R^2 from a log-linear least squares regression); and 4) Sa, the standard deviation of the consensus analysts' five-year EPS growth forecast (mean forecast) as computed by IBES.

After careful analysis of the data used in our study, we felt that we could obtain more meaningful results by imposing six restrictions on the companies included in our study:

1. Because of the need to calculate ten-year historical growth rates, and because we studied three different time periods, 1981, 1982, and 1983, our study requires data for the thirteen-year period 1971-1983. We included only companies with at least a thirteen-year operating history in our study.
2. As our historical growth rate calculations were based on log-linear regressions, and the logarithm of a negative number is not defined, we excluded all companies that experienced negative EPS during any of the years 1971-1983.
3. For similar reasons, we also eliminated companies that did not pay a dividend during any one of the years 1971-1983.
4. To insure comparability of time periods covered by each consensus earnings figure in the P/E ratios, we eliminated all companies that did not have a December 31 fiscal year-end.
5. To eliminate distortions caused by highly unusual events that distort current earnings but not expected future earnings, and thus the firm's price/earnings ratio, we eliminated any firm with a price/earnings ratio greater than 50.
6. As the evaluation of analysts' forecasts is a major part of this study, we eliminated all firms that IBES did not follow.

Our final sample consisted of approximately sixty-five utility firms.[3]

RESULTS

To keep the number of calculations in our study to a reasonable level, we performed the study in two stages. In Stage 1, all forty-one historically oriented approaches for estimating future growth were correlated with each firm's P/E ratio. In Stage 2, the historical growth rate with the highest correlation to the P/E ratio was compared to the consensus analyst growth rate in the multiple regression model described by Equation (4) above. We performed our regressions for each of three recent time periods, because we felt the results of our study might vary over time.

First-Stage Correlation Study

Table 1 gives the results of our first-stage correlation study for each group of companies in each of the years 1981, 1982, and 1983. The values in this table measure the correlation between the historically oriented growth rates for the various time periods and the firm's end-of-year P/E ratio.

The four variables for which historical growth rates were calculated are shown in the left-hand column: EPS indicates historical earnings per share growth, DPS indicates historical dividend per share growth, BVPS indicates historical book value per share growth, and CFPS indicates historical cash flow per share growth. The term "plowback" refers to the product of the firm's retention ratio in the currennt year and its return on book equity for that year. In all, we calculated forty-one historically oriented growth rates for each group of firms in each study period.

The goal of the first-stage correlation analysis was to determine which historically oriented growth rate is most highly correlated with each group's year-end P/E ratio. Eight-year growth in CFPS has the highest correlation with P/E in 1981 and 1982, and ten-year growth in CFPS has the highest correlation with year-end P/E in 1983. In all cases, the plowback estimate of future growth performed poorly, indicating that — contrary to generally held views — plowback is not a factor in investor expectations of future growth.

Second-Stage Regression Study

In the second stage of our regression study, we ran the regression in Equation (4) using two different measures of future growth, g: 1) the best historically oriented growth rate (g_h) from the first-stage correlation study, and 2) the consensus analysts' forecast (g_a) of five-year EPS growth. The regression results, which are shown in Table 2, support at least

TABLE 1

Correlation Coefficients of All Historically Based Growth Estimates by Group and by Year with P/E

Historical Growth Rate Period in Years

Current Year	1	2	3	4	5	6	7	8	9	10
1981										
EPS	−0.02	0.07	0.03	0.01	0.03	0.12	0.08	0.09	0.09	0.09
DPS	0.05	0.18	0.14	0.15	0.14	0.15	0.19	0.23	0.23	0.23
BVPS	0.01	0.11	0.13	0.13	0.16	0.18	0.15	0.15	0.15	0.15
CFPS	−0.05	0.04	0.13	0.22	0.28	0.31	0.30	0.31	−0.57	−0.54
Plowback	0.19									
1982										
EPS	−0.10	−0.13	−0.06	−0.02	−0.02	−0.01	−0.03	−0.03	0.00	0.00
DPS	−0.19	−0.10	0.03	0.05	0.07	0.08	0.09	0.11	0.13	0.13
BVPS	0.07	0.08	0.11	0.11	0.09	0.10	0.11	0.11	0.09	0.09
CFPS	−0.02	−0.08	0.00	0.10	0.16	0.19	0.23	0.25	0.24	0.07
Plowback	0.04									
1983										
EPS	−0.06	−0.25	−0.25	−0.24	−0.16	−0.11	−0.05	0.00	0.02	0.02
DPS	0.03	−0.10	−0.03	0.08	0.15	0.21	0.21	0.21	0.22	0.24
BVPS	0.03	0.10	0.04	0.09	0.15	0.16	0.19	0.21	0.22	0.21
CFPS	−0.08	0.01	0.02	0.08	0.20	0.29	0.35	0.38	0.40	0.42
Plowback	−0.08									

two general conclusions regarding the pricing of equity securities.

First, we found overwhelming evidence that the consensus analysts' forecast of future growth is superior to historically oriented growth measures in predicting the firm's stock price. In every case, the R^2 in the regression containing the consensus analysts' forecast is higher than the R^2 in the regression containing the historical growth measure. The regression coefficients in the equation containing the consensus analysts' forecast also are considerably more significant than they are in the alternative regression. These results are consistent with those found by Cragg and Malkiel for data covering the period 1961-1968. Our results also are consistent with the hypothesis that investors use analysts' forecasts, rather than historically oriented growth calculations, in making stock buy–and–sell decisions.

TABLE 2

Regression Results
Model I

Part A: *Historical*

$P/E = a_0 + a_1 D/E + a_2 g_h + a_3 B + a_4 Cov + a_5 Rsq + a_6 Sa$

Year	$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	$\hat{a}_3$	$\hat{a}_4$	$\hat{a}_5$	$\hat{a}_6$	R^2	F Ratio
1981	−6.42*	10.31*	7.67*	3.24	0.54*	1.42*	57.43	0.83	46.49
	(5.50)	(14.79)	(2.20)	(2.86)	(2.50)	(2.85)	(4.07)		
1982	−2.90*	9.32*	8.49*	2.85	0.45*	−0.42	3.63	0.86	65.53
	(2.75)	(18.52)	(4.18)	(2.83)	(2.60)	(0.05)	(0.26)		
1983	−5.96*	10.20*	19.78*	4.85	0.44*	0.33	32.49	0.82	45.26
	(3.70)	(12.20)	(4.83)	(2.95)	(1.89)	(0.50)	(1.29)		

Part B: *Analysis*

$P/E = a_0 + a_1 D/E + a_2 g_a + a_3 B + a_4 Cov + a_5 Rsq + a_6 Sa$

Year	$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	$\hat{a}_3$	$\hat{a}_4$	$\hat{a}_5$	$\hat{a}_6$	R^2	F Ratio
1981	−4.97*	10.62*	54.85*	−0.61	0.33*	0.63*	4.34	0.91	103.10
	(6.23)	(21.57)	(8.56)	(0.68)	(2.28)	(1.74)	(0.37)		
1982	−2.16*	9.47*	50.71*	−1.07	0.36*	−0.31	119.05*	0.90	97.62
	(2.59)	(22.46)	(9.31)	(1.14)	(2.53)	(1.09)	(1.60)		
1983	−8.47*	11.96*	79.05*	2.16	0.56*	0.20	−34.43	0.87	69.81
	(7.07)	(16.48)	(7.84)	(1.55)	(3.08)	(0.38)	(1.44)		

Notes:
* Coefficient is significant at the 5% level (using a one-tailed test) and has the correct sign. T-statistic in parentheses.

Second, there is some evidence that investors tend to view risk in traditional terms. The interest coverage variable is statistically significant in all but one of our samples, and the stability of the operating income variable is statistically significant in six of the twelve samples we studied. On the other hand, the beta is never statistically significant, and the standard deviation of the analysts' five-year growth forecasts is statistically significant in only two of our twelve samples. This evidence is far from conclusive, however, because, as we demonstrate later, a significant degree of cross-correlation among our four risk variables makes any general inference about risk extremely hazardous.

Possible Misspecification of Risk

The stock valuation theory says nothing about which risk variables are most important to investors. Therefore, we need to consider the possibility that the risk variables of our study are only proxies for the "true" risk variables used by investors. The inclusion of proxy variables may increase the variance of the parameters of most concern, which in this case are the coefficients of the growth variables.[4]

To allow for the possibility that the use of risk proxies has caused us to draw incorrect conclusions concerning the relative importance of analysts' growth forecasts and historical growth extrapolations, we have also estimated Equation (4) with the risk variables excluded. The results of these regressions are shown in Table 3.

Again, there is overwhelming evidence that the consensus analysts' growth forecast is superior to the historically oriented growth measures in predicting the firm's stock price. The R^2 and t-statistics are higher in every case.

CONCLUSION

The relationship between growth expectations and share prices is important in several major areas of finance. The data base of analysts' growth forecasts collected by Lynch, Jones & Ryan provides a unique opportunity to test the hypothesis that investors rely more heavily on analysts' growth forecasts than on historical growth extrapolations in making security buy–and–sell decisions. With the help of this data base, our studies affirm the superiority of analysts' forecasts over simple historical growth extrapolations in the stock price formation process. Indirectly, this finding lends support to the use of valuation models whose input includes expected growth rates.

TABLE 3

Regression Results
Model II

Part A: *Historical*

$P/E = a_0 + a_1 D/E + a_2 g_h$

Year	$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	R^2	F Ratio
1981	−1.05	9.59	21.20	0.73	82.95
	(1.61)	(12.13)	(7.05)		
1982	0.54	8.92	12.18	0.83	167.97
	(1.38)	(17.73)	(6.95)		
1983	−0.75	8.92	12.18	0.77	107.82
	(1.13)	(12.38)	(7.94)		

Part B: *Analysis*

$P/E + a_0 + a_1 D/E + a_2 g_a$

Year	$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	R^2	F Ratio
1981	3.96	10.07	60.53	0.90	274.16
	(8.31)	(8.31)	(20.91)	(15.79)	
1982	−1.75	9.19	44.92	0.88	246.36
	(4.00)	(4.00)	(21.35)	(11.06)	
1983	−4.97	10.95	82.02	0.83	168.28
	(6.93)	(6.93)	(15.93)	(11.02)	

Notes:
* Coefficient is significant at the 5% level (using a one-tailed test) and has the correct sign. T-statistic in parentheses.

[1] We also tried several other definitions of "earnings," including the firm's most recent primary earnings per share prior to any extraordinary items or discontinued operations. As our results were insensitive to reasonable alternative definitions of "earnings " we report only the results for the IBES consensus.

[2] For the latest year, we actually employed a point-to-point growth calculation because there were only two available observations.

[3] We use the word "approximately," because the set of available firms varied each year. In any case, the number varied only from zero to three firms on either side of the figures cited here.

[4] See Maddala (1977).

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7

Estimating Shareholder Risk Premia Using Analysts' Growth Forecasts

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■ One of the most widely used concepts in finance is that shareholders require a risk premium over bond yields to bear the additional risks of equity investments. While models such as the two-parameter capital asset pricing model (CAPM) or arbitrage pricing theory offer explicit methods for varying risk premia across securities, the models are invariably linked to some underlying market (or factor-specific) risk premium. Unfortunately, the theoretical models provide limited practical advice on establishing empirical estimates of such a benchmark market risk premium. As a result, the typical advice to practitioners is to estimate the market risk premium based on historical realizations of share and bond returns (see Brealey and Myers [3]).

In this paper, we present estimates of shareholder required rates of return and risk premia which are derived using forward-looking analysts' growth forecasts. We update, through 1991, earlier work which, due to data availability, was restricted to the period 1982-1984 (Harris [12]). Using stronger tests, we also reexamine the efficacy of using such an expectational approach as an alternative to the use of historical averages. Using the S&P 500 as a proxy for the market portfolio, we find an average market risk premium (1982-1991) of 6.47% above yields on long-term U.S. government bonds and 5.13% above yields on corporate bonds. We also find that required returns for individual stocks vary directly with their risk (as proxied by beta) and that the market risk premium varies over time. In particular, the equity market premium over government bond yields is higher in low interest rate environments and when there is a larger spread between corporate and government bond yields. These findings show that, in addition to fitting the theoretical requirement of being forward-looking, the utilization of analysts' forecasts in estimating return requirements provides reasonable empirical results that can be useful in practical applications.

Section I provides background on the estimation of equity required returns and a brief discussion of related

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literature on financial analysts' forecasts (FAF). In Section II, models and data are discussed. Following a comparison of the results to historical risk premia, the estimates are subjected to economic tests of both their time-series and cross-sectional characteristics in Section III. Finally, conclusions are offered in Section IV.

I. Background and Literature Review

In establishing economic criteria for resource allocation, it is often convenient to use the notion of a shareholder's required rate of return. Such a rate (k) is the minimum level of expected return necessary to compensate the investor for bearing risks and receiving dollars in the future rather than in the present. In general, k will depend on returns available on alternative investments (e.g., bonds or other equities) and the riskiness of the stock. To isolate the effects of risk, it is useful to work in terms of a risk premium (rp), defined as

$$rp = k - i, \tag{1}$$

where i = required return for a zero risk investment.[1]

Lacking a superior alternative, investigators often use averages of historical realizations to estimate a benchmark "market" risk premium which then may be adjusted for the relative risk of individual stocks (e.g., using the CAPM or a variant). The historical studies of Ibbotson Associates [13] have been used frequently to implement this approach.[2] This historical approach requires the assumptions that past realizations are a good surrogate for future expectations and, as typically applied, that risk premia are constant over time. Carleton and Lakonishok [5] demonstrate empirically some of the problems with such historical premia when they are disaggregated for different time periods or groups of firms.

As an alternative to historical estimates, the current paper derives estimates of k, and hence, implied values of rp, using publicly available expectational data. This expectational approach employs the dividend growth model (hereafter referred to as the discounted cash flow or DCF model) in which a consensus measure of financial analysts' forecasts (FAF) of earnings is used as a proxy for investor expectations. Earlier works by Malkiel [17], Brigham, Vinson, and Shome [4], and Harris [12] have used FAF in DCF models, and this approach has been employed in regulatory settings (see Harris [12]) and suggested by consultants as an alternative to use of historical data (e.g., Ibbotson Associates [13, pp. 127, 128]). Unfortunately, the published studies use data extending to 1984 at the latest. Our paper draws on this earlier work but extends it through 1991.[3] Our work is closest to that done by Harris [12], who reviews literature showing a strong link between equity prices and FAF and supporting the use of FAF as a proxy for investor expectations. Using data from 1982 to 1984, Harris' results suggest that this expectational approach to estimating equity risk premia is an encouraging alternative to the use of historical averages. He also demonstrates that such risk premia vary both cross-sectionally with the riskiness of individual stocks and over time with financial market conditions.

II. Models and Data

A. Model for Estimation

The simplest and most commonly used version of the DCF model to estimate shareholders' required rate of return, k, is shown in Equation (2):

$$k = \left(\frac{D_1}{P_0}\right) + g, \tag{2}$$

where D_1 = dividend per share expected to be received at time one, P_0 = current price per share (time 0), and g = expected growth rate in dividends per share. The limitations of this model are well known, and it is straightforward to derive expressions for k based on more general specifications of the DCF model.[4] The primary difficulty in using the DCF model is obtaining an estimate of g, since it should reflect market expectations of future perfor-

[1]Theoretically, i is a risk-free rate, though empirically its proxy (e.g., yield to maturity on a government bond) is only a "least risk" alternative that is itself subject to risk. In this development, the effects of tax codes on required returns are ignored.

[2]Many leading texts in financial management use such historical risk premia to estimate a market return. See, for example, Brealey and Myers [3]. Often a market risk premium is adjusted for the observed relative risk of a stock.

[3]See Harris [12] for a discussion of the earlier work and a detailed discussion of the approach employed here.

[4]As stated, Equation (2) requires expectations of either an infinite horizon of dividend growth at a rate g or a finite horizon of dividend growth at rate g and special assumptions about the price of the stock at the end of that horizon. Essentially, the assumption must ensure that the stock price grows at a compound rate of g over the finite horizon. One could alternatively estimate a nonconstant growth model, although the proxies for multistage growth rates are even more difficult to obtain than single stage growth estimates. Marston, Harris, and Crawford [19] examine publicly available data from 1982-1985 and find that plausible measures of risk are more closely related to expected returns derived from a constant growth model than to those derived from multistage growth models. These findings illustrate empirical difficulties in finding empirical proxies for multistage growth models for large samples.

mance. Without a ready source for measuring such expectations, application of the DCF model is fraught with difficulties. This paper uses published FAF of long-run growth in earnings as a proxy for g.

B. Data

FAF for this research come from IBES (Institutional Broker's Estimate System), which is a product of Lynch, Jones, and Ryan, a major brokerage firm.[5] Representative of industry practice, IBES contains estimates of (i) EPS for the upcoming fiscal years (up to five separate years), and (ii) a five-year growth rate in EPS. Each item is available at monthly intervals.

The mean value of individual analysts' forecasts of five-year growth rate in EPS will be used as a proxy for g in the DCF model.[6] The five-year horizon is the longest horizon over which such forecasts are available from IBES and often is the longest horizon used by analysts. IBES requests "normalized" five-year growth rates from analysts in order to remove short-term distortions that might stem from using an unusually high or low earnings year as a base.

Dividend and other firm-specific information come from COMPUSTAT. Interest rates (both government and corporate) are gathered from Federal Reserve Bulletins and *Moody's Bond Record*. Exhibit 1 describes key variables used in the study. Data collected cover all dividend paying stocks in the Standard & Poor's 500 stock (S&P 500) index, plus approximately 100 additional stocks of regulated companies. Since five-year growth rates are first available from IBES beginning in 1982, the analysis covers the 113-month period from January 1982 to May 1991.

III. Risk Premia and Required Rates of Return

A. Construction of Risk Premia

For each month, a "market" required rate of return is calculated using each dividend paying stock in the S&P 500 index for which data are available. The DCF model in Equation (2) is applied to each stock and the results weighted by market value of equity to produce the market required return.[7] The return is converted to a risk premium

For equity

Exhibit 1. Variable Definitions

k	=	Equity required rate of return.
P_0	=	Average daily price per share.
D_1	=	Expected dividend per share measured as current indicated annual dividend from COMPUSTAT multiplied by $(1 + g)$.[a]
g	=	Average financial analysts' forecast of five-year growth rate in earnings per share (from IBES).
i_{lt}	=	Yield to maturity on long-term U.S. government obligations (source: Federal Reserve Bulletin, constant maturity series).
i_c	=	Yield to maturity on long-term corporate bonds: Moody's average.[b]
rp	=	Equity risk premium calculated as $rp = k - i$.
β	=	beta, calculated from CRSP monthly data over 60 months.

Notes:
[a]See footnote 7 for a discussion of the $(1 + g)$ adjustment.
[b]The average corporate bond yield across bond rating categories as reported by Moody's. See *Moody's Bond Survey* for a brief description and the latest published list of bonds included in the bond rating categories.

[5]Harris [12] provides a discussion of IBES data and its limitations. In more recent years, IBES has begun collecting forecasts for each of the next five years. Since this work was completed, the FAF used here have become available from IBES Inc., now a subsidiary of CitiBank.

[6]While the model calls for expected growth in dividends, no source of data on such projections is readily available. In addition, in the long run, dividend growth is sustainable only via growth in earnings. As long as payout ratios are not expected to change, the two growth rates will be the same.

[7]The construction of D_1 is controversial since dividends are paid quarterly and may be expected to change during the year; whereas, Equation (2), as is typical, is being applied to annual data. Both the quarterly payment of dividends (due to investors' reinvestment income before year's end, see Linke and Zumwalt [15]) and any growth during the year require an upward adjustment of the current annual rate of dividends to construct D_1. If quarterly dividends grow at a constant rate, both factors could be accommodated straightforwardly by applying Equation (2) to quarterly data with a quarterly growth rate and then annualizing the estimated quarterly required return. Unfortunately, with lumpy changes in dividends, the precise nature of the adjustment depends on both an individual company's pattern of growth during the calendar year and an individual company's required return (and hence reinvestment income in the risk class).
In this work, D_1 is calculated as $D_0\ (1 + g)$. The full g adjustment is a crude approximation to adjust for both growth and reinvestment income. For example, if one expected dividends to have been raised, on average, six months ago, a "1/2 g" adjustment would allow for growth, and the remaining "1/2 g" would be justified on the basis of reinvestment income. Any precise accounting for both reinvestment income and growth would require tracking each company's dividend change history and making explicit judgments about the quarter of the next change. Since no organized "market" forecast of such a detailed nature exists, such a procedure is not possible. To get a feel for the magnitudes involved, during the sample period the dividend yield (D_1/P_0) and growth (market value weighted) for the S&P 500 were typically 4% to 6% and 11% to 13%, respectively. As a result, a "full g" adjustment on average increases the required return by 60 to 70 basis points (relative to no g adjustment).

Exhibit 2. Bond Market Yields, Equity Required Return, and Equity Risk Premium,[a] 1982-1991

	Bond Market Yields[b]		Equity Market Required Return[c]	Equity Risk Premium	
Year	(1) U.S. Gov't	(2) Moody's Corporates	(3) S&P 500	U.S. Gov't (3) - (1)	Moody's Corporates (3) - (2)
1982	12.92	14.94	20.08	7.16	5.14
1983	11.34	12.78	17.89	6.55	5.11
1984	12.48	13.49	17.26	4.78	3.77
1985	10.97	12.05	16.32	5.37	4.28
1986	7.85	9.71	15.09	7.24	5.38
1987	8.58	9.84	14.71	6.13	4.86
1988	8.96	10.18	15.37	6.41	5.19
1989	8.46	9.66	15.06	6.60	5.40
1990	8.61	9.77	15.69	7.08	5.92
1991[d]	8.21	9.41	15.61	7.40	6.20
Average[e]	9.84	11.18	16.31	6.47	5.13

Notes:
[a]Values are averages of monthly figures in percent.
[b]Yields to maturity.
[c]Required return on value weighted S&P 500 index using Equation (1).
[d]Figures for 1991 are through May.
[e]Months weighted equally.

over government bonds by subtracting i_{lt}, the yield to maturity on long-term government bonds. A risk premium over corporate bond yields is also constructed by subtracting i_c, the yield on long-term corporate bonds. Exhibit 2 reports the results by year (averages of monthly data).

The results are quite consistent with the patterns reported earlier (i.e., Harris [12]). The estimated risk premia in Exhibit 2 are positive, consistent with equity owners demanding additional rewards over and above returns on debt securities. The average expectational risk premium (1982 to 1991) over government bonds is 6.47%, only slightly higher than the 6.16% average for 1982 to 1984 reported earlier (Harris [12]). Furthermore, Exhibit 2 shows the estimated risk premia change over time, suggesting changes in the market's perception of the incremental risk of investing in equity rather than debt securities.

For comparison purposes, Exhibit 3 contains historical returns and risk premia. The average expectational risk premium reported in Exhibit 2 falls roughly midway between the arithmetic (7.5%) and geometric (5.7%) long-term differentials between returns on stocks and long-term government bonds. Note, however, that the expectational risk premia appear to change over time. In the following sections, we examine the estimated risk premia to see if they vary cross-sectionally with the risk of individual stocks and over time with financial market conditions.

B. Cross-Sectional Tests

Earlier, Harris [12] conducted crude tests of whether expectational equity risk premia varied with risk proxied by bond ratings and the dispersion of analysts' forecasts and found that required returns increased with higher risk. Here we examine the link between these premia and beta, perhaps the most commonly used measure of risk for equities.[8] In keeping with traditional work in this area, we adopt the methodology introduced by Fama and Macbeth [9] but replace realized returns with expected returns from Equation (2) as the variable to be explained. For this portion of our tests, we restrict our sample to 1982-1987

[8]For other efforts using expectational data in the context of the two-parameter CAPM, see Friend, Westerfield, and Granito [10], Cragg and Malkiel [7], Marston, Crawford, and Harris [19], Marston and Harris [20], and Linke, Kannan, Whitford, and Zumwalt [16]. For a more complete treatment of the subject, see Marston and Harris [20] from which we draw some of these results. Marston and Harris also investigate the role of unsystematic risk and the difference in estimates found when using expected versus realized returns.

Exhibit 3. Average Historical Returns on Bonds, Stocks, Bills, and Inflation in the U.S., 1926-1989

Historical Return Realizations	Geometric	Arithmetic
Common stock	10.3%	12.4%
Long-term government bonds	4.6%	4.9%
Long-term corporate bonds	5.2%	5.5%
Treasury bills	3.6%	3.7%
Inflation rate	3.1%	3.2%

Source: Ibbotson Associates, Inc., *1990 Stocks, Bonds, Bills and Inflation*, 1990 Yearbook.

and in any month include firms that have at least three forecasts of earnings growth to reduce measurement error associated with individual forecasts.[9] This restricted sample still consists of, on average, 399 firms for each of the 72 months (or 28,744 company months).

For a given company in a given month, beta is estimated via the market model (using ordinary least squares) on the prior 60 months of return data taken from CRSP. Beta estimates are updated monthly and are calculated against an equally weighted index of all NYSE securities. For each month, we aggregate firms into 20 portfolios (consisting of approximately 20 securities each). The advantage of grouped data is the reduction in potential measurement error inherent in independent variables at the company level. Portfolios are formed based on a ranking of beta estimated from a prior time period (t = -61 to t = -120). Portfolio expected returns and beta are calculated as the simple averages for the individual securities.

Using these data, we estimate the following model for each of the 72 months:

$$R_p = \alpha_0 + \alpha_1 \beta_p + u_p, \quad p = 1...20, \qquad (3)$$

where:

R_p = Expected return for portfolio p in the given month,

β_p = Portfolio beta, estimated over 60 prior months, and

u_p = A random error term with mean zero.

As a result of estimating regression (3) for each month, 72 estimates of each coefficient (α_0 and α_1) are obtained. Using realized returns as the dependent variable, the traditional approach (e.g., Fama and Macbeth [9]) is to assume that realized returns are a fair game. Given this assumption, the mean of the 72 values of each coefficient is an unbiased estimate of the mean over that same time period if one could have actually used expected returns as the dependent variable. Note that if expected returns are used as the dependent variable the fair-game assumption is not required. Making the additional assumption that the true value of the coefficient is constant over the 72 months, a test of whether the mean coefficient is different from zero is performed using a t-statistic where the denominator is the standard error of the 72 values of the coefficient. This is the technique employed by Fama and Macbeth [9]. If one assumes the CAPM is correct, the coefficient α_1 is an empirical estimate of the market risk premium, which should be positive.

To test the sensitivity of the results, we also repeat our procedures using individual security returns rather than portfolios. To account, at least in part, for differences in precision of coefficient estimates in different months we also report results in which monthly parameter estimates are weighted inversely by the standard error of the coefficient estimate rather than being weighted equally (following Chan, Hamao, and Lakonishok [6]).

Exhibit 4 shows that there is a significant positive link between expectational required returns and beta. For instance, in Panel A, the mean coefficient of 2.78 on beta is significantly different from zero at better than the 0.001 level (t = 35.31), and each of the 72 monthly coefficients going into this average is positive (as shown by that 100% positive figure). Using individual stock returns, the significant positive link between beta and expected return remains, though it is smaller in magnitude than for portfolios.[10] Comparison of Panels A and B shows that the results are not sensitive to the weighting of monthly coefficients.

While the findings in Exhibit 4 suggest a strong positive link between beta and risk premia (a result often not supported when realized returns are used as a proxy for expectations; e.g., see Tinic and West [22]), the results do not support the predictions of a simple CAPM. In particular, the intercept is higher than a proxy for the risk-free rate over the sample period and the coefficient of beta is well below estimates of a market risk premium obtained from either expectational (Exhibit 2) or historical data (Exhibit

[9]Firms for which the standard deviation of individual FAF exceeded 20 in any month were excluded since we suspect some of these involve errors in data entry. This screen eliminated very few companies in any month. The 1982-1987 period was chosen due to the availability of data on betas.

[10]The smaller coefficients on beta using individual stock portfolio returns are likely due in part to the higher measurement error in measuring individual stock versus portfolio betas.

Exhibit 4. Mean Values of Monthly Parameter Estimates for the Relationship Between Required Returns and Beta for Both Portfolios and Individual Securities (Figures in Parentheses are *t* Values and Percent Positive), 1982-1987

	Intercept	B	Adjusted $R^{2\,c}$	F^c
Panel A. Equal Weighting[a]				
Portfolio returns	14.06 (54.02, 100)	2.78 (35.31, 100)	0.503	25.4
Security returns	14.77 (58.10, 100)	1.91 (16.50, 99)	0.080	39.0
Panel B. Weighted by Standard Errors[b]				
Portfolio returns	13.86 (215.6, 100)	2.67 (35.80, 100)	0.503	25.4
Security returns	14.63 (398.9, 100)	1.92 (47.3, 99)	0.080	39.0

[a]Equally weighted average of monthly parameters estimated using cross-sectional data for each of the 72 months, January 1982 - December 1987.
[b]In obtaining the reported means, estimates of the monthly intercept and slope coefficients are weighted inversely by the standard error of the estimate from the cross-sectional regression for that month.
[c]Values are averages for the 72 monthly regressions.

3).[11] Nonetheless, the results show that the estimated risk premia conform to the general theoretical relationship between risk and required return that is expected when investors are risk-averse.

C. Time Series Tests — Changes in Market Risk Premia

A potential benefit of using ex ante risk premia is the estimation of changes in market risk premia over time. With changes in the economy and financial markets, equity investments may be perceived to change in risk. For instance, investor sentiment about future business conditions likely affects attitudes about the riskiness of equity investments compared to investments in the bond markets. Moreover, since bonds are risky investments themselves, equity risk premia (relative to bonds) could change due to changes in perceived riskiness of bonds, even if equities displayed no shifts in risk. For example, during the high interest rate period of the early 1980s, the high level of interest rate volatility made fixed income investments more risky holdings than they were in a world of relatively stable rates.

Studying changes in risk premia for utility stocks, Brigham, et al [4] conclude that, prior to 1980, utility risk premia increased with the level of interest rates, but that this pattern reversed thereafter, resulting in an inverse correlation between risk premia and interest rates. Studying risk premia for both utilities and the equity market generally, Harris [12] also reports that risk premia appear to change over time. Specifically, he finds that equity risk premia decreased with the level of government interest rates, increased with the increases in the spread between corporate and government bond yields, and increased with increases in the dispersion of analysts' forecasts. Harris' study is, however, restricted to the 36-month period, 1982 to 1984.

Exhibit 5 reports results of analyzing the relationship between equity risk premia, interest rates, and yield spreads between corporate and government bonds. Following Harris [12], these bond yield spreads are used as a time series proxy for equity risk. As the perceived riskiness of corporate activity increases, the difference between yields on corporate bonds and government bonds should increase. One would expect the sources of increased riskiness to corporate bonds to also increase risks to shareholders. All regressions in Exhibit 5 are corrected for serial correlation.[12]

[11]Estimation difficulties confound precise interpretation of the intercept as the risk-free rate and the coefficient on beta as the market risk premium (see Miller and Scholes [21], and Black, Jensen, and Scholes [2]). The higher than expected intercept and lower than expected slope coefficient on beta are consistent with the prior studies of Black, Jensen, and Scholes [2], and Fama and MacBeth [9] using historical returns. Such results are consistent with Black's [1] zero beta model, although alternative explanations for these findings exist as well (as noted by Black, Jensen, and Scholes [2]).

[12]Ordinary least squares regressions showed severe positive autocorrelation in many cases, with Durbin Watson statistics typically below one. Estimation used the Prais-Winsten method. See Johnston [14, pp. 321-325].

Exhibit 5. Changes in Equity Risk Premia Over Time — Entries are Coefficient (t-value); Dependent Variable is Equity Risk Premium

Time period	Intercept	i_{lt}	$i_c - i_{lt}$	R^2
A. May 1991-1992	0.131 (19.82)	-0.651 (-11.16)		0.53
	0.092 (14.26)	-0.363 (-6.74)	0.666 (5.48)	0.54
B. 1982-1984	0.140 (8.15)	-0.637 (-5.00)		0.43
	0.064 (3.25)	-0.203 (-1.63)	1.549 (4.84)	0.60
C. 1985-1987	0.131 (7.73)	-0.739 (-9.67)		0.74
	0.110 (12.53)	-0.561 (-7.30)	0.317 (1.87)	0.77
D. 1988-1991	0.136 (16.23)	-0.793 (-8.29)		0.68
	0.130 (8.71)	-0.738 (-4.96)	0.098 (0.40)	0.68

Note: All variables are defined in Exhibit 1. Regressions were estimated using monthly data and were corrected for serial correlation using the Prais-Winsten method. For purposes of this regression, variables are expressed in decimal form, e.g., 14% = 0.14.

For the entire sample period, Panel A shows that risk premia are negatively related to the level of interest rates — as proxied by yields on government bonds, i_{lt}. This negative relationship is also true for each of the subperiods displayed in Panels B through D. Such a negative relationship may result from increases in the perceived riskiness of investment in government debt at high levels of interest rates. A direct measure of uncertainty about investments in government bonds would be necessary to test this hypothesis directly.

For the entire 1982 to 1991 period, the addition of the yield spread risk proxy to the regressions dramatically lowers the magnitude of the coefficient on government bond yields, as can be seen by comparing Equations 1 and 2 of Panel A. Furthermore, the coefficient of the yield spread (0.666) is itself significantly positive. This pattern suggests that a reduction in the risk differential between investment in government bonds and in corporate activity is translated into a lower equity market risk premium. Further examination of Panels B through D, however, suggests that the yield spread variable is much more important in explaining changes in equity risk premia in the early portion of the 1980s than in the 1988 to 1991 period.

In summary, market equity risk premia change over time and appear inversely related to the level of government interest rates but positively related to the bond yield spread, which proxies for the incremental risk of investing in equities as opposed to government bonds.

IV. Conclusions

Shareholder required rates of return and risk premia are based on theories about investors' expectations for the future. In practice, however, risk premia are often estimated using averages of historical returns. This paper applies an alternate approach to estimating risk premia that employs publicly available expectational data. At least for the decade studied (1982 to 1991), the resultant average market equity risk premium over government bonds is comparable in magnitude to long-term differences (1926 to 1989) in historical returns between stocks and bonds. There is strong evidence, however, that market risk premia change over time and, as a result, use of a constant historical average risk premium is not likely to mirror changes in investor return requirements. The results also show that the expectational risk premia vary cross-sectionally with the relative risk (beta) of individual stocks.

The approach offers a straightforward and powerful aid in establishing required rates of return either for corporate investment decisions or in the regulatory arena. Since data are readily available on a wide range of equities, an investigator can analyze various proxy groups (e.g., portfolios of utility stocks) appropriate for a particular decision as well as analyze changes in equity return requirements over time.

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The Risk Premium Approach to Measuring a Utility's Cost of Equity

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■ In the mid-1960s, Myron Gordon and others began applying the theory of finance to help estimate utilities' costs of capital. Previously, the standard approach in cost of equity studies was the "comparable earnings method," which involved selecting a sample of unregulated companies whose investment risk was judged to be comparable to that of the utility in question, calculating the average return on book equity (ROE) of these sample companies, and setting the utility's service rates at a level that would permit the utility to achieve the same ROE as comparable companies. This procedure has now been thoroughly discredited (see Robichek [15]), and it has been replaced by three market-oriented (as opposed to accounting-oriented) approaches: (i) the DCF method, (ii) the bond-yield-plus-risk-premium method, and (iii) the CAPM, which is a specific version of the generalized bond-yield-plus-risk-premium approach.

Our purpose in this paper is to discuss the risk-premium approach, including the market risk premium that is used in the CAPM. First, we critique the various procedures that have been used in the past to estimate risk premiums. Second, we present some data on estimated risk premiums since 1965. Third, we examine the relationship between equity risk premiums and the level of interest rates, because it is important, for purposes of estimating the cost of capital, to know just how stable the relationship between risk premiums and interest rates is over time. If stability exists, then one can estimate the cost of equity at any point in time as a function of interest rates as reported in *The Wall Street Journal*, the *Federal Reserve Bulletin*, or some similar source.[1] Fourth, while we do not discuss the CAPM directly, our analysis does have some important implications for selecting a market risk premium for use in that model. Our focus is on utilities, but the methodology is applicable to the estimation of the cost of

[1]For example, the Federal Energy Regulatory Commission's Staff recently proposed that a risk premium be estimated every two years and that, between estimation dates, the last-determined risk premium be added to the current yield on ten-year Treasury bonds to obtain an estimate of the cost of equity to an average utility (Docket RM 80-36). Subsequently, the FCC made a similar proposal ("Notice of Proposed Rulemaking," August 13, 1984, Docket No. 84-800). Obviously, the validity of such procedures depends on (i) the accuracy of the risk premium estimate and (ii) the stability of the relationship between risk premiums and interest rates. Both proposals are still under review.

equity for any publicly traded firm, and also for non-traded firms for which an appropriate risk class can be assessed, including divisions of publicly traded corporations.[2]

Alternative Procedures for Estimating Risk Premiums

In a review of both rate cases and the academic literature, we have identified three basic methods for estimating equity risk premiums: (i) the *ex post*, or historic, yield spread method; (ii) the survey method; and (iii) an *ex ante* yield spread method based on DCF analysis.[3] In this section, we briefly review these three methods.

Historic Risk Premiums

A number of researchers, most notably Ibbotson and Sinquefield [12], have calculated historic holding period returns on different securities and then estimated risk premiums as follows:

$$\text{Historic Risk Premium} = \left(\begin{array}{c}\text{Average of the}\\ \text{annual returns on}\\ \text{a stock index for}\\ \text{a particular}\\ \text{past period}\end{array}\right) - \left(\begin{array}{c}\text{Average of the}\\ \text{annual returns on}\\ \text{a bond index for}\\ \text{the same}\\ \text{past period}\end{array}\right). \quad (1)$$

Ibbotson and Sinquefield (I&S) calculated both arithmetic and geometric average returns, but most of their risk-premium discussion was in terms of the geometric averages. Also, they used both corporate and Treasury bond indices, as well as a T-bill index, and they analyzed all possible holding periods since 1926. The I&S study has been employed in numerous rate cases in two ways: (i) directly, where the I&S historic risk premium is added to a company's bond yield to obtain an estimate of its cost of equity, and (ii) indirectly, where I&S data are used to estimate the market risk premium in CAPM studies.

There are both conceptual and measurement problems with using I&S data for purposes of estimating the cost of capital. Conceptually, there is no compelling reason to think that investors expect the same relative returns that were earned in the past. Indeed, evidence presented in the following sections indicates that relative expected returns should, and do, vary significantly over time. Empirically, the measured historic premium is sensitive both to the choice of estimation horizon and to the end points. These choices are essentially arbitrary, yet they can result in significant differences in the final outcome. These measurement problems are common to most forecasts based on time series data.

The Survey Approach

One obvious way to estimate equity risk premiums is to poll investors. Charles Benore [1], the senior utility analyst for Paine Webber Mitchell Hutchins, a leading institutional brokerage house, conducts such a survey of major institutional investors annually. His 1983 results are reported in Exhibit 1.

Exhibit 1. Results of Risk Premium Survey, 1983*

Assuming a double A, long-term utility bond currently yields 12½%, the common stock for the same company would be fairly priced relative to the bond if its expected return was as follows:

Total Return	Indicated Risk Premium (basis points)	Percent of Respondents
over 20½%	over 800	
20½%	800	
19½%	700	
18½%	600	10%
17½%	500	8%
16½%	400	29%
15½%	300	35%
14½%	200	16%
13½%	100	0%
under 13½%	under 100	1%
Weighted average	358	100%

*Benore's questionnaire included the first two columns, while his third column provided a space for the respondents to indicate which risk premium they thought applied. We summarized Benore's responses in the frequency distribution given in Column 3. Also, in his questionnaire each year, Benore adjusts the double A bond yield and the total returns (Column 1) to reflect current market conditions. Both the question above and the responses to it were taken from the survey conducted in April 1983.

[2]The FCC is particularly interested in risk-premium methodologies, because (i) only eighteen of the 1,400 telephone companies it regulates have publicly-traded stock, and hence offer the possibility of DCF analysis, and (ii) most of the publicly-traded telephone companies have both regulated and unregulated assets, so a corporate DCF cost might not be applicable to the regulated units of the companies.

[3]In rate cases, some witnesses also have calculated the differential between the yield to maturity (YTM) of a company's bonds and its concurrent ROE, and then called this differential a risk premium. In general, this procedure is unsound, because the YTM on a bond is a *future expected* return on the bond's *market value*, while the ROE is the *past realized* return on the stock's *book value*. Thus, comparing YTMs and ROEs is like comparing apples and oranges.

Benore's results, as measured by the average risk premiums, have varied over the years as follows:

Year	Average RP (basis points)
1978	491
1979	475
1980	423
1981	349
1982	275
1983	358

The survey approach is conceptually sound in that it attempts to measure investors' expectations regarding risk premiums, and the Benore data also seem to be carefully collected and processed. Therefore, the Benore studies do provide one useful basis for estimating risk premiums. However, as with most survey results, the possibility of biased responses and/or biased sampling always exists. For example, if the responding institutions are owners of utility stocks (and many of them are), and if the respondents think that the survey results might be used in a rate case, then they might bias upward their responses to help utilities obtain higher authorized returns. Also, Benore surveys large institutional investors, whereas a high percentage of utility stocks are owned by individuals rather than institutions, so there is a question as to whether his reported risk premiums are really based on the expectations of the "representative" investor. Finally, from a pragmatic standpoint, there is a question as to how to use the Benore data for utilities that are not rated AA. The Benore premiums can be applied as an add-on to the own-company bond yields of any given utility only if it can be assumed that the premiums are constant across bond rating classes. *A priori*, there is no reason to believe that the premiums will be constant.

DCF-Based *Ex Ante* Risk Premiums

In a number of studies, the DCF model has been used to estimate the *ex ante* market risk premium, RP_M. Here, one estimates the average expected future return on equity for a group of stocks, k_M, and then subtracts the concurrent risk-free rate, R_F, as proxied by the yield to maturity on either corporate or Treasury securities:[4]

$$RP_M = k_M - R_F. \quad (2)$$

Conceptually, this procedure is exactly like the I&S approach except that one makes direct estimates of future expected returns on stocks and bonds rather than assuming that investors expect future returns to mirror past returns.

The most difficult task, of course, is to obtain a valid estimate of k_M, the expected rate of return on the market. Several studies have attempted to estimate DCF risk premiums for the utility industry and for other stock market indices. Two of these are summarized next.

Vandell and Kester. In a recently published monograph, Vandell and Kester [18] estimated *ex ante* risk premiums for the period from 1944 to 1978. R_F was measured both by the yield on 90-day T-bills and by the yield on the Standard and Poor's AA Utility Bond Index. They measured k_M as the average expected return on the S&P's 500 Index, with the expected return on individual securities estimated as follows:

$$k_i = \left(\frac{D_1}{P_0}\right)_i + g_i, \quad (3)$$

where,

D_1 = dividend per share expected over the next twelve months,
P_0 = current stock price,
g = estimated long-term constant growth rate, and
i = the i^{th} stock.

To estimate g_i, Vandell and Kester developed fifteen forecasting models based on both exponential smoothing and trend-line forecasts of earnings and dividends, and they used historic data over several estimating horizons. Vandell and Kester themselves acknowledge that, like the Ibbotson-Sinquefield premiums, their analysis is subject to potential errors associated with trying to estimate expected future growth purely from past data. We shall have more to say about this point later.

[4]In this analysis, most people have used yields on long-term bonds rather than short-term money market instruments. It is recognized that long-term bonds, even Treasury bonds, are not risk free, so an RP_M based on these debt instruments is smaller than it would be if there were some better proxy to the long-term riskless rate. People have attempted to use the T-bill rate for R_F, but the T-bill rate embodies a different average inflation premium than stocks, and it is subject to random fluctuations caused by monetary policy, international currency flows, and other factors. Thus, many people believe that for cost of capital purposes, R_F should be based on long-term securities.

We did test to see how debt maturities would affect our calculated risk premiums. If a short-term rate such as the 30-day T-bill rate is used, measured risk premiums jump around widely and, so far as we could tell, randomly. The choice of a maturity in the 10- to 30-year range has little effect, as the yield curve is generally fairly flat in that range.

Malkiel. Malkiel [14] estimated equity risk premiums for the Dow Jones Industrials using the DCF model. Recognizing that the constant dividend growth assumption may not be valid, Malkiel used a nonconstant version of the DCF model. Also, rather than rely exclusively on historic data, he based his growth rates on Value Line's five-year earnings growth forecasts plus the assumption that each company's growth rate would, after an initial five-year period, move toward a long-run real national growth rate of four percent. He also used ten-year maturity government bonds as a proxy for the riskless rate. Malkiel reported that he tested the sensitivity of his results against a number of different types of growth rates, but, in his words, "The results are remarkably robust, and the estimated risk premiums are all very similar." Malkiel's is, to the best of our knowledge, the first risk-premium study that uses analysts' forecasts. A discussion of analysts' forecasts follows.

Security Analysts' Growth Forecasts

Ex ante DCF risk premium estimates can be based either on expected growth rates developed from time series data, such as Vandell and Kester used, or on analysts' forecasts, such as Malkiel used. Although there is nothing inherently wrong with time series-based growth rates, an increasing body of evidence suggests that primary reliance should be placed on analysts' growth rates. First, we note that the observed market price of a stock reflects the consensus view of investors regarding its future growth. Second, we know that most large brokerage houses, the larger institutional investors, and many investment advisory organizations employ security analysts who forecast future EPS and DPS, and, to the extent that investors rely on analysts' forecasts, the consensus of analysts' forecasts is embodied in market prices. Third, there have been literally dozens of academic research papers dealing with the accuracy of analysts' forecasts, as well as with the extent to which investors actually use them. For example, Cragg and Malkiel [7] and Brown and Rozeff [5] determined that security analysts' forecasts are more relevant in valuing common stocks and estimating the cost of capital than are forecasts based solely on historic time series. Stanley, Lewellen, and Schlarbaum [16] and Linke [13] investigated the importance of analysts' forecasts and recommendations to the investment decisions of individual and institutional investors. Both studies indicate that investors rely heavily on analysts' reports and incorporate analysts' forecast information in the formation of their expectations about stock returns. A representative listing of other work supporting the use of analysts' forecasts is included in the References section. Thus, evidence in the current literature indicates that (i) analysts' forecasts are superior to forecasts based solely on time series data, and (ii) investors do rely on analysts' forecasts. Accordingly, we based our cost of equity, and hence risk premium estimates, on analysts' forecast data.[5]

Risk Premium Estimates

For purposes of estimating the cost of capital using the risk premium approach, it is necessary either that the risk premiums be time-invariant or that there exists a predictable relationship between risk premiums and interest rates. If the premiums are constant over time, then the constant premium could be added to the prevailing interest rate. Alternatively, if there exists a stable relationship between risk premiums and interest rates, it could be used to predict the risk premium from the prevailing interest rate.

To test for stability, we obviously need to calculate risk premiums over a fairly long period of time. Prior to 1980, the only consistent set of data we could find came from Value Line, and, because of the work involved, we could develop risk premiums only once a year (on January 1). Beginning in 1980, however, we began collecting and analyzing Value Line data on a monthly basis, and in 1981 we added monthly estimates from Merrill Lynch and Salomon Brothers to our data base. Finally, in mid-1983, we expanded our analysis to include the IBES data.

Annual Data and Results, 1966–1984

Over the period 1966–1984, we used Value Line data to estimate risk premiums both for the electric utility industry and for industrial companies, using the companies included in the Dow Jones Industrial and Utility averages as representative of the two groups. Value Line makes a five-year growth rate forecast, but it also gives data from which one can develop a longer-term forecast. Since DCF theory calls for a truly long-term (infinite horizon) growth rate, we concluded that it was better to develop and use such a forecast than to

[5]Recently, a new type of service that summarizes the key data from most analysts' reports has become available. We are aware of two sources of such services, the Lynch, Jones, and Ryan's Institutional Brokers Estimate System (IBES) and Zack's Icarus Investment Service. IBES and the Icarus Service gather data from both buy-side and sell-side analysts and provide it to subscribers on a monthly basis in both a printed and a computer-readable format.

Exhibit 2. Estimated Annual Risk Premiums, Nonconstant (Value Line) Model, 1966–1984

January 1 of the Year Reported	Dow Jones Electrics			Dow Jones Industrials			
	k_{Avg}	R_F	RP	k_{Avg}	R_F	RP	(3) ÷ (6)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1966	8.11%	4.50%	3.61%	9.56%	4.50%	5.06%	0.71
1967	9.00%	4.76%	4.24%	11.57%	4.76%	6.81%	0.62
1968	9.68%	5.59%	4.09%	10.56%	5.59%	4.97%	0.82
1969	9.34%	5.88%	3.46%	10.96%	5.88%	5.08%	0.68
1970	11.04%	6.91%	4.13%	12.22%	6.91%	5.31%	0.78
1971	10.80%	6.28%	4.52%	11.23%	6.28%	4.95%	0.91
1972	10.53%	6.00%	4.53%	11.09%	6.00%	5.09%	0.89
1973	11.37%	5.96%	5.41%	11.47%	5.96%	5.51%	0.98
1974	13.85%	7.29%	6.56%	12.38%	7.29%	5.09%	1.29
1975	16.63%	7.91%	8.72%	14.83%	7.91%	6.92%	1.26
1976	13.97%	8.23%	5.74%	13.32%	8.23%	5.09%	1.13
1977	12.96%	7.30%	5.66%	13.63%	7.30%	6.33%	0.89
1978	13.42%	7.87%	5.55%	14.75%	7.87%	6.88%	0.81
1979	14.92%	8.99%	5.93%	15.50%	8.99%	6.51%	0.91
1980	16.39%	10.18%	6.21%	16.53%	10.18%	6.35%	0.98
1981	17.61%	11.99%	5.62%	17.37%	11.99%	5.38%	1.04
1982	17.70%	14.00%	3.70%	19.30%	14.00%	5.30%	0.70
1983	16.30%	10.66%	5.64%	16.53%	10.66%	5.87%	0.96
1984	16.03%	11.97%	4.06%	15.72%	11.97%	3.75%	1.08

use the five-year prediction.[6] Therefore, we obtained data as of January 1 from Value Line for each of the Dow Jones companies and then solved for k, the expected rate of return, in the following equation:

$$P_0 = \sum_{t=1}^{n} \frac{D_t}{(1+k)^t} + \left(\frac{D_n(1+g_n)}{k-g_n}\right)\left(\frac{1}{1+k}\right)^n. \quad (4)$$

Equation (4) is the standard nonconstant growth DCF model; P_0 is the current stock price; D_t represents the forecasted dividends during the nonconstant growth period; n is the years of nonconstant growth; D_n is the first constant growth dividend; and g_n is the constant, long-run growth rate after year n. Value Line provides D_t values for t = 1 and t = 4, and we interpolated to obtain D_2 and D_3. Value Line also gives estimates for ROE and for the retention rate (b) in the terminal year, n, so we can forecast the long-term growth rate as g_n = b(ROE). With all the values in Equation (4) specified except k, we can solve for k, which is the DCF rate of return that would result if the Value Line forecasts were met, and, hence, the DCF rate of return implied in the Value Line forecast.[7]

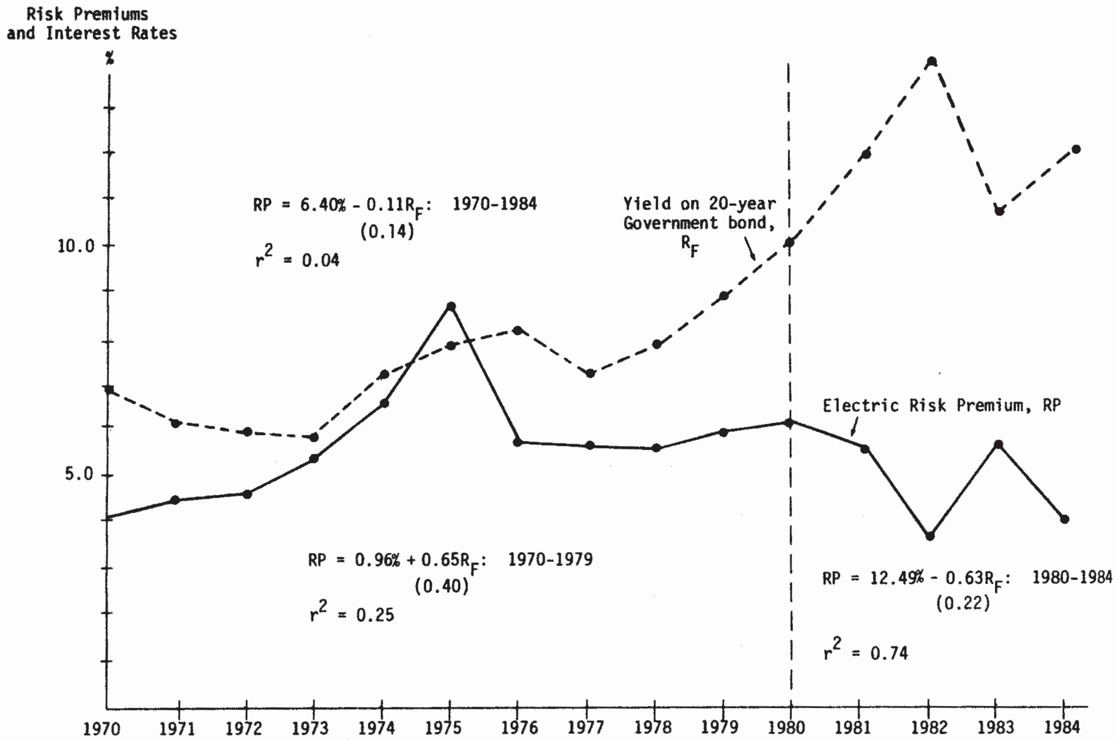
Having estimated a k value for each of the electric and industrial companies, we averaged them (using market-value weights) to obtain a k value for each group, after which we subtracted R_F (taken as the December 31 yield on twenty-year constant maturity Treasury bonds) to obtain the estimated risk premiums shown in Exhibit 2. The premiums for the electrics are plotted in Exhibit 3, along with interest rates. The following points are worthy of note:

1. Risk premiums fluctuate over time. As we shall see in the next section, fluctuations are even wider when measured on a monthly basis.
2. The last column of Exhibit 2 shows that risk premi-

[6]This is a debatable point. Cragg and Malkiel, as well as many practicing analysts, feel that most investors actually focus on five-year forecasts. Others, however, argue that five-year forecasts are too heavily influenced by base-year conditions and/or other nonpermanent conditions for use in the DCF model. We note (i) that most published forecasts do indeed cover five years, (ii) that such forecasts are typically "normalized" in some fashion to alleviate the base-year problem, and (iii) that for relatively stable companies like those in the Dow Jones averages, it generally does not matter greatly if one uses a normalized five-year or a longer-term forecast, because these companies meet the conditions of the constant-growth DCF model rather well.

[7]Value Line actually makes an explicit price forecast for each stock, and one could use this price, along with the forecasted dividends, to develop an expected rate of return. However, Value Line's forecasted stock price builds in a forecasted *change* in k. Therefore, the forecasted price is inappropriate for use in estimating current values of k.

Exhibit 3. Equity Risk Premiums for Electric Utilities and Yields on 20-Year Government Bonds, 1970–1984*



*Standard errors of the coefficients are shown in parentheses below the coefficients.

ums for the utilities increased relative to those for the industrials from the mid-1960s to the mid-1970s. Subsequently, the perceived riskiness of the two groups has, on average, been about the same.

3. Exhibit 3 shows that, from 1970 through 1979, utility risk premiums tended to have a positive association with interest rates: when interest rates rose, so did risk premiums, and vice versa. However, beginning in 1980, an inverse relationship appeared: rising interest rates led to declining risk premiums. We shall discuss this situation further in the next section.

Monthly Data and Results, 1980–1984

In early 1980, we began calculating risk premiums on a monthly basis. At that time, our only source of analysts' forecasts was Value Line, but beginning in 1981 we also obtained Merrill Lynch and Salomon Brothers' data, and then, in mid-1983, we obtained IBES data. Because our focus was on utilities, we restricted our monthly analysis to that group.

Our 1980–1984 monthly risk premium data, along with Treasury bond yields, are shown in Exhibits 4 and 5 and plotted in Exhibits 6, 7, and 8. Here are some comments on these Exhibits:

1. Risk premiums, like interest rates and stock prices, are volatile. Our data indicate that it would not be appropriate to estimate the cost of equity by adding the current cost of debt to a risk premium that had been estimated in the past. Current risk premiums should be matched with current interest rates.
2. Exhibit 6 confirms the 1980–1984 section of Exhibit 3 in that it shows a strong inverse relationship between interest rates and risk premiums; we shall discuss shortly why this relationship holds.
3. Exhibit 7 shows that while risk premiums based on Value Line, Merrill Lynch, and Salomon Brothers

Exhibit 4. Estimated Monthly Risk Premiums for Electric Utilities Using Analysts' Growth Forecasts, January 1980–June 1984

Beginning of Month	Value Line	Merrill Lynch	Salomon Brothers	Average Premiums	20-Year Treasury Bond Yield, Constant Maturity Series
Jan 1980	6.21%	NA	NA	6.21%	10.18%
Feb 1980	5.77%	NA	NA	5.77%	10.86%
Mar 1980	4.73%	NA	NA	4.73%	12.59%
Apr 1980	5.02%	NA	NA	5.02%	12.71%
May 1980	4.73%	NA	NA	4.73%	11.04%
Jun 1980	5.09%	NA	NA	5.09%	10.37%
Jul 1980	5.41%	NA	NA	5.41%	9.86%
Aug 1980	5.72%	NA	NA	5.72%	10.29%
Sep 1980	5.16%	NA	NA	5.16%	11.41%
Oct 1980	5.62%	NA	NA	5.62%	11.75%
Nov 1980	5.09%	NA	NA	5.09%	12.33%
Dec 1980	5.65%	NA	NA	5.65%	12.37%
Annual Avg.	5.35%			5.35%	11.31%
Jan 1981	5.62%	4.76%	5.63%	5.34%	11.99%
Feb 1981	4.82%	4.87%	5.16%	4.95%	12.48%
Mar 1981	4.70%	3.73%	4.97%	4.47%	13.10%
Apr 1981	4.24%	3.23%	4.52%	4.00%	13.11%
May 1981	3.54%	3.24%	4.24%	3.67%	13.51%
Jun 1981	3.57%	4.04%	4.27%	3.96%	13.39%
Jul 1981	3.61%	3.63%	4.16%	3.80%	13.32%
Aug 1981	3.17%	3.05%	3.04%	3.09%	14.23%
Sep 1981	2.11%	2.24%	2.35%	2.23%	14.99%
Oct 1981	2.83%	2.64%	3.24%	2.90%	14.93%
Nov 1981	2.08%	2.49%	3.03%	2.53%	15.27%
Dec 1981	3.72%	3.45%	4.24%	3.80%	13.12%
Annual Avg.	3.67%	3.45%	4.07%	3.73%	13.62%
Jan 1982	3.70%	3.37%	4.04%	3.70%	14.00%
Feb 1982	3.05%	3.37%	3.70%	3.37%	14.37%
Mar 1982	3.15%	3.28%	3.75%	3.39%	13.96%
Apr 1982	3.49%	3.61%	4.29%	3.80%	13.69%
May 1982	3.08%	4.25%	3.91%	3.75%	13.47%
Jun 1982	3.16%	4.51%	4.72%	4.13%	13.53%
Jul 1982	2.57%	4.21%	4.21%	3.66%	14.48%
Aug 1982	4.33%	4.83%	5.27%	4.81%	13.69%
Sep 1982	4.08%	5.14%	5.58%	4.93%	12.40%
Oct 1982	5.35%	5.24%	6.34%	5.64%	11.95%
Nov 1982	5.67%	5.95%	6.91%	6.18%	10.97%
Dec 1982	6.31%	6.71%	7.45%	6.82%	10.52%
Annual Avg.	4.00%	4.54%	5.01%	4.52%	13.09%
Jan 1983	5.64%	6.04%	6.81%	6.16%	10.66%
Feb 1983	4.68%	5.99%	6.10%	5.59%	11.01%
Mar 1983	4.99%	6.89%	6.43%	6.10%	10.71%
Apr 1983	4.75%	5.82%	6.31%	5.63%	10.84%
May 1983	4.50%	6.41%	6.24%	5.72%	10.57%
Jun 1983	4.29%	5.21%	6.16%	5.22%	10.90%
Jul 1983	4.78%	5.72%	6.42%	5.64%	11.12%
Aug 1983	3.89%	4.74%	5.41%	4.68%	11.78%
Sep 1983	4.07%	4.90%	5.57%	4.85%	11.71%
Oct 1983	3.79%	4.64%	5.38%	4.60%	11.64%
Nov 1983	2.84%	3.77%	4.46%	3.69%	11.90%
Dec 1983	3.36%	4.27%	5.00%	4.21%	11.83%
Annual Avg.	4.30%	5.37%	5.86%	5.17%	11.22%
Jan 1984	4.06%	5.04%	5.65%	4.92%	11.97%
Feb 1984	4.25%	5.37%	5.96%	5.19%	11.76%
Mar 1984	4.73%	6.05%	6.38%	5.72%	12.12%
Apr 1984	4.78%	5.33%	6.32%	5.48%	12.51%
May 1984	4.36%	5.30%	6.42%	5.36%	12.78%
Jun 1984	3.54%	4.00%	5.63%	4.39%	13.60%

Exhibit 5. Monthly Risk Premiums Based on IBES Data

Beginning of Month	Average of Merrill Lynch, Salomon Brothers, and Value Line Premiums for Dow Jones Electrics	IBES Premiums for Dow Jones Electrics	IBES Premiums for Entire Electric Industry
Aug 1983	4.68%	4.10%	4.16%
Sep 1983	4.85%	4.43%	4.27%
Oct 1983	4.60%	4.31%	3.90%
Nov 1983	3.69%	3.36%	3.36%
Dec 1983	4.21%	3.86%	3.54%
Jan 1984	4.92%	4.68%	4.18%
Feb 1984	5.19%	5.00%	4.36%
Mar 1984	5.72%	5.35%	4.45%
Apr 1984	5.48%	5.33%	4.23%
May 1984	5.36%	5.26%	4.30%
Jun 1984	4.39%	4.47%	3.40%
Average Premiums	4.83%	4.56%	4.01%

Exhibit 6. Utility Risk Premiums and Interest Rates, 1980–1984

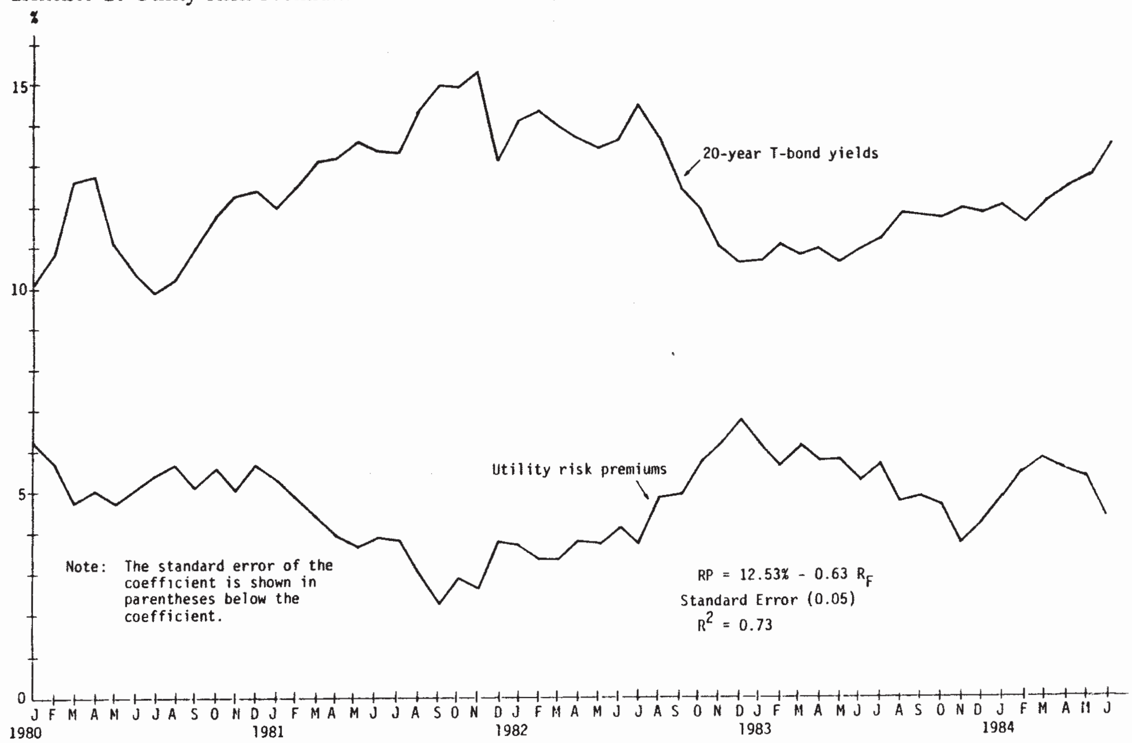


Exhibit 7. Monthly Risk Premiums, Electric Utilities, 1981–1984 (to Date)

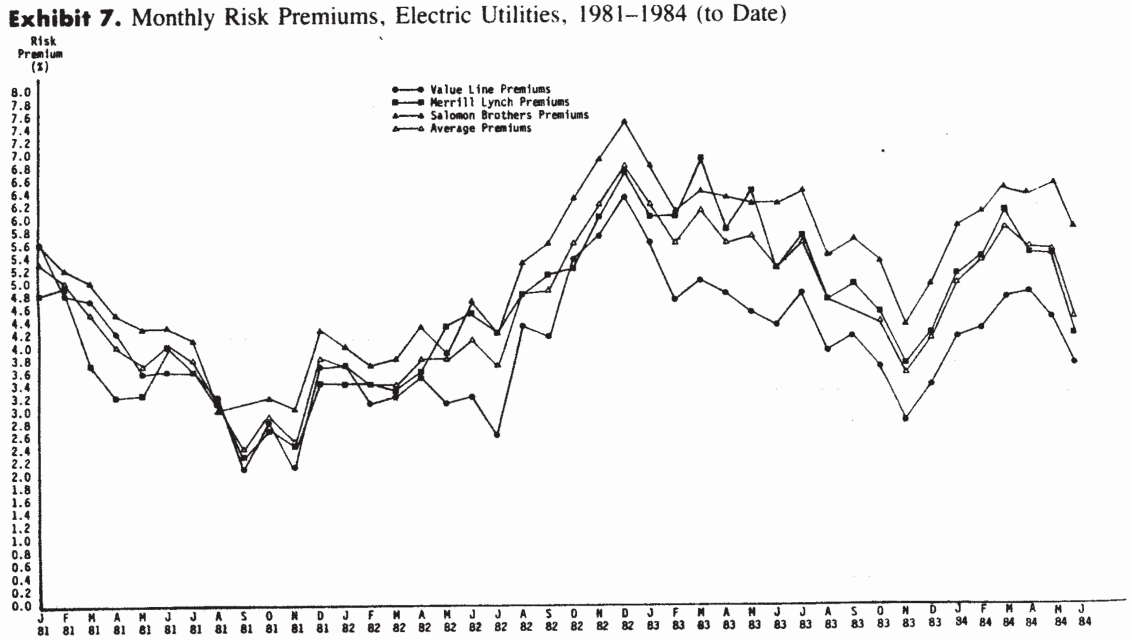
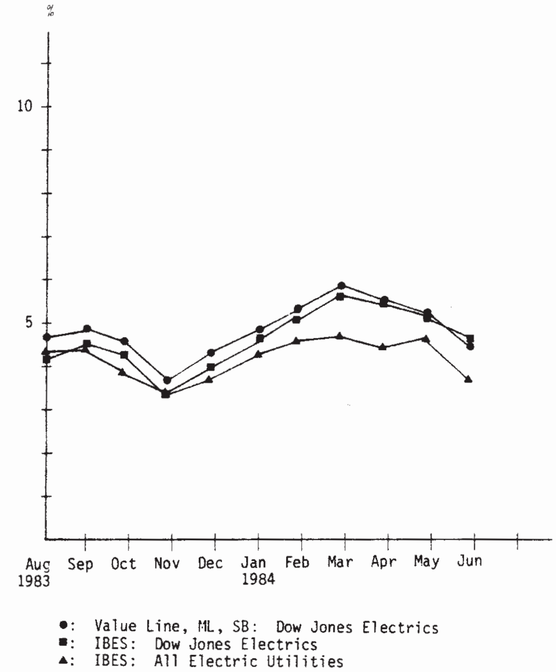


Exhibit 8. Comparative Risk Premium Data



do differ, the differences are not large given the nature of the estimates, and the premiums follow one another closely over time. Since all of the analysts are examining essentially the same data and since utility companies are not competitive with one another, and hence have relatively few secrets, the similarity among the analysts' forecasts is not surprising.

4. The IBES data, presented in Exhibit 5 and plotted in Exhibit 8, contain too few observations to enable us to draw strong conclusions, but (i) the Dow Jones Electrics risk premiums based on our three-analyst data have averaged 27 basis points above premiums based on the larger group of analysts surveyed by IBES and (ii) the premiums on the 11 Dow Jones Electrics have averaged 54 basis points higher than premiums for the entire utility industry followed by IBES. Given the variability in the data, we are, at this point, inclined to attribute these differences to random fluctuations, but as more data become available, it may turn out that the differences are statistically significant. In particular, the 11 electric utilities included in the Dow Jones Utility Index all have large nuclear investments, and this may cause them to be regarded as riskier than the industry average, which includes both nuclear and non-nuclear companies.

Tests of the Reasonableness of the Risk Premium Estimates

So far our claims to the reasonableness of our risk-premium estimates have been based on the reasonableness of our variable measures, particularly the measures of expected dividend growth rates. Essentially, we have argued that since there is strong evidence in the literature in support of analysts' forecasts, risk premiums based on these forecasts are reasonable. In the spirit of positive economics, however, it is also important to demonstrate the reasonableness of our results more directly.

It is theoretically possible to test for the validity of the risk-premium estimates in a CAPM framework. In a cross-sectional estimate of the CAPM equation,

$$(k - R_F)_i = \alpha_0 + \alpha_1\beta_i + u_i, \tag{5}$$

we would expect

$\hat{\alpha}_0 = 0$ and $\hat{\alpha}_1 = k_M - R_F =$ Market risk premium.

This test, of course, would be a joint test of both the CAPM and the reasonableness of our risk-premium estimates. There is a great deal of evidence that questions the empirical validity of the CAPM, especially when applied to regulated utilities. Under these conditions, it is obvious that no unambiguous conclusion can be drawn regarding the efficacy of the premium estimates from such a test.[8]

A simpler and less ambiguous test is to show that the risk premiums are higher for lower rated firms than for higher rated firms. Using 1984 data, we classified the

[8] We carried out the test on a monthly basis for 1984 and found positive but statistically insignificant coefficients. A typical result (for April 1984) follows:

$$(k - R_F)_i = \underset{(0.91)}{3.1675} + \underset{(1.44)}{1.8031}\ \beta_i.$$

The figures in parentheses are standard errors. Utility risk premiums do increase with betas, but the intercept term is not zero as the CAPM would predict, and α_1 is both less than the predicted value and not statistically significant. Again, the observation that the coefficients do not conform to CAPM predictions could be as much a problem with CAPM specification for utilities as with the risk premium estimates.

A similar test was carried out by Friend, Westerfield, and Granito [9]. They tested the CAPM using expectational (survey) data rather than *ex post* holding period returns. They actually found their coefficient of β_i to be negative in all their cross-sectional tests.

Exhibit 9. Relationship between Risk Premiums and Bond Ratings, 1984*

Month	Aaa/AA	AA	Aa/A	A	A/BBB	BBB	Below BBB
January†	—	2.61%	3.06%	3.70%	5.07%	4.90%	9.45%
February	2.98%	3.17%	3.36%	4.03%	5.26%	5.14%	7.97%
March	2.34%	3.46%	3.29%	4.06%	5.43%	5.02%	8.28%
April	2.37%	3.03%	3.29%	3.88%	5.29%	4.97%	6.96%
May	2.00%	2.48%	3.42%	3.72%	4.72%	6.64%	8.81%
June	0.72%	2.17%	2.46%	3.16%	3.76%	5.00%	5.58%
Average	2.08%	2.82%	3.15%	3.76%	4.92%	5.28%	7.84%

*The risk premiums are based on IBES data for the electric utilities followed by both IBES and Salomon Brothers. The number of electric utilities followed by both firms varies from month to month. For the period between January and June 1984, the number of electrics followed by both firms ranged from 96 to 99 utilities.
†In January, there were no Aaa/AA companies. Subsequently, four utilities were upgraded to Aaa/AA.

utility industry into risk groups based on bond ratings. For each rating group, we estimated the average risk premium. The results, presented in Exhibit 9, clearly show that the lower the bond rating, the higher the risk premiums. Our premium estimates therefore would appear to pass this simple test of reasonableness.

Risk Premiums and Interest Rates

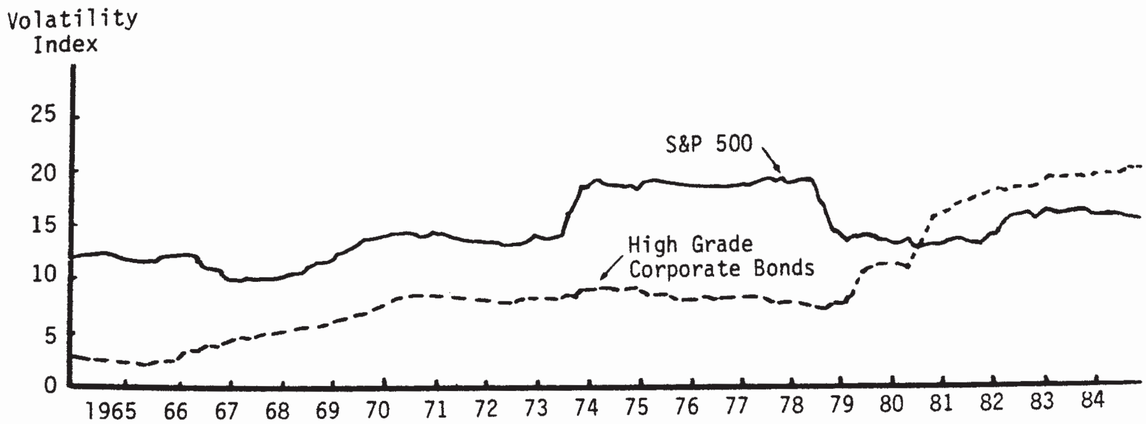
Traditionally, stocks have been regarded as being riskier than bonds because bondholders have a prior claim on earnings and assets. That is, stockholders stand at the end of the line and receive income and/or assets only after the claims of bondholders have been satisfied. However, if interest rates fluctuate, then the holders of long-term bonds can suffer losses (either realized or in an opportunity cost sense) even though they receive all contractually due payments. Therefore, if investors' worries about "interest rate risk" versus "earning power risk" vary over time, then perceived risk differentials between stocks and bonds, and hence risk premiums, will also vary.

Any number of events could occur to cause the perceived riskiness of stocks versus bonds to change, but probably the most pervasive factor, over the 1966–1984 period, is related to inflation. Inflationary expectations are, of course, reflected in interest rates. Therefore, one might expect to find a relationship between risk premiums and interest rates. As we noted in our discussion of Exhibit 3, risk premiums were positively correlated with interest rates from 1966 through 1979, but, beginning in 1980, the relationship turned negative. A possible explanation for this change is given next.

1966–1979 Period. During this period, inflation heated up, fuel prices soared, environmental problems surfaced, and demand for electricity slowed even as expensive new generating units were nearing completion. These cost increases required offsetting rate hikes to maintain profit levels. However, political pressure, combined with administrative procedures that were not designed to deal with a volatile economic environment, led to long periods of "regulatory lag" that caused utilities' earned ROEs to decline in absolute terms and to fall far below the cost of equity. These factors combined to cause utility stockholders to experience huge losses: S&P's Electric Index dropped from a mid-1960s high of 60.90 to a mid-1970s low of 20.41, a decrease of 66.5%. Industrial stocks also suffered losses during this period, but, on average, they were only one third as severe as the utilities' losses. Similarly, investors in long-term bonds had losses, but bond losses were less than half those of utility stocks. Note also that, during this period, (i) bond investors were able to reinvest coupons and maturity payments at rising rates, whereas the earned returns on equity did not rise, and (ii) utilities were providing a rising share of their operating income to debtholders versus stockholders (interest expense/book value of debt was rising, while net income/common equity was declining). This led to a widespread belief that utility commissions would provide enough revenues to keep utilities from going bankrupt (barring a disaster), and hence to protect the bondholders, but that they would not necessarily provide enough revenues either to permit the expected rate of dividend growth to occur or, perhaps, even to allow the dividend to be maintained.

Because of these experiences, investors came to regard inflation as having a more negative effect on utility stocks than on bonds. Therefore, when fears of inflation increased, utilities' measured risk premiums

Exhibit 10. Relative Volatility* of Stocks and Bonds, 1965–1984



*Volatility is measured as the standard deviation of total returns over the last 5 years.
Source: Merrill Lynch, *Quantitative Analysis*, May/June 1984.

also increased. A regression over the period 1966–1979, using our Exhibit 2 data, produced this result:

$$RP = 0.30\% + \underset{(0.22)}{0.73}\, R_F; \qquad r^2 = 0.48.$$

This indicates that a one percentage point increase in the Treasury bond rate produced, on average, a 0.73 percentage point increase in the risk premium, and hence a 1.00 + 0.73 = 1.73 percentage point increase in the cost of equity for utilities.

1980–1984 Period. The situation changed dramatically in 1980 and thereafter. Except for a few companies with nuclear construction problems, the utilities' financial situations stabilized in the early 1980s, and then improved significantly from 1982 to 1984. Both the companies and their regulators were learning to live with inflation; many construction programs were completed; regulatory lags were shortened; and in general the situation was much better for utility equity investors. In the meantime, over most of the 1980–1984 period, interest rates and bond prices fluctuated violently, both in an absolute sense and relative to common stocks. Exhibit 10 shows the volatility of corporate bonds very clearly. Over most of the eighteen-year period, stock returns were much more volatile than returns on bonds. However, that situation changed in October 1979, when the Fed began to focus on the money supply rather than on interest rates.[9]

In the 1980–1984 period, an increase in inflationary expectations has had a more adverse effect on bonds than on utility stocks. If the expected rate of inflation increases, then interest rates *will increase* and bond prices *will fall*. Thus, uncertainty about inflation translates directly into risk in the bond markets. The effect of inflation on stocks, including utility stocks, is less clear. If inflation increases, then utilities should, in theory, be able to obtain rate increases that would offset increases in operating costs and also compensate for the higher cost of equity. Thus, with "proper" regulation, utility stocks would provide a better hedge against unanticipated inflation than would bonds. This hedge did not work at all well during the 1966–1979 period, because inflation-induced increases in operating and capital costs were not offset by timely rate increases. However, as noted earlier, both the utilities and their regulators seem to have learned to live better with inflation during the 1980s.

Since inflation is today regarded as a major investment risk, and since utility stocks now seem to provide a better hedge against unanticipated inflation than do

[9]Because the standard deviations in Exhibit 10 are based on the last five years of data, even if bond returns stabilize, as they did beginning in 1982, their reported volatility will remain high for several more years. Thus, Exhibit 10 gives a rough indication of the current relative riskiness of stocks versus bonds, but the measure is by no means precise or necessarily indicative of future expectations.

bonds, the interest-rate risk inherent in bonds offsets, to a greater extent than was true earlier, the higher operating risk that is inherent in equities. Therefore, when inflationary fears rise, the perceived riskiness of bonds rises, helping to push up interest rates. However, since investors are today less concerned about inflation's impact on utility stocks than on bonds, the utilities' cost of equity does not rise as much as that of debt, so the observed risk premium tends to fall.

For the 1980–1984 period, we found the following relationship (see Exhibit 6):

$$RP = 12.53\% - \underset{(0.05)}{0.63}\, R_F; \qquad r^2 = 0.73.$$

Thus, a one percentage point increase in the T-bond rate, on average, caused the risk premium to fall by 0.63%, and hence it led to a 1.00 − 0.63 = 0.37 percentage point increase in the cost of equity to an average utility. This contrasts sharply with the pre-1980 period, when a one percentage point increase in interest rates led, on average, to a 1.73 percentage point increase in the cost of equity.

Summary and Implications

We began by reviewing a number of earlier studies. From them, we concluded that, for cost of capital estimation purposes, risk premiums must be based on expectations, not on past realized holding period returns. Next, we noted that expectational risk premiums may be estimated either from surveys, such as the ones Charles Benore has conducted, or by use of DCF techniques. Further, we found that, although growth rates for use in the DCF model can be either developed from time-series data or obtained from security analysts, analysts' growth forecasts are more reflective of investors' views, and, hence, in our opinion are preferable for use in risk-premium studies.

Using analysts' growth rates and the DCF model, we estimated risk premiums over several different periods. From 1966 to 1984, risk premiums for both electric utilities and industrial stocks varied widely from year to year. Also, during the first half of the period, the utilities had smaller risk premiums than the industrials, but after the mid-1970s, the risk premiums for the two groups were, on average, about equal.

The effects of changing interest rates on risk premiums shifted dramatically in 1980, at least for the utilities. From 1965 through 1979, inflation generally had a more severe adverse effect on utility stocks than on bonds, and, as a result, an increase in inflationary expectations, as reflected in interest rates, caused an increase in equity risk premiums. However, in 1980 and thereafter, rising inflation and interest rates increased the perceived riskiness of bonds more than that of utility equities, so the relationship between interest rates and utility risk premiums shifted from positive to negative. Earlier, a 1.00 percentage point increase in interest rates had led, on average, to a 1.73% increase in the utilities' cost of equity, but after 1980 a 1.00 percentage point increase in the cost of debt was associated with an increase of only 0.37% in the cost of equity.

Our study also has implications for the use of the CAPM to estimate the cost of equity for utilities. The CAPM studies that we have seen typically use either Ibbotson-Sinquefield or similar historic holding period returns as the basis for estimating the market risk premium. Such usage implicitly assumes (i) that *ex post* returns data can be used to proxy *ex ante* expectations and (ii) that the market risk premium is relatively stable over time. Our analysis suggests that neither of these assumptions is correct; at least for utility stocks, *ex post* returns data do not appear to be reflective of *ex ante* expectations, and risk premiums are volatile, not stable.

Unstable risk premiums also make us question the FERC and FCC proposals to estimate a risk premium for the utilities every two years and then to add this premium to a current Treasury bond rate to determine a utility's cost of equity. Administratively, this proposal would be easy to handle, but risk premiums are simply too volatile to be left in place for two years.

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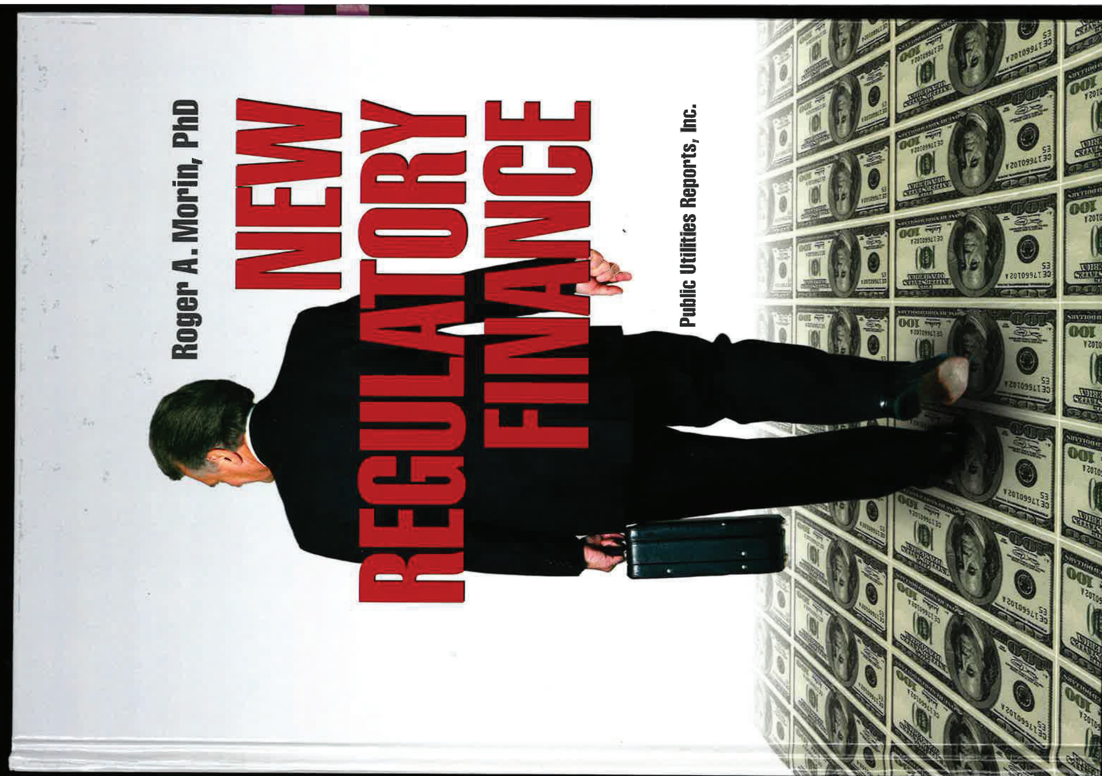
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The average growth rate estimate from all the analysts that follow the company measures the consensus expectation of the investment community for that company. In most cases, it is necessary to use earnings forecasts rather than dividend forecasts due to the extreme scarcity of dividend forecasts compared to the widespread availability of earnings forecasts. Given the paucity and variability of dividend forecasts, using the latter would produce unreliable DCF results. In any event, the use of the DCF model prospectively assumes constant growth in both earnings and dividends. Moreover, as discussed below, there is an abundance of empirical research that shows the validity and superiority of earnings forecasts relative to historical estimates when estimating the cost of capital.

The uniformity of growth projections is a test of whether they are typical of the market as a whole. If, for example, 10 out of 15 analysts forecast growth in the 7%–9% range, the probability is high that their analysis reflects a degree of consensus in the market as a whole. As a side note, the lack of uniformity in growth projections is a reasonable indicator of higher risk. Chapter 3 alluded to divergence of opinion amongst analysts as a valid risk indicator.

Because of the dominance of institutional investors and their influence on individual investors, analysts' forecasts of long-run growth rates provide a sound basis for estimating required returns. Financial analysts exert a strong influence on the expectations of many investors who do not possess the resources to make their own forecasts, that is, they are a cause of g. The accuracy of these forecasts in the sense of whether they turn out to be correct is not at issue here, as long as they reflect widely held expectations. As long as the forecasts are typical and/or influential in that they are consistent with current stock price levels, they are relevant. The use of analysts' forecasts in the DCF model is sometimes denounced on the grounds that it is difficult to forecast earnings and dividends for only one year, let alone for longer time periods. This objection is unfounded, however, because it is present investor expectations that are being priced; it is the consensus forecast that is embedded in price and therefore in required return, and not the future as it will turn out to be.

Empirical Literature on Earnings Forecasts

Published studies in the academic literature demonstrate that growth forecasts made by security analysts represent an appropriate source of DCF growth rates, are reasonable indicators of investor expectations and are more accurate than forecasts based on historical growth. These studies show that investors rely on analysts' forecasts to a greater extent than on historic data only.

Academic research confirms the superiority of analysts' earnings forecasts over univariate time-series forecasts that rely on history. This latter category

includes many *ad hoc* forecasts from statistical models, ranging from the naive methods of simple averages, moving averages, etc. to the sophisticated time-series techniques such as the Box-Jenkins modeling techniques. The literature suggests that analysts' earnings forecasts incorporate all the public information available to the analysts and the public at the time the forecasts are released. This finding implies that analysts have already factored historical growth trends into their forecast growth rates, making reliance on historical growth rates somewhat redundant and, at worst, potentially double counting growth rates which are irrelevant to future expectations. Furthermore, these forecasts are statistically more accurate than forecasts based solely on historical earnings, dividends, book value equity, and the like.

Summary of Empirical Research

Important papers include Brown and Rozeff (1978), Cragg and Malkiel (1968, 1982), Harris (1986), Vander Weide and Carleton (1988), Lys and Sohn (1990), and Easterwood and Nutt (1999).

The study by Brown and Rozeff (1978) shows that analysts, as proxied by Value Line analysts, make better forecasts than could be obtained using only historical data, because analysts have available not only past data but also a knowledge of such crucial factors as rate case decisions, construction programs, new products, cost data, and so on. Brown and Rozeff test the accuracy of analysts' forecasts versus forecasts based on past data only, and conclude that their evidence of superior analyses means that analysts' forecasts should be used in studies of cost of capital. Their evidence supports the hypothesis that Value Line analysts consistently make better predictions than historical time-series models.

Using the IBES consensus earnings forecasts as proxies for investor expectation, Harris (1986) estimates the cost of equity using expected rather than historical earnings growth rates. In his review of the literature on financial analysts' forecasts, Harris concludes that a growing body of knowledge shows that analysts' earnings forecasts are indeed reflected in stock prices. Elton, Gruber, and Gultekin (1981) show that stock prices react more to changes in analysts' forecasts of earnings than they do to changes in earnings themselves, suggesting the usefulness of analysts' forecasts as surrogates for market expectations. In an extensive National Bureau of Economic Research study using analysts' earnings forecasts, Cragg and Malkiel (1982) present detailed empirical evidence that the average analyst's expectation is more similar to expectations being reflected in the marketplace than historical growth rates, and that it is the best possible source of DCF growth rates. The authors show that historical growth rates do not contain any information that is not already impounded in analysts' growth forecasts. They conclude that the expectations formed by Wall Street professionals get quickly and thoroughly impounded into the prices of securities and that the company valuations made by analysts are reflected in security prices.

Vander Weide and Carleton (1988) update the Cragg and Malkiel study and find overwhelming evidence that the consensus analysts' forecasts of future growth is superior to historically oriented growth measures in predicting the firm's stock price. Their results also are consistent with the hypothesis that investors use analysts' forecasts, rather than historically oriented growth calculations, in making stock buy-and-sell decisions. A study by Timme and Eiseman (1989) produced similar results.

Using virtually all publicly available analyst earnings forecasts for a large sample of companies (over 23,000 individual forecasts by 100 analyst firms), Lys and Sohn (1990) show that stock returns respond to individual analyst earnings forecasts, even when they are closely preceded by earnings forecasts made by other analysts or by corporate accounting disclosures. Using actual and IBES data from 1982–1995, Easterwood and Nutt (1999) regress the analysts' forecast errors against either historical earnings changes or analysts' forecasting errors in the prior years. Results show that analysts tend to underreact to negative earnings information, but overreact to positive earnings information.

The more recent studies provide evidence that analysts make biased forecasts and misinterpret the impact of new information.[11] For example, several studies in the early 1990s suggest that analysts either systematically underreact or overreact to new information. Easterwood and Nutt (1999) discriminate between these different reactions and reported that analysts underreact to negative information, but overreact to positive information. The recent studies do not necessarily contradict the earlier literature. The earlier research focused on whether analysts' earnings forecasts are better at forecasting future earnings than historical averages, whereas the recent literature investigates whether the analysts' earnings forecasts are unbiased estimates of future earnings. It is possible that even if the analysts' forecasts are biased, they are still closer to future earnings than the historical averages, although this hypothesis has not been tested in the recent studies. One way to assess the concern that analysts' forecasts may be biased upward is to incorporate into the analysis the growth forecasts of independent research firms, such as Value Line, in addition to the analyst consensus forecast. Unlike investment banking firms and stock brokerage firms, independent research firms such as Value Line have no incentive to distort earnings growth estimates in order to bolster interest in common stocks.

[11] Other relevant papers corroborating the superiority of analysts' forecasts as predictors of future returns versus historical growth rates include: Fried and Givoly (1982), Moyer, Chatfield and Kelley (1985), and Gordon, Gordon and Gould (1989).

Some argue that analysts tend to forecast earnings growth rates that exceed those actually achieved and that this optimism biases the DCF results upward. The magnitude of the optimism bias for large rate-regulated companies in stable segments of an industry is likely to be very small. Empirically, the severity of the optimism problem is unclear for regulated utilities, if a problem exists at all. It is interesting to note that Value Line forecasts for utility companies made by independent analysts with no incentive for over- or understating growth forecasts are not materially different from those published by analysts in security firms with incentives not based on forecast accuracy, and may in fact be more robust. If the optimism problem exists at all, it can be circumvented by relying on multiple-stage DCF models that substitute long-term economic growth for analysts' growth forecasts in the second and/or third stages of the model.

Empirical studies have also been conducted showing that investors who rely primarily on data obtained from several large reputable investment research houses and security dealers obtain better results than those who do not.[12] Thus, both empirical research and common sense indicate that investors rely primarily on analysts' growth rate forecasts rather than on historical growth rates alone.

Ideally, one could decide which analysts make the most reliable forecasts and then confine the analysis to those forecasts. This would be impractical since reliable data on past forecasts are generally not available. Moreover, analysts with poor track records are replaced by more competent analysts, so that a poor forecasting record by a particular firm is not necessarily indicative of poor future forecasts. In any event, analysts working for large brokerage firms typically have a following, and investors who heed a particular analyst's recommendations do exert an influence on the market. So, an average of all the available forecasts from large reputable investment houses is likely to produce the best DCF growth rate.

Growth rate forecasts are available online from several sources. For example, Value Line Investment Analyzer, IBES (Institutional Brokers' Estimate System), Zacks Investment Research, Reuters, First Call, Yahoo Finance, and Multex Web sites provide analysts' earnings forecasts on a regular basis by reporting on the results of periodic (usually monthly) surveys of the earnings growth forecasts of a large number of investment advisors, brokerage houses, and other firms that engage in fundamental research on U.S. corporations. These firms include most large institutional investors, such as pension funds, banks, and insurance companies. Representative of industry practices, the Zacks Investment Research Web site is a central location whereby investors

[12] Examples of these studies include Stanley, Lewellen and Schlarbaum (1981) and Touche Ross Co. (1982).

are able to research the different analyst estimates for any given stock without necessarily searching for each individual analyst. Zacks gathers and compiles the different estimates made by stock analysts on the future earnings for the majority of U.S. publicly traded companies. Estimates of earnings per share for the upcoming 2 fiscal years, and a projected 5-year growth rate in such earnings per share are available at monthly intervals. The forecast 5-year growth rates are normalized in order to remove short-term distortions. Forecasts are updated when analysts formally change their stated predictions.

Exclusive reliance on a single analyst's growth forecast runs the risk of being unrepresentative of investors' consensus forecast. One would expect that averages of analysts' growth forecasts, such as those contained in IBES or Zacks, are more reliable estimates of investors' consensus expectations likely to be impounded in stock prices.[13] Averages of analysts' growth forecasts rather than a single analyst's growth forecasts are more reliable estimates of investors' consensus expectations.

One problem with the use of published analysts' forecasts is that some forecasts cover only the next one or two years. If these are abnormal years, they may not be indicative of longer-run average growth expectations. Another problem is that forecasts may not be available in sufficient quantities or may not be available at all for certain utilities, for example water utilities, in which case alternate methods of growth estimation must be employed.

Some financial economists are uncomfortable with the assumption that the DCF growth rates are perpetual growth rates, and argue that above average growth can be expected to prevail for a fixed number of years and then the growth rate will settle down to a steady-state, long-run level, consistent with that of the economy. The converse also can be true whereby below-average growth can be expected to prevail for a fixed number of years and then the growth rate will resume a higher steady-state, long-run level. Extended DCF models are available to accommodate such assumptions, and were discussed in Chapter 8.

Earnings versus Dividend Forecasts

Casual inspection of the Zacks Investment Research, First Call Thompson, and Multex Web sites reveals that earnings per share forecasts dominate the information provided. There are few, if any, dividend growth forecasts. Only Value Line provides comprehensive long-term dividend growth forecasts. The wide availability of earnings forecasts is not surprising. There is an abundance of evidence attesting to the importance of earnings in assessing investors'

[13] The earnings growth rates published by Zacks, First Call, Reuters, Value Line, and IBES contain significant overlap since all rely on virtually the same population of institutional analysts who provide such forecasts.

expectations. The sheer volume of earnings forecasts available from the investment community relative to the scarcity of dividend forecasts attests to their importance. The fact that these investment information providers focus on growth in earnings rather than growth in dividends indicates that the investment community regards earnings growth as a superior indicator of future long-term growth. Surveys of analytical techniques actually used by analysts reveal the dominance of earnings and conclude that earnings are considered far more important than dividends. Finally, Value Line's principal investment rating assigned to individual stocks, Timeliness Rank, is based primarily on earnings, accounting for 65% of the ranking.

Historical Growth Rates Versus Analysts' Forecasts

Obviously, historical growth rates as well as analysts' forecasts provide relevant information to the investor with regard to growth expectations. Each proxy for expected growth brings information to the judgment process from a different light. Neither proxy is without blemish; each has advantages and shortcomings. Historical growth rates are available and easily verifiable, but may no longer be applicable if structural shifts have occurred. Analysts' growth forecasts may be more relevant since they encompass both history and current changes, but are nevertheless imperfect proxies.

9.5 Growth Estimates: Sustainable Growth Method

The third method of estimating the growth component in the DCF model, alternately referred to as the ''sustainable growth'' or ''retention ratio'' method, can be used by investment analysts to predict future growth in earnings and dividends. In this method, the fraction of earnings expected to be retained by the company, b, is multiplied by the expected return on book equity, r, to produce the growth forecast. That is,

$$g = b \times r$$

The conceptual premise of the method, enunciated in Chapter 8, Section 8.4, is that future growth in dividends for existing equity can only occur if a portion of the overall return to investors is reinvested into the firm instead of being distributed as dividends.

For example, if a company earns 12% on equity, and pays all the earnings out in dividends, the retention factor, b, is zero and earnings per share will not grow for the simple reason that there are no increments to the asset base (rate base). Conversely, if the company retains all its earnings and pays no dividends, it would grow at an annual rate of 12%. Or again, if the company earns 12% on equity and pays out 60% of the earnings in dividends, the

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Equity Valuation Using Multiples

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ABSTRACT

We examine the valuation performance of a comprehensive list of value drivers and find that multiples derived from forward earnings explain stock prices remarkably well: pricing errors are within 15 percent of stock prices for about half our sample. In terms of relative performance, the following general rankings are observed consistently each year: forward earnings measures are followed by historical earnings measures, cash flow measures and book value of equity are tied for third, and sales performs the worst. Curiously, performance declines when we consider more complex measures of intrinsic value based on short-cut residual income models. Contrary to the popular view that different industries have different "best" multiples, these overall rankings are observed consistently for almost all industries examined. Since we require analysts' earnings and growth forecasts and positive values for all measures, our results may not be representative of the many firm-years excluded from our sample.

1. Introduction

In this study we examine the proximity to stock prices of valuations generated by multiplying a value driver (such as earnings) by the corresponding multiple, where the multiple is obtained from the ratio of stock price to that value driver for a group of comparable firms. While multiples are used extensively in practice, there is little published research in the academic literature documenting the absolute and relative performance of different

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multiples.[1] We seek to investigate the performance of a comprehensive list of multiples, and also examine a variety of related issues, such as the variation in performance across industries and over time and the performance improvement obtained by using alternative approaches to compute multiples.

Although the actual valuation process used by market participants is unobservable, we assume that stock prices can be replicated by comprehensive valuations that convert all available information into detailed projections of future flows. Given this efficient markets framework for traded stocks, what role do multiples play? Even in situations where market valuations are absent, either because the equity is privately-held or because the proposed publicly traded entity has not yet been created (e.g., mergers and spinoffs), is there a role for multiples vis-à-vis comprehensive valuations? While the multiple approach bypasses explicit projections and present value calculations, it relies on the same principles underlying the more comprehensive approach: value is an increasing function of future payoffs and a decreasing function of risk. Therefore, multiples are used often as a substitute for comprehensive valuations, because they communicate efficiently the essence of those valuations. Multiples are also used to complement comprehensive valuations, typically to calibrate those valuations and to obtain terminal values.[2]

In effect, our study documents the extent to which different value drivers serve as a summary statistic for the stream of expected payoffs, and comparable firms resemble the target firm along important value attributes, such as growth and risk. We first evaluate value drivers using the conventional ratio representation (i.e., price doubles when the value driver doubles). To identify the importance of incorporating the average effect of omitted variables, we extend the ratio representation to allow for an intercept in the price/value driver relation. To study the impact of selecting comparable firms from the same industry, we contrast our results obtained by using industry comparables (the middle category from the Sector/Industry/Group classification provided by IBES) with results obtained when all firms available each year are used as comparables. As in prior research, we evaluate performance by examining the distribution of pricing errors (actual price less predicted price, scaled by actual price).

The value drivers we consider include measures of historical cash flow, such as cash flow from operations and EBITDA (earnings before interest,

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[1] Studies offering descriptive evidence include Boatsman and Baskin [1981], LeClair [1990], and Alford [1992]. Recently, a number of studies have examined the role of multiples for firm valuation in specific contexts, such as tax and bankruptcy court cases and initial public offerings (e.g., Beatty, Riffe, and Thompson [1999], Gilson, Hutchkiss, and Ruback [2000], Kim and Ritter [1999], and Tasker [1998]).

[2] Another very different role for multiples that has been examined in the literature is the identification of mispriced stocks. We do not investigate that role because we assume market efficiency. Two such market inefficiency studies are Basu [1977] and Stattman [1980], where portfolios derived from earnings and book value multiples are shown to earn abnormal returns.

taxes, depreciation, and amortization), and historical accrual-based measures, such as sales, earnings, and book value of equity. We also consider forward-looking measures derived from analysts' forecasts of EPS (earnings per share) and long-term growth in EPS, such as 2-year out consensus EPS forecasts and PEG (price-earnings-growth) ratios (e.g., Bradshaw [1999a; 1999b]). Since sales and EBITDA should properly be associated with enterprise value (debt plus equity), rather than equity alone, for those two value drivers we also consider multiples based on enterprise value (market value of equity plus book value of debt). Finally, we consider short-cut intrinsic value measures based on the residual income model that have been used recently in the academic literature (e.g., Frankel and Lee [1998], and Gebhardt, Lee, and Swaminathan [2001]).

The following is an overview of the relative performance of different value drivers: (1) forward earnings perform the best, and performance improves if the forecast horizon lengthens (1-year to 2-year to 3-year out EPS forecasts) and if earnings forecasted over different horizons are aggregated; (2) the intrinsic value measures, based on short-cut residual income models, perform considerably worse than forward earnings;[3] (3) among drivers derived from historical data, sales performs the worst, earnings performs better than book value; and IBES earnings (which excludes many one-time items) outperforms COMPUSTAT earnings; (4) cash flow measures, defined in various forms, perform poorly; and (5) using enterprise value, rather than equity value, for sales and EBITDA further reduces performance.

Turning from relative performance to absolute performance, forward earnings measures describe actual stock prices reasonably well for a majority of firms. For example, for 2-year out forecasted earnings, approximately half the firms have absolute pricing errors less than 16 percent. The dispersion of pricing errors increases substantially for multiples based on historical drivers, such as earnings and cash flows, and is especially large for sales multiples.

Some other important findings are as follows: (1) performance improves when multiples are computed using the harmonic mean, relative to the mean or median ratio of price to value driver for comparable firms, (2) performance declines substantially when all firms in the cross-section each year are used as comparable firms, (3) allowing for an intercept improves performance mainly for poorly-performing multiples, and (4) relative performance is relatively unchanged over time and across industries.

Our findings have a number of implications for valuation research. First, we confirm the validity of two precepts underlying the valuation role of accounting numbers: (1) accruals improve the valuation properties of cash flows, and (2) despite the importance of top-line revenues, its value

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[3] Bradshaw [1999a and 1999b] observes results that are related to ours. He finds that valuations based on PEG ratios (this ratio of forward P/E to forecast growth in EPS is described later in section 3.1) explain more variation in analysts' target prices and recommendations than more complex intrinsic value models.

relevance is limited until it is matched with expenses. Second, we confirm that forward earnings contain considerably more value-relevant information than historical data, and they should be used as long as earnings forecasts are available. Third, contrary to general perception, different industries are not associated with different "best multiples." Finally, our investigation of the signal/noise tradeoff associated with the more complex intrinsic value drivers based on the residual income model suggests that even though these measures utilize more information than that contained in forward earnings and impose a structure derived from valuation theory on that information, measurement error associated with the additional variables required, especially terminal value estimates, negatively impacts performance.[4]

These findings are associated with certain caveats. Since we exclude firms not covered by IBES, typically firms with low and medium market capitalization, we are uncertain about the extent to which our results extend to those firms. Even firms with IBES data are not fully represented in our sample, since we exclude firm-years with negative values for any value driver. In particular, our results may not be descriptive of start-up firms reporting losses and high growth firms with negative operating cash flows.

2. *Prior Research*

While textbooks on valuation (e.g., Copeland, Koller, and Murrin [1994], Damodaran [1996], and Palepu, Healy, and Bernard [2000]) devote considerable space to discussing multiples, most published papers that study multiples examine a limited set of firm-years and consider only a subset of multiples, such as earnings and EBITDA. Also, comparisons across different studies are hindered by methodological differences.

Among commonly used value drivers, historical earnings and cash flows have received most of the attention. Boatsman and Baskin [1981] compare the valuation accuracy of P/E multiples based on two sets of comparable firms from the same industry. They find that valuation errors are smaller when comparable firms are chosen based on similar historical earnings growth, relative to when they are chosen randomly. Alford [1992] investigates the effects of choosing comparables based on industry, size (risk), and earnings growth on the precision of valuation using P/E multiples. He finds that pricing errors decline when the industry definition used to select comparable firms is narrowed from a broad, single digit SIC code to classifications based on two and three digits, but there is no additional improvement when the four-digit classification is considered. He also finds that controlling for size and earnings growth, over and above industry controls, does not reduce valuation errors.

[4] Given our efficient markets framework, we do not investigate here whether the relatively poor performance of the intrinsic value measures is due to an inefficient market that values stocks using multiples of forward earnings. We find evidence inconsistent with that explanation in a separate paper (Liu, Nissim, and Thomas [2001]).

Kaplan and Ruback [1995] examine the valuation properties of the discounted cash flow (DCF) approach for highly leveraged transactions. While they conclude that DCF valuations approximate transacted values reasonably well, they find that simple EBITDA multiples result in similar valuation accuracy. Beatty, Riffe, and Thompson [1999] examine different linear combinations of value drivers derived from earnings, book value, dividends, and total assets. They derive and document the benefits of using the harmonic mean, and introduce the price-scaled regressions we use. They find the best performance is achieved by using (1) weights derived from harmonic mean book and earnings multiples and (2) coefficients from price-scaled regressions on earnings and book value.

In a recent study, Baker and Ruback [1999] examine econometric problems associated with different ways of computing industry multiples, and compare the relative performance of multiples based on EBITDA, EBIT (or earnings before interest and taxes), and sales. They provide theoretical and empirical evidence that absolute valuation errors are proportional to value. They also show that industry multiples estimated using the harmonic mean are close to minimum-variance estimates based on Monte Carlo simulations. Using the minimum-variance estimator as a benchmark, they find that the harmonic mean dominates alternative simple estimators such as the simple mean, median, and value-weighted mean. Finally, they use the harmonic mean estimator to calculate multiples based on EBITDA, EBIT, and sales, and find that industry-adjusted EBITDA performs better than EBIT and sales.

Instead of focusing only on historical accounting numbers, Kim and Ritter [1999], in their investigation of how initial public offering prices are set using multiples, add forecasted earnings to a conventional list of value drivers, which includes book value, earnings, cash flows, and sales. Consistent with our results, they find that forward P/E multiples (based on forecasted earnings) dominate all other multiples in valuation accuracy, and that the EPS forecast for next year dominates the current year EPS forecast.

Using large data sets could diminish the performance of multiples, since the researcher selects comparable firms in a mechanical way. In contrast, market participants may select comparable firms more carefully and take into account situation-specific factors not considered by researchers. Tasker [1998] examines across-industry patterns in the selection of comparable firms by investment bankers and analysts in acquisition transactions. She finds the systematic use of industry-specific multiples, which is consistent with different multiples being more appropriate in different industries.[5]

[5] Since it is not clear whether the objective of investment bankers/analysts is to achieve the most accurate valuation in terms of smallest dispersion in pricing errors, our results may not be directly comparable with those in Tasker [1998].

3. Methodology

3.1 VALUE DRIVERS

We group the value drivers based on whether they refer to cash flows or accruals, whether they relate to stocks or flows, and whether they are based on historical or forward-looking information.[6] We provide a brief description here for some variables that readers may not be familiar with (details for all variables are provided in Appendix A) and then describe the links drawn in the prior literature between different value drivers and equity value. (1) Accrual flows: sales, actual earnings from COMPUSTAT (CACT) and actual earnings from IBES (IACT). (2) Accrual stocks: book value of equity (BV). (3) Cash flows: cash flow from operations (CFO), free cash flow to debt and equity holders (FCF), maintenance cash flow (MCF), equal to free cash flows for the case when capital expenditures equal depreciation expense, and earnings before interest, taxes, depreciation and amortization (EBITDA). (4) Forward looking information: consensus (mean) one year and two year out earnings forecasts (EPS1, and EPS2), and two forecasted earnings-growth combinations (EG1 = EPS2*(1 + g) and EG2 = EPS2 *g), which are derived from EPS2 and *g* (the mean long-term EPS growth forecast provided by analysts). (5) Intrinsic value measures (P1*, P2*, and P3*): These measures are based on the residual income (or abnormal earnings) valuation approach, where equity value equals the book value today plus the present value of future abnormal earnings. Abnormal earnings for years +1 to +5, projected from explicit or implied earnings forecasts for those years, are the same for the first two measures. We assume that after year +5, abnormal earnings remain constant for P1* and equal zero for P2*. For P3*, we assume the level of profitability (measured by ROE) trends linearly from the level implied by earnings forecasted for year +3 to the industry median by year +12, and abnormal earnings remains constant thereafter. (6) Sum of forward earnings (ES1 and ES2): These measures aggregate the separate forward earnings forecasts. ES1 is the sum of the EPS forecasts for years +1 to +5, and ES2 is the sum of the present value of those forecasts.[7] As explained later, these two measures are designed to provide evidence on the poor performance of the intrinsic value measures.

Value drivers based on accruals, which distinguish accounting numbers from their cash flow counterparts, have been used extensively in multiple valuations. Book value and earnings, which are often assumed to represent "fundamentals," have been linked formally to firm value (e.g., Ohlson [1995] and Feltham and Ohlson [1995]). Although the use of sales as a value driver has less theoretical basis, relative to earnings and cash flows,

[6] Some value drivers are not easily classified. For example, Sales, which we categorize as an accrual flow, could contain fewer accruals than EBITDA, which we categorize as a cash flow measure.

[7] We thank Jim Ohlson for suggesting ES1.

we consider it because of its wide use in certain emerging industries where earnings and cash flow are perceived to be uninformative.

At an intuitive level, accounting earnings could be more value-relevant than reported cash flows because some cash flows do not reflect value creation (e.g., asset purchases/sales), and accruals allow managers to reflect their judgment about future prospects. The COMPUSTAT EPS measure we consider is reported primary EPS excluding extraordinary items and discontinued operation and the IBES EPS measure is derived from reported EPS by deleting some one-time items, such as write-offs and restructuring charges. To the extent that the IBES measure is a better proxy for "permanent" or "core" earnings expected to persist in the future, it should exhibit superior performance.

The use of cash flow multiples in practice appears to be motivated by the implicit assumption that reported cash flow is the best available proxy for the future cash flows that underlie stock prices, and by the feeling that they are less susceptible to manipulation by management. The four cash flow measures we consider remove the impact of accruals to different extents. EBITDA adjusts pre-tax earnings to debt and equity holders for the effects of depreciation and amortization only. CFO deducts interest and taxes from EBITDA and also deducts the net investment in working capital. FCF deducts from CFO net investments in all long-term assets, whereas MCF only deducts from CFO an investment equal to the depreciation expense for that year.

The potential for analysts' EPS forecasts to reflect value-relevant data not captured by historical earnings has long been recognized in the literature. For example, Liu and Thomas [2000] find that revisions in analysts' earnings forecasts along with changes in interest rates explain a substantially larger portion of contemporaneous stock returns than do earnings surprises based on reported earnings. Consensus estimates are often available for forecasted earnings for the current year (EPS1) and the following year (EPS2). Consensus estimates are also frequently available for the long-term growth forecast (g) for earnings over the next business cycle (commonly interpreted to represent the next 5 years). The measure EG1 ($=$EPS2$^*(1+g)$), which is an estimate of three-year out earnings, should reflect value better than EPS2, if three-year out earnings reflect long-term profitability better than two-year out earnings.

While the second earnings-growth measure EG2 ($=$EPS2$^*g$) also combines the information contained in EPS2 and g, it imposes a different structure. Recently, analysts have justified valuations using the following rule of thumb: forward P/E ratios (current price divided by EPS2) should equal g. If, for example, EPS is expected to grow at 30 percent over the next business cycle, forward P/E should equal 30. Stated differently, the ratio of forward P/E to g (referred to as the PEG ratio) should equal 1. For certain sectors, such as technology, analysts have suggested that even higher PEG ratios are appropriate. Using EG2 as a value driver is equivalent to using a PEG ratio obtained from the PEG ratios of comparable firms.

Several recent studies provide evidence that the intrinsic values derived using the residual income model explain stock prices (e.g., Abarbanell and Bernard [2000], Claus and Thomas [2000]) and returns (e.g., Liu and Thomas [2000], Liu [1999]). The three generic patterns we use to project abnormal earnings past a horizon date have been considered in Frankel and Lee [1998] (P1*), Palepu, Healy, and Bernard [2000] (P2*), and Gebhardt, Lee, and Swaminathan [2001] (P3*). Although these generic approaches do not allow for firm-specific growth patterns for abnormal earnings past a terminal date, they offer a convenient alternative to comprehensive valuations as long as observed long-term growth patterns tend to converge to the generic patterns assumed by these measures.

While the two final earnings sum measures we consider (ES1 and ES2) have not been discussed in the literature, we examine them to understand better the poor performance observed for the intrinsic value measures. ES1 simply sums the earnings forecasted for years +1 to +5, and ES2 attempts to control heuristically for the timing and risk of the different earnings numbers by discounting those forecasted earnings before summing them. If both ES1 and ES2 perform poorly, relative to simple forward earnings multiple (e.g., EPS2) the earnings projected for years +3 to +5 probably contain considerable error. If ES1 performs well, but ES2 does not, estimation errors in the firm-specific discount rates used to discount flows at different horizons are responsible for the poor performance of the intrinsic value measures. If both ES1 and ES2 perform well, the poor performance of intrinsic value measures is probably because the assumed terminal values in each case diverge substantially from the market's estimates of terminal values.

We also consider the impact of using enterprise value (TP), rather than equity value, for sales and EBITDA multiples, since both value drivers reflect an investment base that includes debt and equity. We measure TP as the market value of equity plus the book value of debt. To obtain predicted share prices, we estimate the relation between TP and the value driver for comparable firms, generate predicted TP for target firms, and then subtract the book value of their debt.

3.2 TRADITIONAL MULTIPLE VALUATION

In the first stage of our analysis, we follow the traditional ratio representation and require that the price of firm i (from the comparable group) in year t (p_{it}) is directly proportional to the value driver:

$$p_{it} = \beta_t x_{it} + \varepsilon_{it} \tag{1}$$

where x_{it} is the value driver for firm i in year t, β_t is the multiple on the value driver and ε_t is the pricing error. To improve efficiency, we divide equation (1) by price:

$$1 = \beta_t \frac{x_{it}}{p_{it}} + \frac{\varepsilon_{it}}{p_{it}}. \tag{2}$$

Baker and Ruback [1999] and Beatty, Riffe, and Thompson [1999] demonstrate that estimating the slope using equation (2) rather than equation (1) is likely to produce more precise estimates because the valuation error (the residual in equation (1)) is approximately proportional to price.

When estimating β_t, we elected to impose the restriction that expected pricing errors (E[ε/p]) be zero, even though an unrestricted estimate for β_t from equation (2) offers a lower value of mean squared pricing error. (Throughout the paper, the term "pricing error" refers to proportional pricing error, or the pricing error scaled by share price.) Empirically, we find that our approach generates lower pricing errors for most firms, relative to an unrestricted estimate, but it generates substantially higher errors in the tails of the distribution.[8] By restricting ourselves to unbiased pricing errors, we are in effect assigning lower weight to extreme pricing errors, relative to the unrestricted approach. We are also maintaining consistency with the tradition in econometrics that strongly prefers unbiasedness over reduced dispersion.

β_t is the only parameter to be estimated in equation (2), and it is determined by the restriction we impose that pricing errors be zero on average, i.e., $E[\frac{\varepsilon_{it}}{p_{it}}] = 0$. Rearranging terms in equation (2) and applying the expected value operator, we obtain the harmonic mean of p_{it}/x_{it} as an estimate for β_t:

$$E\left[\frac{\varepsilon_{it}}{p_{it}}\right] = 1 - E\left[\frac{\beta x_{it}}{p_{it}}\right] = 0 \Rightarrow \beta_t = \frac{1}{E[\frac{x_{it}}{p_{it}}]} \tag{3}$$

We multiply this harmonic mean estimate for β_t by the target firm's value driver to obtain a prediction for the target firm's equity value, and calculate the pricing error as follows:[9]

$$\frac{\varepsilon_{it}}{p_{it}} = \frac{p_{it} - \hat{\beta}_t x_{it}}{p_{it}}. \tag{4}$$

To evaluate the performance of multiples, we examine measures of dispersion, such as the interquartile range, for the pooled distribution of ε_{it}/p_{it}.

[8] We estimated equation (2) for comparable firms from the cross-section without imposing the unbiasedness restriction. (When using comparable firms from the same industry, the estimated multiples for this unrestricted case generated substantial pricing errors.) We find that the pricing error distributions for all multiples are shifted to the right substantially, relative to the distributions for the restricted case reported in the paper (our distributions tend to peak around zero pricing error). This shift to the right indicates that the multiples and predicted valuations for the unrestricted case are on average lower than ours. We find that the bias created by this shift causes greater pricing errors for the bulk of the firms not in the tails of the distribution, relative to our restricted case.

[9] While some studies measure pricing error as predicted value minus price (e.g., Alford [1992]) we measure pricing error as price minus predicted value.

3.3 INTERCEPT ADJUSTED MULTIPLES

For the second stage of our analysis, we relax the direct proportionality requirement and allow for an intercept:

$$p_{it} = \alpha_t + \beta_t x_{it} + \varepsilon_{it}. \tag{5}$$

Many factors, besides the value driver under investigation, affect price, and the average effect of such omitted factors is unlikely to be zero.[10] Since the intercept in equation (5) captures the average effect of omitted factors, allowing for an intercept should improve the precision of out of sample predictions.

As with the simple multiple approach, we divide equation (5) by price to improve estimation efficiency:

$$1 = \alpha_t \frac{1}{p_{it}} + \beta_t \frac{x_{it}}{p_{it}} + \frac{\varepsilon_{it}}{p_{it}}, \tag{6}$$

Estimating equation (6) with no restrictions minimizes the square of pricing errors, but the expected value of those errors is nonzero.[11] For the reasons mentioned in section 3.2, we again impose the restriction that pricing errors be unbiased.[12] That is, we seek to estimate the parameters α_t and β_t that minimize the variance of ε_{it}/p_{it}, subject to the restriction that the expected value of ε_{it}/p_{it} is zero:

$$\begin{aligned}\min_{\alpha,\beta} \operatorname{var}(\varepsilon_{it}/p_{it}) &= \operatorname{var}[(p_{it} - \alpha_t - \beta_t \cdot x_{it})/p_{it}] \\ &= \operatorname{var}\left[1 - \left(\alpha_t \frac{1}{p_{it}} + \beta_t \frac{x_{it}}{p_{it}}\right)\right] \end{aligned} \tag{7a}$$

$$s.t. \quad \mathrm{E}\left[\frac{\varepsilon_{it}}{p_{it}}\right] = 0. \tag{7b}$$

It can be shown that the estimates for α_t and β_t that satisfy (7a) and (7b) are as follows

$$\beta_t = \frac{E\left[\frac{x_t}{p_t}\right]\operatorname{var}\left(\frac{1}{p_t}\right) - \operatorname{cov}\left(\frac{1}{p_t}, \frac{x_t}{p_t}\right)E\left[\frac{1}{p_t}\right]}{E\left[\frac{1}{p_t}\right]^2\operatorname{var}\left(\frac{x_t}{p_t}\right) + E\left[\frac{x_t}{p_t}\right]^2\operatorname{var}\left(\frac{1}{p_t}\right) - 2E\left[\frac{1}{p_t}\right]E\left[\frac{x_t}{p_t}\right]\operatorname{cov}\left(\frac{1}{p_t}, \frac{x_t}{p_t}\right)} \tag{8}$$

$$\alpha_t = \frac{1 - \beta_t E\left[\frac{x_t}{p_t}\right]}{E\left[\frac{1}{p_t}\right]} \tag{9}$$

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[10] If the relation between price and the value driver is non-linear, the omitted factors include higher powers of the value driver.

[11] In general, this bias could be removed by allowing for an intercept. That avenue is not available, however, when the dependent variable is a constant (=1), since the intercept captures all the variation in the dependent variable, thereby making the independent variables redundant.

[12] As with equation (2), pricing errors from the unrestricted approach for equation (6) are higher for most firms (in the middle of the distribution) but there are fewer firms in the tails of the distribution. (See footnote 8.)

where the different $E_t[.]$, var(.), and cov(.) represent the means, variances, and covariances of those expressions for the population, and are estimated using the corresponding sample moments for the comparable group. We compute prediction errors, defined by equation (10), and examine their distribution to determine performance.

$$\frac{\varepsilon_{it}}{p_{it}} = \frac{p_{it} - \hat{\alpha}_t - \hat{\beta}_t x_{it}}{p_{it}}. \tag{10}$$

4. *Sample and Data*

To construct our sample, we merge data from three sources: accounting numbers from COMPUSTAT; price, analyst forecasts, and actual earnings per share from IBES; and stock returns from CRSP. As of April of each year (labeled year t + 1), we select firm-years that satisfy the following criteria: (1) COMPUSTAT data items 4, 5, 12, 13, 25, 27, 58, and 60 are non-missing for the previous fiscal year (year t); (2) at least 30 monthly returns (not necessarily contiguous) are available on CRSP from the prior 60 month period; (3) price, actual EPS, forecasted EPS for years t + 1 and t + 2, and the long term growth forecast are available in the IBES summary file; and (4) all price to value-driver ratios for the simple multiples (excluding the three P* and two ES measures) lie within the 1st and 99th percentiles of the pooled distribution. The resulting sample, which includes 26,613 observations between 1982 and 1999, is used for the descriptive statistics reported in table 1.

For the results reported after table 1, we impose three additional requirements: (1) share price on the day IBES publishes summary forecasts in April is greater than or equal to $2; (2) all multiples are positive; and (3) each industry-year combination has at least five observations. The first condition avoids large pricing errors in the second stage analysis (where an intercept is allowed) due to firms with low share prices. The second condition avoids negative predicted prices, and the third condition ensures that the comparable group is not unreasonably small. Regarding the second condition, we discovered that many firm-years were eliminated because of negative values for two cash flow measures: free cash flow and maintenance cash flow. More important, preliminary analysis indicated that both measures exhibited larger pricing errors than the other measures. As a result, we felt that these two measures were unsuitable for large sample multiples analyses and dropped them from the remainder of our study. The final sample has 19,879 firm-years.

Our sample represents a small fraction of the NYSE + AMAX + NASDAQ population that it is drawn from: the fraction included varies between 11 percent earlier in the sample period to 18 percent later in our sample period. The fraction of market value of the population represented, however, is considerably larger because the firms deleted for lack of analyst data are on average much smaller than our sample firms. Also, firm-years excluded because they have negative value drivers are potentially different from our

TABLE 1

Distribution of Ratio of Value Driver to Price

Summary descriptions of the variables are as follows (all amounts are on per share basis): P is stock price; BV is book value of equity; MCF is maintenance cash flow (equivalent to free cash flow when depreciation expense equals capital expenditure); FCF is free cash flow to debt and equity holders; CFO is cash flow from operations; EBITDA is earnings before interest, taxes, depreciation and amortization; CACT is COMPUSTAT earnings before extraordinary items; IACT is IBES actual earnings; EPS1 and EPS2 are one year out and two year out EPS forecasts; EG1 = EPS2*(1 + g), EG2 = EPS2*g, where g is the growth forecast; and TP is enterprise value (market value of equity + book value of debt).

$$P1_t^* = BV_t + \sum_{s=1}^{5}\left(\frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1+k_t)^s}\right) + \frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+4})}{k_t(1+k_t)^s},$$

$$P2_t^* = BV_t + \sum_{s=1}^{5}\left(\frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1+k_t)^s}\right)$$

$$P3_t^* = BV_t + \sum_{s=1}^{2}\left(\frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1+k_t)^s}\right) + \sum_{s=3}^{11}\frac{[\mathrm{E}_t(ROE_{t+s}) - k_t]BV_{t+s-1}}{(1+k_l)^s}$$

$$+ \frac{[\mathrm{E}_t(ROE_{t+12}) - k_t]BV_{t+11}}{k_t(1+k_t)^{11}},$$

where $\mathrm{E}_t(ROE_{t+s})$ for s = 4, 5, …, 12 is forecasted using a linear interpolation to the industry median ROE. The industry median ROE is calculated as a moving median of the past ten years' ROE of all firms in the industry. To eliminate outliers, industry median ROEs are Winsorized at the risk free rate and 20%.

$$ES1_t = \sum_{s=1}^{5}\mathrm{E}_t(EPS_{t+s}), \text{ and } ES2_t = \sum_{s=1}^{5}\left(\frac{\mathrm{E}_t(EPS_{t+s})}{(1+k_t)^s}\right).$$

Sample firms are collected in April each year between 1982 and 1999, and we require non-missing values for a set of core financial variables from COMPUSTAT, 30 non-missing monthly returns from the prior 60 months from CRSP, and non-missing share price, 1 and 2-year out EPS forecasts and long-term growth forecasts from IBES. The sample is trimmed at 1% and 99% for each value driver using the pooled distribution, resulting in a sample of 26,613 firm-years.

	Mean	Median	SD	1%	5%	10%	25%	75%	90%	95%	99%
BV/P	0.549	0.489	0.336	0.050	0.131	0.184	0.308	0.717	0.985	1.180	1.620
MCF/P	0.035	0.035	0.183	−0.566	−0.171	−0.076	−0.002	0.074	0.145	0.238	0.626
FCF/P	−0.025	0.002	0.252	−1.008	−0.379	−0.218	−0.069	0.050	0.131	0.234	0.648
CFO/P	0.093	0.079	0.190	−0.516	−0.100	−0.019	0.034	0.146	0.239	0.328	0.693
CACT/P	0.050	0.056	0.073	−0.249	−0.043	0.005	0.033	0.080	0.108	0.130	0.178
IACT/P	0.057	0.059	0.060	−0.184	−0.013	0.018	0.040	0.082	0.109	0.130	0.175
Ebitda/P	0.173	0.148	0.128	−0.051	0.032	0.055	0.095	0.224	0.320	0.397	0.617
Sales/P	1.419	0.988	1.416	0.098	0.215	0.313	0.552	1.773	2.991	4.080	7.112
EPS1/P	0.073	0.070	0.037	−0.026	0.024	0.036	0.052	0.092	0.117	0.137	0.178
EPS2/P	0.091	0.085	0.036	0.027	0.043	0.052	0.067	0.108	0.138	0.160	0.205
EG1/P	0.105	0.097	0.040	0.034	0.052	0.062	0.077	0.124	0.159	0.183	0.235
EG2/P	0.013	0.011	0.007	0.002	0.004	0.005	0.008	0.016	0.021	0.026	0.036
P1*/P	0.708	0.658	0.296	0.222	0.318	0.383	0.500	0.863	1.086	1.264	1.660
P2*/P	0.587	0.553	0.241	0.186	0.258	0.308	0.407	0.732	0.910	1.029	1.304
P3*/P	0.652	0.577	0.366	0.125	0.203	0.266	0.393	0.834	1.120	1.330	1.918
ES1/P	0.525	0.489	0.202	0.164	0.259	0.310	0.389	0.624	0.794	0.912	1.168
ES2/P	0.350	0.334	0.125	0.111	0.173	0.209	0.265	0.417	0.517	0.588	0.723
Ebitda/TP	0.113	0.110	0.060	−0.031	0.026	0.044	0.075	0.147	0.187	0.215	0.276
Sales/TP	0.939	0.708	0.788	0.086	0.169	0.234	0.396	1.234	1.925	2.495	3.981

sample, because they are more likely to be young firms and/or technology firms. For these reasons, our results may not be descriptive of the general population.

We adjust all per share numbers for stock splits and stock dividends using IBES adjustment factors. If IBES indicates that the consensus forecast for that firm-year is on a fully diluted basis, we use IBES dilution factors to convert those numbers to a primary basis. We use a discount rate (k_t) equal to the risk-free rate plus beta times the equity risk premium. The risk-free rate is the 10-year Treasury bond yield on April 1 of year $t+1$ and we assume the equity premium is 5 percent. We estimate betas using monthly stock returns and value-weighted CRSP returns over the 60 month period ending in March of year $t+1$. Since individual firm betas are measured with considerable error, we set firm beta equal to the median beta of all firms in the same beta decile.

For a subgroup of firm-years (less than 5 percent), we were able to obtain mean IBES forecasts for all years in the five-year horizon. For all other firms, with less than complete forecasts available between years 3 and 5, we generate forecasts by applying the mean long-term growth forecast (g) to the mean forecast for the prior year in the horizon; i.e., $eps_{t+s} = eps_{t+s-1}{}^{*}(1+g)$.

We obtain book values for future years by assuming the "ex-ante clean surplus relation" (ending book value in each future period equals beginning book value plus forecasted earnings less forecasted dividends). Since analyst forecasts of future dividends are not available on IBES, we assume that the current dividend payout ratio will be maintained in the future. We measure the current dividend payout as the ratio of the indicated annual cash dividends to the earnings forecast for year $t+1$ (both obtained from the IBES summary file).[13] To minimize biases that could be induced by extreme dividend payout ratios (caused by forecast $t+1$ earnings that are close to zero), we Winsorize payout ratios to lie between 10% and 50%. The results are relatively insensitive to assumed payout ratios, since altering the payout has only a small effect on future book values and an even smaller effect on computed future abnormal earnings.

5. *Results*

We report results separately for two sets of comparable firms with data available that year: all firms from the same industry and all firms in the cross-section. In either case, our analysis is always conducted out of sample; i.e., the target firm is removed from the group of comparable firms. Since the traditional approach involves the no-intercept relation and the selection of comparable firms from the same industry, much of our discussion focuses

[13] Indicated annual dividends are four times the most recent quarter's declared dividends. We use EPS1 as the deflator because it varies less than current year's earnings and is less likely to be close to zero or negative.

on that combination, and most of our ancillary investigations relate only to this combination.

To conduct the analysis using comparable firms from the same industry, we considered alternative industry classifications. Because of the evidence that SIC codes frequently misclassify firms (Kim and Ritter [1999]), we use the industry classification provided by IBES, which is indicated to be based loosely on SIC codes, but is also subject to detailed adjustments.[14] The IBES industry classification has three levels (in increasing fineness): sector, industry, and group. We use the intermediate (industry) classification level because visual examination of firms included in the same sector suggested it was too broad a classification to allow the selection of homogeneous firms, and tabulation of the number of firms in different groups suggested it was too narrow to allow the inclusion of sufficient comparable firms (given the loss of observations due to our data requirements).

Because of the volume of results generated, we report only some representative results and describe briefly some interesting extensions. In particular, we do not report on tests of statistical significance we conducted to compare differences in performance across value drivers. Our statistical significance tests focus on the interquartile range as the primary measure of dispersion that is relevant to us, and we conduct a bootstrap-type analysis for each pair of value drivers for all sets of results reported in tables 2 and 3. We generate "samples" of 19,879 firm-years by drawing observations randomly from our sample, with replacement. For each trial we compute the inter-quartile range for each multiple, and then compute the difference between all pairs of inter-quartile ranges. This process is repeated 100 times and a distribution is obtained for each pairwise difference. (Increasing the number of trials beyond 100 has little impact on the t-statistics generated.) We compute a t-statistic by dividing the mean by the standard deviation for each of these distributions. Those t-statistics (available from the authors) indicate that almost every pairwise difference for the different interquartile ranges reported in our tables is statistically significant (t-statistic greater than 2). In essence, readers can safely assume that if differences in performance across value drivers are economically significant, they are also statistically significant.

In section 5.4, we provide a summary of our results on variation in performance of different value drivers across different industries and years in our sample. Appendix B contains more details of the across-industry variation in performance.

5.1 DESCRIPTIVE STATISTICS

Table 1 reports the pooled distribution of different value drivers, scaled by price. While most distributions contain very few negative values, the

[14] The IBES classification resembles the industry groupings suggested by Morgan Stanley.

TABLE 2

Distribution of Pricing Errors for Simple Multiples

Value and value drivers are assumed to be proportional: $p_{it} = \beta_t x_{it} + \varepsilon_{it}$. Multiples are estimated using harmonic means: $\beta_t = 1/E_t(\frac{x_{it}}{p_{it}})$ in panels A&B, and medians are used in panel C. Pricing error is $\frac{\varepsilon_{it}}{p_{it}} = \frac{p_{it} - \beta x_{it}}{p_{it}}$. Summary descriptions of the variables are as follows (all amounts are on per share basis): P is stock price; BV is book value of equity; CFO is cash flow from operations; EBITDA is earnings before interest, taxes, depreciation and amortization; CACT is COMPUSTAT earnings before extraordinary items; IACT is IBES actual earnings; EPS1, EPS2 are one year out and two year out EPS forecasts; EG1 = EPS2 * (1 + g), EG2 = EPS2 * g, where g is growth forecast. TP is enterprise value (market value of equity plus book value of debt). When TP multiples are used, predicted equity value is calculated by subtracting the book value of debt.

$$P1_t^* = BV_t + \sum_{s=1}^{5}\left(\frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1+k_t)^s}\right) + \frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+4})}{k_t(1+k_t)^s},$$

$$P2_t^* = BV_t + \sum_{s=1}^{5}\left(\frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1+k_t)^s}\right)$$

$$P3_t^* = BV_t + \sum_{s=1}^{2}\left(\frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1+k_t)^s}\right) + \sum_{s=3}^{11}\frac{[\mathrm{E}_t(ROE_{t+s}) - k_t]BV_{t+s-1}}{(1+k_l)^s}$$
$$+ \frac{[\mathrm{E}_t(ROE_{t+12}) - k_t]BV_{t+11}}{k_t(1+k_1)^{11}},$$

where $\mathrm{E}_t(ROE_{t+s})$ for s = 4, 5, ..., 12 is forecasted using a linear interpolation to the industry median ROE. The industry median ROE is calculated as a moving median of the past ten years' ROE of all firms in the industry. To eliminate outliers, industry median ROEs are Winsorized at the risk free rate and 20%.

$$ES1_t = \sum_{s=1}^{5}\mathrm{E}_t(EPS_{t+s}),\ \text{and}\ ES2_t = \sum_{s=1}^{5}\left(\frac{\mathrm{E}_t(EPS_{t+s})}{(1+k_t)^s}\right).$$

Sample firms are collected in April each year between 1982 and 1999, and we require non-missing values for a set of core financial variables from COMPUSTAT, 30 non-missing monthly returns from the prior 60 months from CRSP, and non-missing share price, 1- and 2-year out EPS forecasts and long-term growth forecasts from IBES. The sample is trimmed at 1% and 99% for each value driver. We then require a minimum $2 share price, that all value drivers be positive, and that each industry-year combination have at least five observations. The final sample contains 19,879 firm-years.

	Mean	Median	SD	75%-25%	90%-10%	95%-5%
Panel A: Multiples based on harmonic means of firms from the same industry						
BV/P	−0.016	0.066	0.560	0.602	1.266	1.710
CFO/P	−0.042	0.150	0.989	0.777	1.652	2.355
CACT/P	−0.012	0.012	0.490	0.518	1.119	1.549
IACT/P	−0.009	0.023	0.421	0.442	0.941	1.317
Ebitda/P	−0.017	0.066	0.573	0.553	1.163	1.631
Sales/P	−0.032	0.163	0.859	0.738	1.645	2.357
EPS1/P	−0.005	0.015	0.321	0.348	0.744	1.037
EPS2/P	−0.004	0.021	0.290	0.317	0.677	0.935
EG1/P	−0.004	0.027	0.290	0.313	0.671	0.936
EG2/P	−0.009	0.071	0.435	0.424	0.907	1.280
P1*/P	−0.006	0.037	0.351	0.377	0.807	1.118
P2*/P	−0.006	0.033	0.352	0.410	0.835	1.124
P3*/P	−0.009	0.055	0.443	0.469	0.983	1.377
ES1/P	−0.004	0.026	0.285	0.307	0.661	0.915

TABLE 2—*continued*

	Mean	Median	SD	75%-25%	90%-10%	95%-5%
ES2/P	−0.004	0.023	0.283	0.311	0.664	0.919
Ebitda/TP	−0.013	0.024	0.645	0.619	1.266	1.753
Sales/TP	−0.057	0.156	1.067	0.901	1.919	2.763
Panel B: Multiples based on harmonic means of firms from the entire cross-section						
BV/P	0.000	0.080	0.565	0.744	1.343	1.732
CFO/P	−0.001	0.261	1.086	0.812	1.682	2.460
CACT/P	0.000	0.045	0.512	0.625	1.228	1.627
IACT/P	0.000	0.048	0.453	0.551	1.077	1.431
Ebitda/P	0.000	0.127	0.613	0.692	1.343	1.778
Sales/P	−0.001	0.265	0.943	0.801	1.766	2.531
EPS1/P	0.000	0.028	0.361	0.452	0.880	1.166
EPS2/P	0.000	0.030	0.320	0.388	0.781	1.038
EG1/P	0.000	0.041	0.317	0.368	0.754	1.024
EG2/P	0.000	0.077	0.500	0.526	1.168	1.608
P1*/P	0.000	0.053	0.378	0.479	0.923	1.211
P2*/P	0.000	0.052	0.396	0.549	0.986	1.250
P3*/P	0.000	0.098	0.511	0.652	1.257	1.587
ES1/P	0.000	0.040	0.312	0.362	0.740	1.008
ES2/P	0.000	0.030	0.312	0.379	0.760	1.011
Ebitda/TP	−0.008	0.029	0.734	0.704	1.415	1.939
Sales/TP	0.026	0.284	1.337	1.097	2.374	3.648
Panel C: Multiples based on median of comparable firms from the same industry						
BV/P	−0.110	0.000	0.638	0.649	1.407	1.962
CFO/P	−0.263	0.000	1.235	0.903	2.020	2.944
CACT/P	−0.041	0.000	0.527	0.513	1.164	1.640
IACT/P	−0.046	0.000	0.457	0.450	0.985	1.394
Ebitda/P	−0.111	0.000	0.676	0.581	1.283	1.814
Sales/P	−0.287	0.001	1.157	0.887	2.062	3.020
EPS1/P	−0.028	−0.001	0.351	0.350	0.761	1.074
EPS2/P	−0.033	0.000	0.314	0.320	0.696	0.980
EG1/P	−0.039	0.000	0.318	0.318	0.702	0.982
EG2/P	−0.099	−0.003	0.490	0.444	0.988	1.419
P1*/P	0.014	0.029	0.441	0.425	0.982	1.604
P2*/P	−0.051	0.000	0.378	0.421	0.882	1.205
P3*/P	−0.087	0.000	0.497	0.499	1.070	1.522
ES1/P	−0.039	0.000	0.312	0.312	0.691	0.967
ES2/P	−0.035	0.000	0.306	0.319	0.691	0.961
Ebitda/TP	−0.054	0.000	0.678	0.629	1.321	1.842
Sales/TP	−0.290	0.000	1.312	1.038	2.279	3.361

incidence of negative values is higher for cash flow measures. In particular, free cash flow and maintenance cash flow are often negative (approximately 30% and 20% of the sample, respectively). Moreover, the mean of FCF/P is negative, and the mean of MCF/P is close to zero, despite the deletion of observations with extreme values (top and bottom 1%). Including these two value drivers would result in a drastic reduction in sample size. Since we discovered that they perform considerably worse than other value

TABLE 3

Distribution of Pricing Errors for Intercept Adjusted Multiples

Value and value drivers are assumed to be linear: $p_{it} = \alpha_t + \beta_t x_{it} + \varepsilon_{it}$. Multiple is estimated excluding the firm under valuation, by solving the following constrained minimization problem:

$$\min_{\alpha,\beta} \operatorname{var}(\varepsilon_{it}/p_{it}) = \operatorname{var}[(p_{it} - \alpha_t - \beta_t \cdot x_{it})/p_{it}]];\ s.t.\ \mathrm{E}\left(\frac{\varepsilon_{it}}{p_{it}}\right) = 0.$$

Pricing error is $\frac{\varepsilon_{it}}{p_{it}} = \frac{p_{it}-\alpha_t-\beta_t x_{it}}{p_{it}}$ Summary descriptions of the variables are as follows (all amounts are on per share basis): P is stock price; BV is book value of equity; CFO is cash flow from operations; EBITDA is earnings before interest, taxes, depreciation and amortization; CACT is COMPUSTAT earnings before extraordinary items; IACT is IBES actual earnings; EPS1, EPS2 are one year out and two year out EPS forecasts; EG1 = EPS2*(1 + g), EG2 = EPS2*g, where g is growth forecast. TP is enterprise value (market value of equity plus book value of debt). When TP multiples are used, predicted equity value is calculated by subtracting the book value of debt.

$$P1_t^* = BV_t + \sum_{s=1}^{5}\left(\frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1+k_t)^s}\right) + \frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+4})}{k_t(1+k_t)^s},$$

$$P2_t^* = BV_t + \sum_{s=1}^{5}\left(\frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1+k_t)^s}\right)$$

$$P3_t^* = BV_t + \sum_{s=1}^{2}\left(\frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1+k_t)^s}\right) + \sum_{s=3}^{11}\frac{[\mathrm{E}_t(ROE_{t+s}) - k_t]BV_{t+s-1}}{(1+k_l)^s}$$
$$+ \frac{[\mathrm{E}_t(ROE_{t+12}) - k_t]BV_{t-11}}{k_t(1+k_1)^{11}},$$

where $\mathrm{E}_t(ROE_{t+s})$for s = 4, 5, ..., 12 is forecasted using a linear interpolation to the industry median ROE. The industry median ROE is calculated as a moving median of the past ten years' ROE of all firms in the industry. To eliminate outliers, industry median ROEs are Winsorized at the risk free rate and 20%.

$$ES1_t = \sum_{s=1}^{5}\mathrm{E}_t(EPS_{t+s}), \text{and } ES2_t = \sum_{s=1}^{5}\left(\frac{E_t(EPS_{t+s})}{(1+k_t)^s}\right).$$

Sample firms are collected in April each year between 1982 and 1999, and we require non-missing values for a set of core financial variables from COMPUSTAT, 30 non-missing monthly returns from the prior 60 months from CRSP, and non-missing share price, 1- and 2-year out EPS forecasts and long-term growth forecasts from IBES. The sample is trimmed at 1% and 99% for each value driver. We then require a minimum $2 share price, that all value drivers be positive, and that each industry-year combination have at least five observations. The final sample contains 19,879 firm-years.

	Mean	Median	SD	75%-25%	90%-10%	95%-5%
Panel A: Comparable firms from the same industry						
BV/P	−0.027	0.058	0.538	0.538	1.153	1.599
CFO/P	−0.037	0.091	0.621	0.577	1.237	1.765
CACT/P	−0.018	0.027	0.439	0.433	0.953	1.352
IACT/P	−0.015	0.029	0.387	0.390	0.843	1.179
Ebitda/P	−0.025	0.052	0.488	0.482	1.041	1.459
Sales/P	−0.039	0.101	0.646	0.614	1.312	1.841
EPS1/P	−0.010	0.018	0.310	0.323	0.704	0.982
EPS2/P	−0.008	0.019	0.290	0.305	0.656	0.917
EG1/P	−0.007	0.023	0.291	0.306	0.654	0.912
EG2/P	−0.012	0.055	0.400	0.402	0.855	1.195

TABLE 3—*continued*

	Mean	Median	SD	75%-25%	90%-10%	95%-5%
P1*/P	−0.013	0.034	0.348	0.365	0.775	1.078
P2*/P	−0.014	0.028	0.360	0.392	0.819	1.120
P3*/P	−0.020	0.045	0.428	0.433	0.919	1.276
ES1/P	−0.007	0.022	0.285	0.301	0.648	0.888
ES2/P	−0.007	0.021	0.283	0.302	0.649	0.891
Ebitda/TP	−0.008	0.025	0.626	0.538	1.121	1.576
Sales/TP	−0.038	0.094	0.838	0.730	1.532	2.154
Panel B: Comparable firms from the entire cross-section						
BV/P	0.008	0.084	0.518	0.610	1.171	1.581
CFO/P	0.013	0.175	0.654	0.582	1.279	1.833
CACT/P	−0.002	0.053	0.447	0.513	1.006	1.385
IACT/P	−0.005	0.050	0.405	0.475	0.923	1.252
Ebitda/P	0.012	0.111	0.517	0.560	1.090	1.513
Sales/P	0.038	0.206	0.646	0.595	1.293	1.849
EPS1/P	−0.009	0.025	0.339	0.415	0.811	1.092
EPS2/P	−0.007	0.023	0.315	0.376	0.759	1.024
EG1/P	−0.003	0.040	0.314	0.361	0.743	1.016
EG2/P	0.031	0.120	0.459	0.495	1.060	1.459
P1*/P	−0.007	0.049	0.359	0.445	0.855	1.141
P2*/P	−0.007	0.042	0.385	0.517	0.934	1.200
P3*/P	−0.010	0.078	0.455	0.556	1.047	1.380
ES1/P	−0.002	0.040	0.308	0.355	0.732	0.993
ES2/P	−0.006	0.028	0.307	0.366	0.739	0.994
Ebitda/TP	0.044	0.059	0.686	0.587	1.207	1.710
Sales/TP	0.143	0.246	1.010	0.835	1.860	2.805

drivers, we decided to remove them from the set of value drivers considered hereafter.

Examination of correlations for different pairs of value drivers, scaled by price, indicates that most value drivers are positively correlated, which suggests that they share considerable common information. (These results, which are available from the authors, show that Pearson correlations are very similar to Spearman correlations.) The correlations among different forward earnings and earnings-growth measures are especially high, generally around 90%. Interestingly, the correlations between the different forward earnings measures and the three intrinsic value measures (P1*, P2*, and P3*) are much lower (only about 50 percent).

5.2 NO-INTERCEPT RELATION BETWEEN PRICE AND VALUE DRIVERS

The results of the first stage analysis, based on the ratio representation (no intercept), are reported in table 2. Our primary results are those reported in panel A, where comparable firms are selected from the same industry. The results reported in panel B are based on comparable firms including all firms in the cross-section. We report the following statistics that describe the distribution of the pricing errors: two measures of central tendency (mean and median) and four measures of dispersion (the standard deviation and three non-parametric dispersion measures: interquartile range, 90th percentile less 10th percentile, and 95th percentile less 5th percentile). We separate our results into four categories: historical value drivers, forward earnings measures, intrinsic value and earnings sum measures, and multiples based on enterprise value.

To offer a visual picture of the relative and absolute performance of different categories of multiples, we provide in figure 1, Panel A, the histograms for pricing errors for the following selected multiples: EPS2, P1*, IACT, EBITDA, BV, and Sales. The histograms report the percentage of the sample that lies within ranges of pricing error that are of width equal to 10% of price (e.g. −0.1 to 0, 0 to 0.1, and so on). To reduce clutter, we draw a smooth line through the middle of the top of each histogram column, rather than provide the histograms for each of the multiples. We consider a multiple superior if it has a more peaked distribution. The differences in performance across the different value drivers are clearly visible in figure 1.

In general, the valuation errors we report are skewed to the left, indicated by medians that are greater than means.[15] While the skewness is less noticeable for multiples based on forward earnings, it is quite prominent for multiples based on sales and cash flows. Since predicted values are bounded from below at zero, while they are not bounded above, the right side of the pricing error distribution cannot exceed +1, whereas the left side is unbounded. One way to make the error distribution more symmetrical is to take the log of the ratio of predicted price to observed price (Kaplan and Ruback [1995]). Although we find that the distributions are indeed more symmetric for the log pricing error metric, we report the results using the pricing error metric because it is easier to interpret absolute performance using that metric. We did, however, recalculate the dispersion metrics reported here using the log pricing error metric to confirm that all our inferences regarding relative performance remain unchanged.

Examination of the standard deviation and the three non-parametric dispersion measures in panel A suggests the following ranking of multiples. Forecasted earnings, as a group, exhibit the lowest dispersion of pricing errors. This result is intuitively appealing because earnings forecasts should reflect future profitability better than historical measures. Consistent with this reasoning, performance increases with forecast horizon. The dispersion measures for two-year out forward earnings (EPS2) are lower than those for one-year out earnings (EPS1), and they are lower still for three-year out forward earnings (EG1). The multiple derived from PEG ratios (EG2) does not perform as well, however, suggesting that the specific relation between

[15] Means are close to zero because we require pricing errors to be unbiased, on average. Of course, the observed means would deviate slightly from zero by chance, since the valuations are done out of sample.

forward earnings and growth implied by the PEG ratio is not supported for our sample of firm-years.

Multiples generated from the three intrinsic value measures (P1*, P2*, and P3*) also do not perform as well as the simple forward earnings multiples. This result is consistent with measurement error in the estimated discount rates, forecasted forward abnormal earnings, or assumed terminal values for these three measures. The larger pricing errors associated with P2* relative to P1* suggests that the terminal value assumption of zero abnormal earnings past year +5 (for P2*) is less appropriate than the assumption of zero growth in abnormal earnings past year +5 (for P1*). The very high pricing errors associated with P3* suggest that the more complex structure of profitability trends imposed for this measure and/or the assumption that abnormal earnings remain constant past year +12 at the level determined by current industry profitability are inappropriate.

The sharp improvement in performance observed for ES1 and ES2 supports the view that the poor performance of the intrinsic value measures is caused by the generic terminal value assumptions. Recall that ES1 simply aggregates the same five years' earnings forecasts that are used for P1* and P2*, and ES2 discounts those forecasts using firm-specific discount rates (k_t) before summing them. The fact that the performance of ES2 is only slightly worse than that of ES1 suggests that the estimated values of k_t in the denominators of the intrinsic value terms (used to discount future abnormal earnings) are unlikely to be responsible for the poor performance of those measures. The improvement in performance observed for ES1 over the one-, two-, and three-year earnings forecasts suggests that despite the high correlation observed among these forecasts for different horizons, they contain independent value relevant information.

Comparing book value and earnings, the two popular accounting value drivers, we find that earnings measures clearly outperform book value. Pricing errors for book value (BV) exhibit greater dispersion than those for COMPUSTAT earnings (CACT). The performance of historical earnings is further enhanced by the removal of one-time transitory components. Consistent with the results in Liu and Thomas [2000], pricing errors for IBES earnings (IACT) exhibit lower dispersion than those for CACT. The sales multiple performs quite poorly, suggesting that sales do not reflect profitability until expenses have been considered.

Contrary to the belief voiced by some that cash flow measures are better than accrual measures at representing future cash flows, our results show that cash flows perform significantly worse than accounting earnings. Between the two cash flow measures, CFO fares considerably worse than EBITDA; in fact it is consistently the worst performer in all our analyses.

The last two rows in panel A of table 2 relate to valuations for sales and EBITDA multiples based on enterprise value. Even though enterprise value is more appropriate for these two value drivers, the performance for both multiples is even worse than that reported for the same multiples based on equity value. For example, the interquartile range of pricing errors for sales increases from 0.738 to 0.901 when the base is changed from equity value (P) to enterprise value (TP). We find this result surprising and are unable to provide any rationale for why such a result might be observed. (Similar results are reported in Alford [1992].)

A frequent reason for using sales as a value driver is because earnings and cash flows are negative. Since we restrict our sample to firms with positive earnings and cash flows, our sample is less likely to contain firms for which the sales multiple is more likely to be used in practice. In particular, our sample is unlikely to contain emerging technology firms such as Internet stocks. While some early research, such as Hand [1999] and Trueman, Wong, and Zhang [2000], suggests that traditional value drivers are inappropriate for such stocks, Hand [2000] finds that economic fundamentals, especially forward earnings forecasts, explain valuations for such firms.

To provide some evidence on the impact of deleting firms with negative values for earnings and cash flow measures, we examine the pricing errors for sales and forward earnings multiples for a larger sample of 44,563 firm-years with positive values for sales, EPS1, and EPS2. Although this sample is obtained by applying the same conditions used to generate our primary sample it is more than twice as large because we do not require positive values for all the other value drivers. We find that even though the relative performance differences reported in table 2, panel A, are observed again in this larger sample, the dispersion of pricing errors increases for all three multiples. For example, the interquartile ranges for sales, EPS1, and EPS2 increase to 0.805, 0.448, and 0.396, respectively, from 0.738, 0.348, and 0.317 in table 2, panel A. These results emphasize our earlier caution that the results reported for our main sample may not be descriptive of other samples.

In addition to ranking the relative performance of different multiples, the results in table 2, panel A, and the histograms in figure 1 can also be used to infer absolute performance. Our main finding is that industry multiples based on simple forward EPS forecasts provide reasonably accurate valuations for a large fraction of firms. Consider, for example, the percentages of the sample covered by the two intervals on either side of zero for EPS2 in figure 1. The sum of those four percentages (13 percent between −0.2 and −0.1, 18 percent between −0.1 and 0, 16.5 percent between 0 and 0.1, and 12 percent between 0.1 and 0.2) suggests that multiples based on industry harmonic means for EPS2 generate valuations within 20 percent of observed prices for almost 60 percent of firm years. Alternatively, halving the interquartile range of 0.348 for EPS2 in panel A suggests that absolute pricing errors below 17.4 percent are observed for approximately

50 percent of the sample.[16] The lower interquartile ranges for other value drivers, such as 0.313 for EG1 and 0.307 for ES1, indicate the potential for further improvement with other value drivers derived from forward earnings.

The pricing error distributions in panel B of table 2, when the comparable group includes all firms in the cross-section, are systematically more dispersed for all multiples, relative to those reported in panel A. The superior performance observed when the comparable group is selected from the same industry, is consistent with the joint hypothesis that (1) increased homogeneity in the value-relevant factors omitted from the multiples results in better valuation, and (2) the IBES industry classification identifies relatively homogeneous groups of firms.[17] Overall, we find that the frequency of small (medium) pricing errors increases (decreases), when comparable firms are selected from the same industry. (The frequency of large valuation error remains relatively unchanged.)

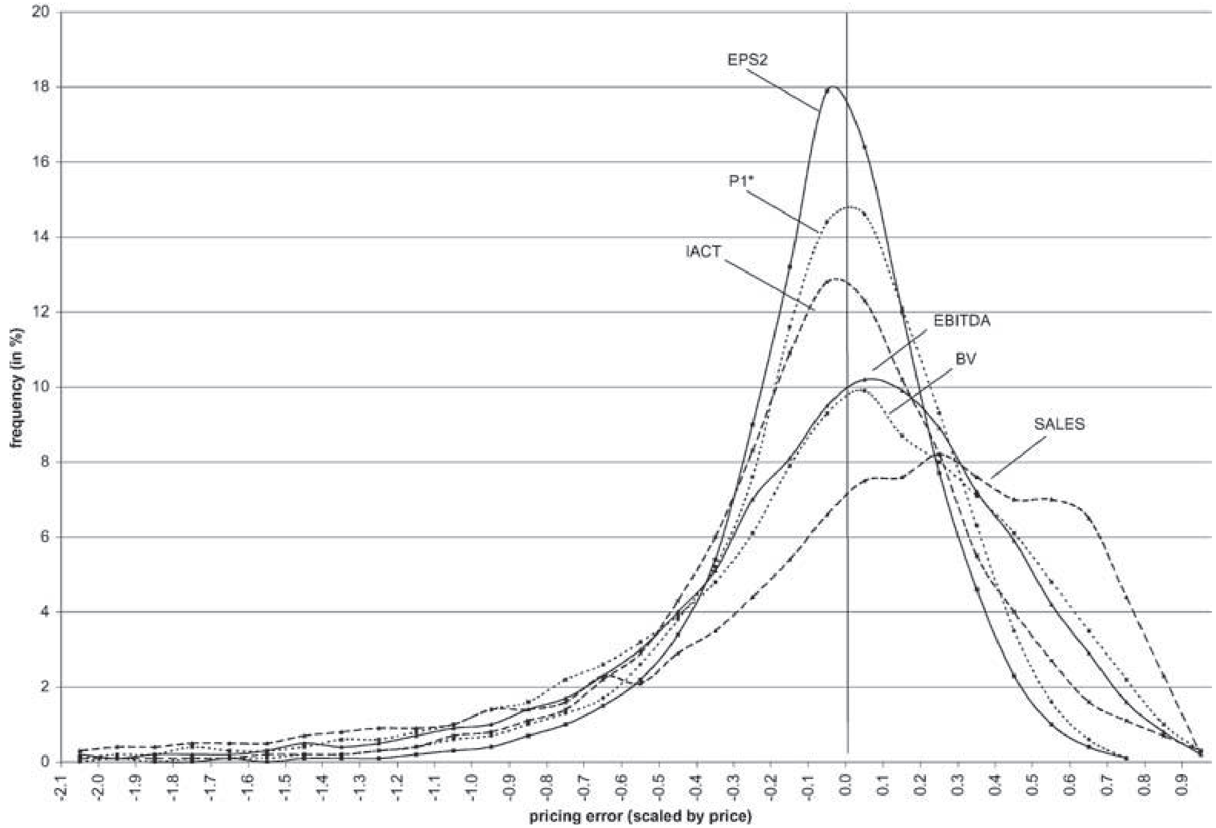
The multiples used in calculating the pricing errors in panels A and B are estimated using the harmonic mean. To allow comparison with results in previous studies (e.g., Alford [1992]), we repeat the panel A analysis using the median instead of the harmonic mean. Those results are reported in panel C. Consistent with the evidence in Baker and Ruback [1999] and Beatty, Riffe, and Thompson [1999], we find that the absolute

[16] This statement assumes the distribution is symmetric around zero. Since that assumption is only approximately true, and only for better-performing multiples (e.g. forward earnings), this description is intended primarily for illustrative purposes.

[17] Even if these conditions are satisfied, it is not clear that there should be an improvement. Moving from the cross-section to each industry results in a substantial decrease in sample size, and consequently the estimation is less precise. This fact is also reflected in the increase in the deviation of the sample mean of the valuation errors from zero.

FIG. 1.—Distribution of Pricing Errors Using Simple Industry Multiples. Value for firm i in year t (p_{it}) and value drivers (x_{it}) are assumed to be proportional: $p_{it} = \beta_i x_{it} + \varepsilon_{it}$. The multiple, β_t, is estimated using the industry harmonic mean: $\beta_t = 1/\mathrm{E}(\frac{x_{it}}{p_{it}})$, and pricing errors are computed as $\frac{\varepsilon_{it}}{p_{it}} = \frac{p_{it} - \hat{\beta}_t x_{it}}{p_{it}}$. The variables are defined as follows (all amounts are on a per share basis): P is stock price; BV is book value of equity; EBITDA is earnings before interest, taxes, depreciation and amortization; IACT is IBES actual earnings; EPS2 is two year out earnings forecast and g is growth forecast, and $P1_t^* = BV_t + \sum_{s=1}^{5} (\frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1+k_t)^s}) + \frac{E_t(EPS_{t+s} - k_t BV_{t+4})}{k_t(1+k_t)^s}$. All multiples are calculated using the harmonic means for comparable firms within each industry (based on IBES industry classification), and the firm being valued is excluded when computing industry multiples. Sample firms are collected in April each year between 1982 and 1999, and we require non-missing values for a set of core financial variables from COMPUSTAT, 30 non-missing monthly returns from the prior 60 months from CRSP, and non-missing share price, 1- and 2-year out EPS forecasts and long-term growth forecasts from IBES. The sample is trimmed at 1% and 99% for each value driver. We then require a minimum $2 share price, that all value drivers be positive, and that each industry-year combination have at least five observations. The final sample contains 19,879 firm-years.

Panel A: Pooled distribution of pricing errors: The chart below is derived from a histogram with columns of width = 0.1 (or 10% of price). For example, for EPS2, the fraction of the sample with pricing error between 0 and −0.1 is about 18%



Panel B: Performance across industries: For each of 81 industries, value drivers are ranked based on the interquartile range for pricing errors (scaled by share price). Lower ranks imply lower pricing errors (better performance). The table and figure below report the # of industries for each value driver/rank combination. For example, Sales was never ranked first or second, was ranked third for 2 industries, and so on

	rank					
	1	2	3	4	5	6
SALES	0	0	2	5	14	60
BV	1	3	5	17	41	14
EBITDA	1	1	10	44	21	4
IACT	0	12	53	11	3	2
P1*	13	54	9	2	2	1
EPS2	66	11	2	2	0	0

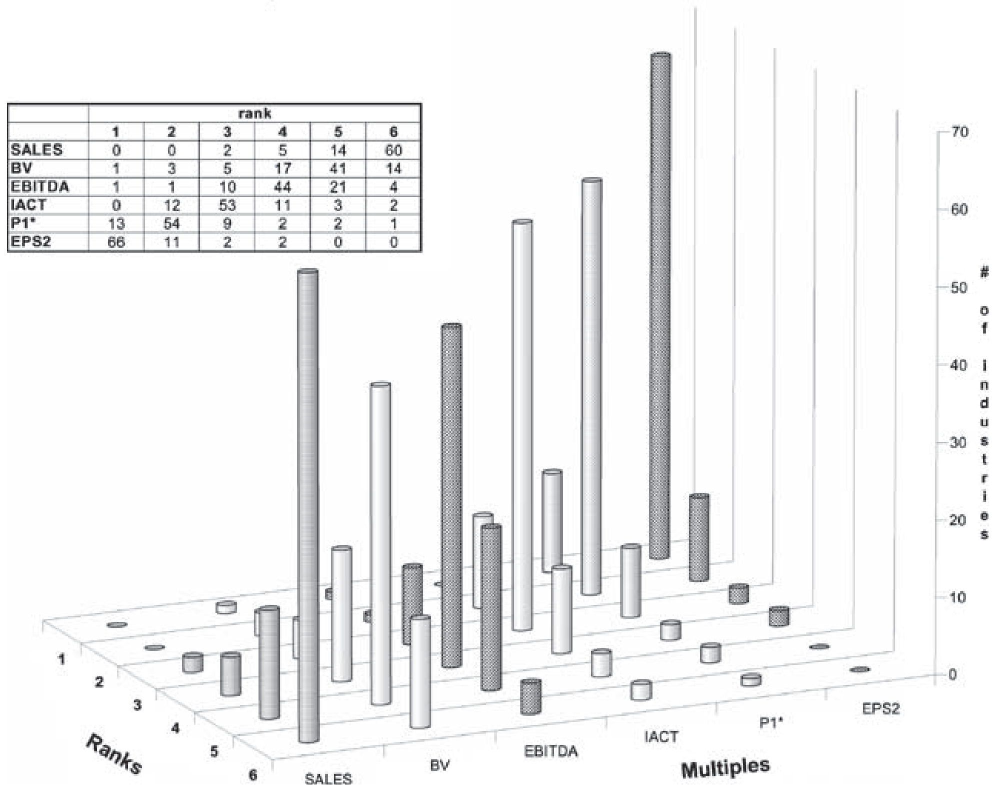


FIG. 1.—*continued*

Panel C: Performance across years: Plotted below are the annual interquartile ranges for the distribution of pricing errors (scaled by share price) for each value driver

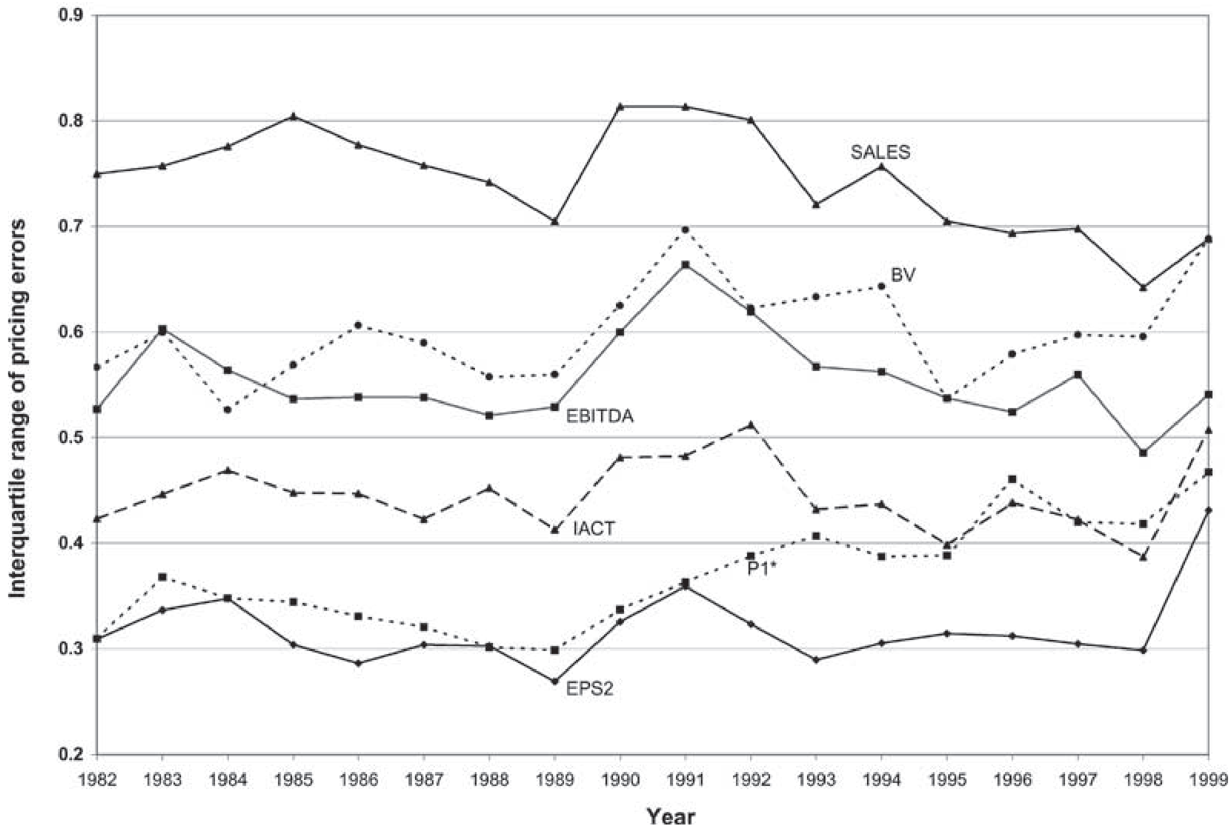


FIG. 1.—*continued*

performance of median multiples is worse than that for harmonic mean multiples. To be sure, the mean pricing error is no longer close to zero, whereas the median pricing error is now close to zero. Note that the improvement observed for harmonic means, relative to median multiples, is inversely related to the absolute performance of that multiple, and the improvement for forward earnings multiples is quite small. Importantly, the relative performance of the different multiples remains unchanged.

We also examined the impact of using the industry mean of price-to-value driver ratios as the multiple, rather than the harmonic mean (results available from authors). We find that the pricing error distributions for different value drivers exhibit much greater dispersion, and mean values that are substantially negative. Similar to the results reported for medians, the decline in performance is greater for multiples that perform poorly in table 2, panel A.

While it is inappropriate to include the target firm in the group of comparable firms, we investigated the bias caused by doing so. The bias (in terms of the impact on the distribution of pricing errors for multiples computed in sample versus out of sample) is negligible when the group of comparable firms includes all firms in the cross-section (corresponding to panel B results), since the addition of one firm has almost no effect on the multiple. When firms are selected from the same industry, however, there is a decrease in the dispersion of pricing errors when we use in-sample harmonic means (e.g. the interquartile range for EPS2 declines from 0.317 in table 2, panel A, to 0.301). The decline in dispersion is even larger for in-sample median multiples (e.g., interquartile range for EPS2 declines from 0.320 in table 2, panel C, to 0.290).

We considered two other extensions to the multiple approach (results available upon request). First, we combined two or more value drivers (e.g., Cheng and McNamara [1996]). Our results, based on a regression approach that is related to the intercept adjusted multiple approach discussed in section 3.3 (e.g., Beatty, Riffe, and Thompson [1999]) indicate only small improvements in performance over that obtained for forward earnings. Second, we investigated conditional earnings and book value multiples. That is, rather than using the harmonic mean P/E and P/B values of comparable firms, we use a P/E (P/B) that is appropriate given the forecast earnings growth (forecast book profitability) for that firm. We first estimate the relation between forward P/E ratios and forecast earnings growth (P/B ratios and forecast return on common equity) for each industry-year, and then read off from that relation the P/E (P/B) corresponding to the earnings growth forecast (forecast ROCE) for the firm being valued. Despite the intuitive appeal of conditioning the multiple on relevant information, little or no improvement in performance was observed over the unconditional P/E and P/B multiples.

5.3 INTERCEPT ALLOWED IN PRICE-VALUE DRIVER RELATION

In this subsection, we report results based on the second stage analysis, where we allow for an intercept in the relation between price and value drivers. Again, the analysis is conducted separately for comparable firms from the same industry (table 3, panel A) and for comparable firms from the entire cross-section (panel B).

As predicted, relaxing the no-intercept restriction improves the performance of all multiples. The best performance is achieved when we allow for an intercept and select comparable firms from the same industry (table 3, panel A). Comparison of these results with those in table 2, panel B, provides the joint improvement created by limiting comparable firms to be from the same industry and allowing for an intercept. Generally, the improvement generated by selecting comparable firms from the same industry (panel B to panel A in each table) is relatively uniform across value drivers. In contrast, the improvement generated by allowing an intercept (table 2 to table 3 for each panel) is inversely related to that value driver's performance in table 2. Value drivers that perform poorly in table 2 improve more than those that do well in that table. Contrast, for example, the improvement observed for Sales (interquartile range of 0.738 in table 2, panel A, to 0.614 in table 3, panel A) with the improvement observed for EG1 (interquartile range of 0.313 in table 2, panel A, to 0.306 in table 3, panel A). Although the improvement in absolute performance of the value drivers is not uniform, the rank order of different value drivers remains unchanged from table 2 to table 3.

5.4 VARIATION IN PERFORMANCE ACROSS INDUSTRIES AND YEARS

Given our focus on understanding the underlying information content of the different multiples, our results so far relate to pooled data. We consider next variation in the performance of different value drivers across years and industries to determine if the overall results are observed consistently in different years and industries. Arguments have been made before for different value drivers to perform better in certain industries than in others. For example, Tasker [1998] reports that investment bankers and analysts appear to use different preferred multiples in different industries. Although we recognize that our search is unlikely to offer conclusive results, since we do not pick comparable firms with the same skill and attention as is done in other contexts, we offer some preliminary findings.

Since investment professionals use simple multiples (no intercept) and select comparable firms from the same industry, we conduct the analysis only for that combination (corresponding to table 2, panel A). We pool the valuation results for each industry across years, and rank multiples based on the interquartile range of pricing errors within each industry. The results for the 81 industries we analyze are reported in Appendix B. The rankings range between 1 (best) and 17 (worst). We also report summary statistics of the rankings at the bottom of the table. The rankings reported in our pooled results are observed with remarkable consistency across all industries.

To illustrate graphically the essence of these rankings, we focus only on the six representative value drivers considered in figure 1, panel A, compute rankings again for each industry, and tabulate the number of times each value driver was ranked first, second, and so on in an industry. The results of that tabulation are reported in figure 1, panel B, and the consistency of the rankings across industries is clearly evident. EPS2 is ranked first in 66 of 81 industries, ranked second in 11 industries and ranked third and fourth in two industries each. It is never ranked fifth or sixth. The modal rank for P1* is second, is third for IACT, is fourth for EBITDA, is fifth for BV, and sixth for Sales. These modal ranks are observed in more than half the 81 industries in each case. Removing P1* from the analysis only strengthens further the performance of EPS2 (it is ranked first 77 times out of 81).

This pattern of superior relative performance for forward earnings multiples, which is consistent with the results in Kim and Ritter [1999], suggests that the information contained in forward looking value drivers captures a considerable fraction of value, and this feature is common to all industries. The absence of a significant number of industries where EBITDA performs better than other value drivers is inconsistent with the conventional wisdom that this cash flow measure is particularly useful in low growth industries or industries with considerable amortization of goodwill. The absence of superior performance for Sales in any industry (it is never ranked first or second in figure 1, panel B) is also inconsistent with Sales multiples being useful in certain industries.

Our evidence on the consistency of these rankings across different years is reported in figure 1, panel C. We focus only on the six representative value drivers and report the interquartile range of pricing errors each year for the six value drivers. The absolute and relative levels of those interquartile ranges appear fairly consistent over time. One noticeable deviation from that overall description is that although the performance of P1* is similar to that of EPS2 during the 1980s, it declines during the 1990s (interquartile range for EPS2 increases from about 0.35 in 1991 to 0.46 by 1999). Notwithstanding this deviation, these results suggest that our overall results are robust and observed consistently throughout the 18-year sample period.

6. Conclusions

In this study we examine the valuation properties of a comprehensive list of value drivers. Although our primary focus is on the traditional approach, which assumes direct proportionality between price and value driver and selects comparable firms from the same industry, we also consider a less restrictive approach that allows for an intercept and examine the effect of expanding the group of comparable firms to include all firms in the cross-section.

We find that multiples based on forward earnings explain stock prices reasonably well for a majority of our sample. In terms of relative performance, our results show historical earnings measures are ranked second after forward earnings measures, cash flow measures and book value are tied for third, and sales performs the worst. This ranking is robust to the use of different statistical methods and, more importantly, similar results are obtained across different industries and sample years. We find that the common practice of selecting firms from the same industry improves performance for all value drivers. Although we find that the improvement in performance obtained by allowing for an intercept in the price/value driver relation is quite large for value drivers that perform poorly, it is minimal for value drivers that perform well (such as forward earnings). We speculate that multiples are used primarily because they are simple to comprehend and communicate and the additional complexity associated with including an intercept may exceed the benefits of improved fit.

Our results regarding the information in different value drivers are consistent with intuition. For example, forward-looking earnings forecasts reflect value better than historical accounting information, accounting accruals add value-relevant information to cash flows, and profitability can be better measured when revenue is matched with expenses. Some results in this paper are surprising, however. For example, multiples based on the residual income model, which explicitly forecasts terminal value and adjusts for risk, perform worse than simple multiples based on earnings forecasts. And adjusting for leverage does not improve the valuation properties of EBITDA and Sales. We investigate these results further and feel that these results indicate the trade-off that exists between signal and noise when more complex but theoretically correct structures are imposed. As a caveat, we recognize that our study is designed to provide an overview of aggregate patterns, and thus may have missed more subtle relationships that are apparent only in small sample studies.

APPENDIX A

This appendix describes how the variables are constructed. The #s in parentheses refer to data items from COMPUSTAT. Number of shares and per share data from COMPUSTAT are adjusted for subsequent splits and stock dividends to allow comparability with IBES per share data.

P: Share price from IBES, as of April each year.

TP: Enterprise value per share = book value of debt, deflated by shares outstanding (#25), plus share price (P), where book value of debt = long term debt (#9) + debt in current liabilities (#34) + preferred stock (#130) − preferred treasury stock (#227) + preferred dividends in arrears (#242).

BV: Per share book value of equity = book equity (#60) deflated by shares outstanding (#25).

SALES: Per share sales = sales (#12) deflated by shares outstanding (#25).

CACT: COMPUSTAT actual earnings per share = EPS excluding extraordinary items (#58).

IACT: IBES actual earnings per share (per share earnings adjusted for one-time items).

EBITDA: Per share earnings before interest, taxes, depreciation and amortization = EBITDA (#13), deflated by shares outstanding (#25).

CFO: Per share cash flow from operations = EBITDA minus the total of interest expense (#15), tax expense (#16) and the net change in working capital, deflated by shares outstanding (#25), where net change in working capital is change in current assets (#4) minus change in cash and cash equivalents (#1) minus change in current liabilities (#5) plus change in debt included in current liabilities (#34).
Data items 15, 16, 1 or 34 are set to zero if missing.

FCF: Per share free cash flow = CFO minus net investment, where net investment is capital expenditures (#128) plus acquisitions (#129) plus increase in investment (#113) minus sale of PP&E (#107) minus sale of investment (#109), deflated by shares outstanding (#25).
Data items 128, 129, 113, 107 or 109 are set to zero if missing.

MCF: Per share maintenance cash flow = CFO minus depreciation expense (#125), deflated by shares outstanding (#25).

EPS1: mean IBES one year out earnings per share forecast

EPS2: mean IBES two year out earnings per share forecast

EG1: IBES three year out earnings per share forecast, measured as EPS2*(1 + g), where g is mean IBES long term growth forecast

EG2: EPS2*g, where g is mean IBES long term EPS growth forecast

The three P* measures are defined as follows:

$$P1_t^* = BV_t + \sum_{s=1}^{5} \left(\frac{E_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1 + k_t)^s} \right) + \frac{E_t(EPS_{t+s} - k_t BV_{t+4})}{k_t(1 + k_t)^s}$$

$$P2_t^* = BV_t + \sum_{s=1}^{5} \left(\frac{E_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1+k_t)^s} \right)$$

$$P3_t^* = BV_t + \sum_{s=1}^{2} \left(\frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1+k_t)^s} \right)$$

$$+ \sum_{s=3}^{11} \frac{[\mathrm{E}_t(ROE_{t+5}) - k_t] BV_{t+s-1})}{(1+k_t)^s} + \frac{[\mathrm{E}_t(ROE_{t+12}) - k_t] BV_{t+11}}{K_t(1+k_t)^{11}}$$

The variables used in the P* calculations are obtained as follows: The discount rate (k_t) is calculated as the risk-free rate plus beta times the equity risk premium. We use the 10-year Treasury bond yield on April 1 of year t + 1 as the risk-free rate and assume a constant 5% equity risk premium. We measure beta as the median beta of all firms in the same beta decile in year t. We estimate betas using monthly stock returns and value-weighted CRSP returns for the five years ending in March of year t + 1 (we require a minimum of 30 non-missing monthly returns in those 5 years).

For a subgroup of firm-years (less than 5 percent), we were able to obtain mean IBES forecasts for all years in the five-year horizon. For all other firms, with less than complete forecasts available between years 3 and 5, we generated forecasts by applying the mean long-term growth forecast (g) to the mean forecast for the prior year in the horizon; i.e., $EPS_{t+s} = EPS_{t+s-1}{}^*(1+g)$.

The book values for future years, corresponding to the earnings forecasts, are determined by assuming the "ex-ante clean surplus" relation (ending book value in each future period equals beginning book value plus forecasted earnings less forecasted dividends). Since analyst forecasts of future dividends are not available on IBES, we assume that the current dividend payout ratio will be maintained in the future. We measure the current dividend payout as the ratio of the indicated annual cash dividends to the earnings forecast for year t + 1 (both obtained from the IBES summary file). To minimize biases that could be induced by extreme dividend payout ratios (caused by forecast t + 1 earnings that are close to zero), we Winsorize payout ratios at 10% and 50%.

In the calculation of $P3_t^*$, we forecast $\mathrm{E}_t(ROE_{t+5})$ for s = 4, 5, . . . , 12 using a linear interpolation to the industry median ROE. The industry median ROE is calculated as a moving median of the past ten years' ROE of all firms in the industry. To eliminate outliers, industry median ROEs are Winsorized at the risk free rate and 20%.

The earnings forecasts for years +1 to +5 are summed to obtain the two earnings sum measures.

$$ES1_t = \sum_{s=1}^{5} \mathrm{E}_t(EPS_{t+s}) \quad \text{and} \quad ES2_t = \sum_{s=1}^{5} \left(\frac{\mathrm{E}_t(EPS_{t+s})}{(1+k_t)^s} \right)$$

APPENDIX B

INDUSTRY RANKINGS OF MULTIPLES

Pricing errors (scaled by share price) are computed for each firm-year using harmonic means of firms in each industry. Multiples are ranked for each industry according to the inter-quartile range of pricing errors. Lower ranks indicate better performance. Industry classification is from the IBES sector/industry group classification code. Years covered are 1981 through 1999. Sample size is 19,879. Summary descriptions of the variables are as follows (all amounts are on per share basis): P is stock price; BV is book value of equity; CFO is cash flow from operations; EBITDA is earnings before interest, taxes, depreciation and amortization; CACT is COMPUSTAT earnings before extraordinary items; IACT is IBES actual earnings; EPS1, EPS2 are one year out and two year out earnings forecasts; EG1 = EPS2*(1 + g), EG2 = EPS2*g, where g is growth forecast. TP is enterprise value (market value of equity plus book value of debt). When TP multiples are used, predicted equity value is calculated by subtracting the book value of debt.

$$P1_t^* = BV_t + \sum_{s=1}^{5}\left(\frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1+k_t)^s}\right) + \frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+4})}{k_t(1+k_t)^s},$$

$$P2_t^* = BV_t + \sum_{s=1}^{5}\left(\frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1+k_t)^s}\right)$$

$$P3_t^* = BV_t + \sum_{s=1}^{2}\left(\frac{\mathrm{E}_t(EPS_{t+s} - k_t BV_{t+s-1})}{(1+k_t)^s}\right) + \sum_{s=3}^{11}\frac{[\mathrm{E}_t(ROE_{t+s}) - k_t]BV_{t+s-1}}{(1+k_t)^s} + \frac{[\mathrm{E}_t(ROE_{t+12}) - k_t]BV_{t+11}}{k_t(1+k_t)^{11}},$$

where $\mathrm{E}_t(ROE_{t+s})$ for s = 4, 5, …, 12 is forecasted using a linear interpolation to the industry median ROE. The industry median ROE is calculated as a moving median of the past ten years' ROE of all firms in the industry. To eliminate outliers, industry median ROEs are Winsorized at the risk free rate and 20%.

$$ES1_t = \sum_{s=1}^{5}\mathrm{E}_t(EPS_{t+s}), \quad \text{and} \quad ES2_t = \sum_{s=1}^{5}\left(\frac{\mathrm{E}_t(EPS_{t+s})}{(1+k_t)^s}\right).$$

Years covered are 1982 through 1999. Sample size is 19,879.

Sector	Industry	BV	CFO	CACT	IACT	Ebitda	Sales	EPS1	EPS2	EG1	EG2	P1*	P2*	P3*	ES1	ES2	Ebitda/ TP	Sales/ TP
Basic Ind.	Building & Related	17	15	10	11	12	16	8	6	7	2	1	9	3	5	4	13	14
Basic Ind.	Chemicals	14	16	11	8	13	15	5	4	3	7	6	9	10	1	2	12	17
Basic Ind.	Containers	14	17	15	10	11	16	6	3	2	7	5	9	8	4	1	12	13
Basic Ind.	EAFE Metals-Nonfer	8	17	16	15	6	7	13	4	1	11	12	3	9	2	5	10	14
Basic Ind.	Forest Products	13	14	15	11	10	16	8	2	4	9	6	5	7	3	1	12	17
Basic Ind.	Metal Fab & Dist	14	15	9	10	13	16	4	5	3	2	8	7	12	1	6	11	17
Basic Ind.	Multi-Ind Basic	11	16	10	9	12	14	3	1	4	15	7	6	8	5	2	13	17
Basic Ind.	Nonfer Base Met	13	15	11	12	10	16	7	1	8	6	9	5	2	3	4	14	17
Basic Ind.	Paper	13	16	11	10	12	15	7	6	2	9	3	8	5	4	1	14	17
Basic Ind.	Precious Metals	13	12	14	8	10	16	11	6	4	15	2	7	1	5	3	9	17
Basic Ind.	Steel	5	16	14	11	12	15	8	2	3	10	7	1	9	6	4	13	17
Basic Ind.	Textiles	14	17	10	9	13	15	5	2	4	8	6	7	11	1	3	12	16
Cap. Goods	Aerospace	14	15	11	9	13	16	6	1	3	5	7	10	8	2	4	12	17
Cap. Goods	Auto OEMS	10	17	11	12	13	14	6	1	2	8	7	5	9	3	4	15	16
Cap. Goods	Bldg Materials	14	16	11	10	13	15	5	2	3	7	6	9	8	1	4	12	17
Cap. Goods	Defense	12	17	11	10	13	15	6	3	5	8	4	7	9	1	2	14	16
Cap. Goods	Electrical	14	16	11	10	12	15	3	7	5	9	1	6	8	2	4	13	17
Cap. Goods	Machinery	12	16	13	9	11	15	5	3	1	8	6	7	10	2	4	14	17
Cap. Goods	Multi-Ind Cap Good	17	16	8	9	10	12	2	3	4	1	7	14	13	5	6	11	15
Cap. Goods	Office Products	16	14	9	7	13	15	3	1	2	8	6	12	11	4	5	10	17
Cap. Goods	Undesig Capital	15	14	11	13	8	16	5	1	2	12	6	10	9	4	3	7	17

APPENDIX B—*continued*

Sector	Industry	BV	CFO	CACT	IACT	Ebitda	Sales	EPS1	EPS2	EG1	EG2	P1*	P2*	P3*	ES1	ES2	Ebitda/ TP	Sales/ TP
Consumer Dur.	Auto Part Mfg	14	17	11	7	12	15	4	1	3	8	9	6	10	2	5	13	16
Consumer Dur.	Automotive Mfg	3	8	15	14	16	7	13	11	12	6	4	1	2	10	9	17	5
Consumer Dur.	Home Bldg	13	17	11	10	12	15	5	1	3	6	7	8	9	2	4	14	16
Consumer Dur.	Home Furnish	14	17	12	8	11	15	5	3	4	10	6	7	13	2	1	9	16
Consumer Dur.	Leisure Prods	14	15	7	4	11	16	1	2	3	6	9	10	13	5	8	12	17
Consumer Dur.	Rec Vehicles	14	16	10	7	13	17	1	3	5	6	8	9	12	2	4	11	15
Consumer Dur.	Rubber	16	17	13	9	10	15	7	5	4	8	3	11	6	2	1	12	14
Consumer Dur.	Tools & Hardware	12	15	3	4	16	17	7	2	5	13	10	9	11	6	1	8	14
Cons. Non-Dur.	Beverages	15	14	10	8	12	16	7	5	2	6	4	11	9	1	3	13	17
Cons. Non-Dur.	Clothing	14	16	12	10	9	15	4	1	5	6	7	8	13	3	2	11	17
Cons. Non-Dur.	Consumer Containers	13	15	12	10	9	16	2	4	5	11	6	7	8	3	1	14	17
Cons. Non-Dur.	Cosmetics	17	14	8	6	13	15	5	3	2	11	7	12	9	1	4	10	16
Cons. Non-Dur.	Food Processors	15	14	9	8	13	16	1	3	5	6	7	12	11	2	4	10	17
Cons. Non-Dur.	Home Prods	14	15	12	8	13	16	6	5	1	3	7	9	10	2	4	11	17
Cons. Non-Dur.	Leisure Time	16	17	14	12	10	13	5	4	3	9	8	6	11	1	2	7	15
Cons. Non-Dur.	Leisure Times	12	14	11	9	15	16	7	4	1	8	6	5	10	2	3	13	17
Cons. Non-Dur.	Paint & Rel Mats	13	16	10	8	12	15	6	4	5	2	7	11	9	3	1	14	17
Cons. Non-Dur.	Tobacco	16	15	13	7	11	14	6	1	3	8	5	10	9	4	2	12	17
Cons. Services	Communications	15	14	13	8	12	16	7	3	5	4	6	10	9	1	2	11	17
Cons. Services	Ind Svcs	13	16	10	6	14	15	4	7	3	8	1	9	11	5	2	12	17
Cons. Services	Retail—Foods	14	15	10	8	12	16	5	4	2	7	6	9	11	1	3	13	17
Cons. Services	Retail—Goods	14	16	10	9	12	15	6	4	2	3	7	8	11	1	5	13	17
Cons. Services	Undesig Conr Svc	12	16	10	8	14	15	4	3	2	7	6	9	11	1	5	13	17

APPENDIX B—*continued*

Sector	Industry	BV	CFO	CACT	IACT	Ebitda	Sales	EPS1	EPS2	EG1	EG2	P1*	P2*	P3*	ES1	ES2	Ebitda/ TP	Sales/ TP
Energy	Canadian Energy	14	16	10	8	11	15	5	1	6	13	7	9	2	3	4	12	17
Energy	Coal	12	16	7	10	14	17	6	5	2	8	4	11	9	3	1	13	15
Energy	EAFE Energy Srcs	2	13	16	15	1	12	11	8	4	9	10	6	14	3	5	7	17
Energy	Gas	7	14	8	12	10	16	3	4	6	15	11	1	9	5	2	13	17
Energy	Oil	9	13	15	12	11	16	8	5	2	10	6	1	7	3	4	14	17
Finance	Banking	11	16	9	6	12	13	5	3	4	8	10	7	14	2	1	17	15
Finance	Finan & Loan	8	17	7	4	11	10	6	1	2	13	12	9	14	3	5	15	16
Finance	Finan Svcs	17	16	12	6	13	11	9	5	3	8	1	7	10	4	2	14	15
Finance	Insurance	15	16	12	8	10	14	5	2	3	7	6	11	9	4	1	13	17
Finance	Investments	14	15	11	9	12	17	6	2	5	10	4	8	7	3	1	13	16
Finance	S & L	11	15	12	7	9	14	1	4	2	10	8	5	13	3	6	17	16
Finance	Undesignated Finance	10	14	6	7	12	16	15	11	9	2	1	4	3	8	5	13	17
Health Care	Biotech	14	17	13	11	9	15	10	1	4	2	7	8	3	6	5	16	12
Health Care	Drugs	15	17	13	10	11	14	5	4	2	9	7	6	8	1	3	12	16
Health Care	Hosp Supplies	14	17	11	9	12	15	7	6	2	4	5	8	10	1	3	13	16
Health Care	Hospitals	14	15	12	10	13	16	6	1	5	9	4	8	7	2	3	11	17
Health Care	Med Supplies	15	17	10	9	13	14	5	4	2	6	7	8	12	1	3	11	16
Health Care	Svc to Med Prof	14	15	12	9	11	16	7	5	4	1	8	6	13	2	3	10	17
Misc. Undesig.	Unclassified	12	13	11	10	14	16	5	3	4	7	6	9	8	2	1	15	17
Public Utilities	Electrical Util	11	14	10	9	12	15	5	2	4	13	6	7	8	3	1	16	17
Public Utilities	Gas Util	8	16	11	9	10	15	5	1	2°	14	7°	6°	12	3°	4°	13	17
Public Utilities	Phone Util	15	16	13	8	12	11	5	4	2°	10	7°	6°	9°	1°	3°	17	14
Public Utilities	Water Util	9	12	8	4	5	13	1	3°	2°	15	11	10	14	6°	7°	16	17

APPENDIX B—*continued*

Sector	Industry	BV	CFO	CACT	IACT	Ebitda	Sales	EPS1	EPS2	EG1	EG2	P1*	P2*	P3*	ES1	ES2	Ebitda/ TP	Sales/ TP
Technology	Computers	14	17	11	10	12	15	6	4	2	5	7	8	9	1	3	13	16
Technology	Electronics Sys/Dev	14	15	10	8	11	16	6	4	3	5	7	9	12	1	2	13	17
Technology	Electronics	13	15	14	11	12	16	6	3	4	7	5	8	9	2	1	10	17
Technology	Office/Comm Equip	13	17	15	9	14	12	5	3	1	7	6	8	10	2	4	11	16
Technology	Other Computers	15	14	11	9	13	16	4	6	3	5	7	8	10	1	2	12	17
Technology	Photo-Optic Equip	14	17	11	10	15	13	5	4	2	7	6	8	9	3	1	16	12
Technology	Semicond/Comp	14	15	12	9	11	16	6	4	3	8	7	5	13	1	2	10	17
Technology	Software EDP	17	15	14	8	12	13	5	4	1	6	9	7	10	3	2	11	16
Technology	Undesignated Tech	12	14	7	9	15	16	1	3	4	10	8	6	11	2	5	13	17
Technology	Undesignated Technology	15	17	12	11	10	13	7	2	6	14	8	5	9	3	4	1	16
Transportation	Airlines	11	15	13	10	12	16	8	7	5	1	6	3	9	2	4	14	17
Transportation	Maritime	9	16	13	8	12	17	7	4	2	11	3	1	14	6	5	10	15
Transportation	Railroads	12	13	11	7	15	16	5	2	4	8	6	9	10	3	1	14	17
Transportation	Trucking	12	14	8	10	16	15	4	3	5	9	7	6	11	1	2	13	17
	Mean Rank	12.9	15.3	11.1	9.0	11.7	14.8	5.7	3.5	3.5	7.5	6.4	7.5	9.4	2.8	3.2	12.3	16.1
	Median Rank	14	16	11	9	12	15	5	3	3	8	7	8	9	2	3	13	17
	Standard Deviation of Rank	2.90	1.53	2.37	2.18	2.30	1.90	2.61	2.08	1.87	3.44	2.35	2.68	2.95	1.79	1.76	2.55	1.72

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Valuation Model Use and the Price Target Performance of Sell-Side Equity Analysts

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Abstract

This study investigates the influence of inferred valuation model use on the investment performance of sell-side equity analysts' published price target opinions. There is limited and inconclusive evidence on how analysts' price targets are determined and on their value for investment decisions. Using a broad sample of 45,693 price targets provided to First Call by sell-side analysts during 1997 through 2003, we first show that price targets have investment value because they predict future stock returns. Next, we develop and implement an innovative large-sample procedure for *inferring* valuation model use from the observed correlation between analysts' price targets and two researcher-constructed stock valuation estimates that differ in simplicity and rigor. Reliance on a less rigorous valuation model may diminish the investment advantage associated with an analyst's more accurate earnings forecasts but it may also mitigate the disadvantage of less accurate forecasts. We test whether the apparent use of a more rigorous valuation technique yields higher quality price targets as measured by realized investment returns over a 12-month horizon, controlling for possible differences in earnings forecast accuracy. The central message from our data is that price targets exhibit superior investment performance when analysts appear to be using a fundamental residual income (RIM) stock valuation technique rather than a simple price-earnings-growth (PEG) valuation heuristic. This investment advantage is reduced when analysts' earnings forecasts are inaccurate. Our results underscore the importance of valuation model choice to analyst's stock investment evaluation process.

JEL Classification: G10, G14, G24

Key Words: security analysts, earnings forecasts, price targets, earnings-based valuation models

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1. Introduction

"The analyst could do a more dependable and professional job of passing judgment on a common stock if he were able to determine some objective value, independent of the market quotation, with which he could compare the current price. He could then advise the investor to buy when price was substantially below value, and to sell when price exceeded value." (Graham and Dodd 1951: 404-5)

By the mid-1990s, a growing number of sell-side equity analysts had begun to disclose price targets in their published stock research reports.[1] Price targets are presumably intended to convey analysts' opinions about what a stock is truly worth and thus form the basis for their less granular Buy/Sell recommendations. Despite the growing popularity of price targets and their potential to provide a more precise signal about analysts' investment opinions, large-sample evidence on the quality of analysts' price target opinions is limited.

Investors do consider price target revisions to be informative. The average stock price reaction at revision is comparable in magnitude to that for changes in Buy/Sell recommendations (Brav and Lehavy 2003; Asquith, Mikhail, and Au 2005). Moreover, price target revisions contain information beyond that found in changes in analysts' summary earnings forecasts or recommendations (Brav and Lehavy 2003; Asquith et al. 2005). However, less than 50 percent of analysts' price targets are actually attained during the ensuing 12 months—the most common horizon analysts specify (Asquith et al. 2005; Bradshaw and Brown 2006). Additionally, the

[1] Among the roughly 378,000 stock research reports published between July 1982 and December 1996 and available from the INVESTEXT© archive, we find from text searches that only 9 percent mention price targets. The frequency of price targets in published stock research reports increases to 32.8 percent for the period January 1997 to December 2003 (our sample period), and 42.8 percent after December 2003. As described later in the paper, we draw our price target sample from the First Call electronic data files rather than hand-collect price targets from INVESTEXT© stock research reports. Individual analysts' price targets published from 1999 on are now also available through I/B/E/S.

investment returns realized from simple price target trading strategies are substantially below the ex ante returns implied by analysts' price targets (Brav and Lehavy 2003).

Prior research has identified two factors that may explain why analysts' published price targets are of limited value as investment signals. One possibility is that price targets serve a purpose other than that envisioned by Graham and Dodd (1951). Bradshaw (2002), for example, argues that analysts sometimes concoct price targets to justify *ex post* their Buy/Sell recommendations. Such *ad hoc* departures from traditional valuation methods undoubtedly compromise price target quality. A second possibility is that, even when analysts derive their price targets using accepted stock valuation techniques, price target quality is compromised by inaccurate forecasts of earnings, cash flows, or other firm fundamentals that serve as valuation model inputs. Overly optimistic earnings forecasts, for example, may give rise to inflated price targets that exaggerate potential investment returns. The available evidence on how analysts' earnings forecast accuracy affects price target quality is scant and varies with research design choices. Bradshaw and Brown (2006) find that the *past* accuracy of analysts' earnings forecasts is unrelated to price target attainability. Loh and Mian (2006) and Ertimur, Sunder, and Sunder (2007) find that analysts who issue more accurate *contemporaneous* earnings forecasts also issue more profitable Buy/Sell recommendations (a proxy for price targets).

This study investigates a third potential contributor to low quality price targets; namely, the possibility that some sell-side analysts use inefficient heuristics to set their price targets. Even analysts adept at formulating accurate earnings forecasts may favor the use of simple valuation heuristics rather than more rigorous and proven techniques.[2] Using a broad sample of

[2] The popularity of simple valuation heuristics can be traced to their ease of implementation and to the absence of unambiguous feedback about their actual success or failure in use. Feedback can be ambiguous because, under certain circumstances, the investment signals generated by a simple valuation heuristic can be consistent with those derived from more rigorous valuation techniques (e.g., Easton 2004; Penman 2005). *Value Line*, for example, says

45,693 price targets provided to First Call by sell-side analysts during the calendar years 1997 through 2003, we implement a statistical procedure for *inferring* valuation model use from the observed correlation between analysts' price targets and researcher-constructed stock valuation estimates. We then test whether the apparent use of a more rigorous valuation technique yields higher quality price targets as measured by realized investment returns over a 12-month horizon. Our tests control for possible differences in earnings forecast accuracy (including an optimistic bias) and its association with inferred valuation model use.

Three research questions thus anchor the study. First, do analysts' price target opinions predict future stock returns? We document the 12-month holding period abnormal returns realized by portfolios constructed from analysts' price target opinions and find that realized returns are greater for more favored stocks but the relation is not strictly monotonic. Second, does *inferred* valuation model use moderate the ability of analysts' price targets to predict future returns? The valuation models considered here incorporate analysts' earnings forecasts and yet differ in simplicity and rigor. Reliance on a less rigorous valuation model may diminish the investment advantage associated with an analyst's more accurate earnings forecast but it may also mitigate the disadvantage of less accurate forecasts. Our final research question is motivated by the need to isolate any incremental effects of *inferred* valuation model use on realized returns from those associated with differences in earnings forecast accuracy and recommendation opinions. Loh and Mian (2006) and Ertimur et al. (2007) both find that analysts who issue more accurate EPS forecasts also provide more profitable Buy/Sell recommendations. Our third research question thus sheds light on the relative influence of valuation model use on price target investment performance.

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that the price targets produced by its analysts are based on the analyst's projections for earnings multiplied by an estimated price/earnings ratio (http://valueline.com/ed_vlpage.html and Brav, Lehavy, and Michaely 2005). This simple valuation heuristic may be efficient in some circumstances and inefficient in others.

Our key finding is that substantial improvements in price target investment performance occur when analysts appear to use a rigorous valuation technique rather than an heuristic. This improvement in realized returns is most pronounced among analysts who are also adept at formulating accurate earnings forecasts, a key input to the valuation models we consider. Our results are robust to a battery of sensitivity tests. The central message from our data is that the profitability of analysts' published price targets is substantially reduced when those price targets appear to have been derived from a valuation heuristic using inferior earnings forecasts.

Our study contributes to several streams of ongoing research. First, the study adds to a growing literature on the role of analysts' price targets as information signals (Brav and Lehavy 2003; Asquith et al. 2005). We show that analyst price targets predict future returns, and that this effect is incremental to the returns predictability of Buy/Sell recommendations. Second, the paper extends Bradshaw's (2002, 2004) research on valuation model choice and analysts' investment opinions. Third, the study sheds light on the relative importance of valuation model use to the profitability of analysts' price targets. Finally, the study makes an important methodological contribution by developing an approach to inferring analysts' valuation model use in large samples. Despite the inherent limitations of inferring analysts' unobservable valuation models from imperfect signals, which we discuss at the end of Section 3, we believe our approach has broad applicability for generating new insights about how analysts' earnings forecasts, price targets, and recommendations are intertwined.

We present the remainder of the paper in five parts. Section 2 reviews the relevant prior literature and develops our hypotheses about valuation model use and price target quality. Section 3 provides details about the sample selection process, measurement issues, and descriptive statistics about sample firms and analysts. The results are presented in section 4. We discuss supplemental analyses in section 5. Concluding remarks are provided in section 6.

2. Prior research

Sell-side equity analysts collect, evaluate, and disseminate information about future financial and investment performance of the firms they cover. Many analysts' reports highlight three key summary measures: near-term forecasts of earnings; a price target reflecting the analyst's opinion about what the stock is currently worth; and a Buy/Sell investment recommendation. Descriptions of the equity research process (e.g., Copeland, Koller, Murrin 2000; English 2001; Penman 2010) indicate that the quality of an analyst's Buy/Sell recommendation depends on how well each of three distinct tasks is performed: formulating accurate forecasts of earnings and other fundamentals; translating those forecasts into reliable valuation price targets; and then assigning a recommendation to the stock based on a comparison of the stock's current market price against the price target. Success at one task does not guarantee success at the others. For example, an analyst adept at forecasting earnings and other firm fundamentals may use those superior forecasts as inputs to a flawed valuation technique thereby generating inferior price targets and recommendations.

This section summarizes earlier research on the prevalence and informativeness of analysts' price target opinions and on whether earnings forecast accuracy and valuation model choice influence price target investment performance.

Analysts' price targets

Asquith et al. (2005) report that price targets are disclosed in about 73 percent of the research reports authored by *Institutional Investor* "All American" analyst team members from

1997 to 1999.[3] Among this group of top-rated analysts, price targets are most often associated with a 12-month horizon and are on average 33 percent higher than the stock's market price at the time the report is published. Price targets below current market price are uncommon, and the tendency to disclose a price target is greater for more favorable stock recommendations. This price target disclosure pattern is also evident in random samples of sell-side equity research reports from this same time period (Bradshaw 2002; Brav and Lehavy 2003).

Price target revisions are accompanied by a mean five-day abnormal stock return of -3.9 percent around downward revision announcements and +3.2 percent for upward revisions (Brav and Lehavy 2003). The stock return associated with price target revisions is comparable in magnitude to that for changes in Buy/Sell recommendations (Asquith et al. 2005). [4] Price target revisions are more frequent than recommendation changes but analysts often issue revised price targets and Buy/Sell recommendations simultaneously. Both studies confirm that changes in summary earnings forecasts, stock recommendations, and price targets each provide independent value-relevant information to the capital market.[5]

Investor reaction to analysts' price target revisions is justified only if price targets convey incremental information useful for predicting future stock prices. But some have argued that

[3] By comparison, all of the reports examined in Asquith et al. (2005) contain a summary Buy/Sell recommendation and nearly all reports also provide earnings per share (EPS) forecasts—99 percent for the current fiscal year and 95 percent for at least one subsequent year. Only 23 percent of the reports contain explicit EPS forecasts beyond one subsequent year, although EPS growth rate forecasts over a three to five year horizon are common.

[4] Brav and Lehavy's (2003) findings may overstate investor reaction to price target revisions. Altinkilic and Hansen (2009) find that analysts Buy/Sell recommendation revisions often piggyback on other recent corporate news and that recommendation revisions are associated with economically insignificant mean share price reactions after controlling for this other news. The same may be true for price target revisions. Our interest is in the ability of price targets to predict future stock returns rather than the information content of price target revision announcements.

[5] Asquith et al. (2005) find that other information contained in a report, such as the strength of the written arguments made to support an analyst's opinion, also exerts a significant influence on stock returns that accompany the issuance of sell-side research reports. The stronger the justifications provided in the report, the stronger the market's reaction to the report. Recent evidence derived from intra-day stock returns (Altinkilic and Hansen 2009; Altinkilic, Balashov, and Hansen 2009) raises new questions about whether analysts' earnings forecasts and stock recommendations are an important source of incremental information for investment purposes or just piggyback on other recent news.

published price targets may at times serve a quite different purpose. Analysts have incentives to compromise their objectivity and optimistically bias their commentaries, forecasts, price targets, and recommendations (e.g., Lin and McNichols 1998; Michaely and Womack 1999; Dechow, Hutton, and Sloan 2000; Bradshaw, Richardson, and Sloan 2003; Lin, McNichols, and O'Brien 2005). Asquith et al. (2005, 276) note that: "Analysts might be more likely to issue highly favorable recommendations due to concerns over personal compensation, relationships with the analyzed firms' management, or their own firm's underwriting business. Price targets can be either a way for analysts to ameliorate the effects of overly optimistic reports or a part of the sales hype used to peddle stocks".

One way to gauge the performance of analysts' price targets is to determine how often they are attained. "All American" analysts' price targets are attained 54 percent of the time during the 12 months following publication of the research report (Asquith et al. 2005). Stocks that attain the price targets of these top-rated analysts usually overshoot by an average of 37 percent during the ensuing 12 months. The remaining 46 percent of stocks fall about 16 percent short of the price target at their peak over the year. Bradshaw and Brown (2006) use a comprehensive price target data set compiled by First Call to investigate the attainability of 95,852 price targets for U.S. firms issued in 1997-2002. Only 45 percent of these price targets are attained in the ensuing year.

Price target attainability is an incomplete performance measure when viewed from the perspective of investors. After all, the probability of a stock attaining the price target is inversely related to the level of optimism exhibited by the analyst, as measured by the projected stock price change at publication of the research report. Put simply, a $10 stock is much more likely over the next 12 months to attain an $11 price target than a $15 price target but the realized return from doing so is vastly lower as well. We depart from this earlier emphasis on price target attainability and instead use a 12-month buy-and-hold return as our performance measure.

Our first research goal is then to document the investment returns realized by portfolios built from analysts' price targets. This is the first study to provide large sample evidence on whether analysts' price targets predict future stock returns. If price target opinions do indeed predict future market prices, then the *ex ante* return implied by the price target when first published (e.g., 10 percent for an $11 price target assigned to a $10 stock) should exhibit a reliably positive association with the ensuing 12-month *ex post* realized return. Evidence of a positive association between implied returns and realized returns would be consistent with the notion that price targets are credible, informative, and intended to convey analysts' opinions about the worth of a stock. Of course, a positive association between implied returns and realized returns does not preclude the possibility that price targets are sometimes influenced by other considerations as well.

Analysts' valuation model choice

Stock valuation methodologies fall into one of two broad categories: so-called *fundamental valuation methods* such as the discounted cash flow (DCF) approach that combine projected cash flows or earnings from comprehensive financial forecasts of firm performance with estimated discount rates; and *relative valuation multiples* such as price-to-earnings (P/E), price-to-revenue, or price-to-book value ratios that are compared to historical norms or to other firms in the same industry. As Penman (2010, 74) notes: "In valuation, as with most technologies, there is always a tradeoff between simple approaches that ignore some pertinent features and more elaborate techniques that accommodate complexities".

Valuation multiples are heuristics derived from informal methods and experience. They are simple to apply and communicate but use limited information about the firm, its factor and product markets, future prospects, or industry competition. Damodaran (2005, 754) has characterized analysts' use of relative valuation multiples as "a story telling experience; analysts with better and more believable stories are given credit for better valuations". Fundamental valuation methods, on the other hand, are theoretically sound but challenging to implement and communicate. They require analysts to identify all the relevant information and then to extract from that information the applicable implications for valuing the firm and its securities. Despite important theoretical and practical differences in the two valuation methodologies, they can lead to identical price targets under certain circumstances.

What valuation methodologies do sell-side analysts use when formulating price targets? Two strands of research are pertinent. One strand provides evidence on *self-reported* valuation model use. Demirakos, Strong, and Walker (2004), for example, report that only half of the 104 comprehensive research reports in their sample of London Stock Exchange listed companies mention DCF valuation models or variations such as residual income. Nearly all reports mention heuristics such as earnings or sales multiples, and price-to-book or price-to-assets ratios. This pattern is also evident in reports authored by *Institutional Investor* "All-American" team members: 99 percent of the reports examined by Asquith et al. (2005) mention an earnings multiple (e.g., price-to-earnings) but only 13 percent mention the use of DCF or its variations. Evidence on valuation model use obtained from content analyses of sell-side research reports may provide an incomplete picture of how analysts actually formulate their price targets. As Bradshaw (2004, 27) observes: "… individual analysts who use present value [DCF] models may choose to communicate the results of their analyses in the simplest terms, excluding a detailed discussion of present value techniques (i.e., dividend assumptions, discount rates, etc.). Additionally, there are obvious proprietary costs to divulging particular methods of identifying any single security for recommended investment".

Concerns of this sort spawned a second strand of research that *infers* valuation model use from the observed correlation between analysts' stated price targets (or recommendations) and researcher-constructed valuation estimates. A high observed correlation means that analysts' price target opinions behave "as if" they were formed according to the particular valuation methodology under consideration. Bradshaw (2002) compares the price targets sell-side analysts disclosed in a hand-collected sample of 67 research reports on U.S. firms with *pseudo*-price targets constructed from PEG ratios and from industry-adjusted P/E multiples that incorporate analysts' one-year and two-year-ahead earnings forecasts.[6] PEG-based *pseudo*-price targets are more highly correlated with analysts' actual price targets than are *pseudo*-price targets constructed from industry P/E multiples. Bradshaw (2002) does not examine the explanatory power of *pseudo*-price targets constructed from DCF or residual income valuation models.

Bradshaw (2004) reports large sample evidence on whether valuation estimates constructed from analysts' *consensus* earnings forecasts are consistent with *consensus* Buy/Sell recommendations. Four valuation approaches are considered: two specifications of the DCF residual income model, a PEG ratio, and analysts' projections of long-term earnings growth. Analysts' price targets are not considered because of data availability limitations at the time. The results indicate that analysts seem to give their highest recommendations to growth stocks without regard to valuation, and among growth stocks, the highest recommendations are stocks

[6] The PEG ratio is a firm's price-to-forward-earnings (P/E) ratio divided by its forecasted long-term earnings growth (G) rate. PEG ratio advocates claim that a value greater than one constitutes a Buy signal. Numerous articles in the financial press describe the pervasive use of the PEG ratio as a stock investment tool, but Easton (2004) is the first to provide a formal derivation of PEG by imposing simplifying assumptions on fundamental valuation theory.

favored by the PEG model. Consensus recommendations are not well explained by consensus *pseudo*-price targets constructed from either DCF valuation model. Notably, Bradshaw (2004) concludes that investors would earn higher returns over a one-year holding period by relying on formal DCF models that incorporate analysts' consensus earnings forecasts rather than on analysts' consensus Buy/Sell recommendations alone.

Several messages from these findings are relevant to our study. First, individual analysts often mention more than one valuation approach when describing how they arrive at their price targets and Buy/Sell recommendations. Why they do so is unclear, but one interpretation is that analysts vary in their adherence to rigorous fundamental stock valuation methodologies. Second, prior research on inferred valuation model use (Bradshaw 2002, 2004) supports the view that some analysts employ heuristics that yield less profitable price targets than do multi-period DCF valuation approaches. However, these findings are derived from a small sample of actual price targets (Bradshaw 2002) or from consensus stock recommendations (Bradshaw 2004) that may not fully reflect the investment opinions of individual analysts.

As our second research goal, we contribute to this research stream by providing the first large sample evidence on whether differences in inferred valuation model use by individual analysts contribute to differences in price target quality. In contrast to Bradshaw (2004), we focus on analysts' price target opinions because they are more granular, more verifiable, and more comparable across analysts than are Buy/Sell recommendations and because large sample price target data files are now available in electronic form. Our research methods allow for the possibility that competing valuation approaches (e.g., DCF residual income and PEG model) sometimes yield the same price target estimate and thus provide an inconclusive basis for inferring valuation model use. Our tests also control for potential differences in analysts' EPS forecast accuracy because earnings forecasts are inputs to the valuation models we consider.

Analysts' earnings forecast accuracy

Conventional wisdom suggests that more accurate EPS forecasts will result in higher quality price targets, but there are reasons to question the strength of this predicted relation.[7] Loh and Mian (2006) and Ertimur et al. (2007) both find that analysts who issue more accurate EPS forecasts also provide more profitable Buy/Sell recommendations, but they do not identify price target superiority as the source of this profitability improvement. Bradshaw (2002) argues that analysts concoct their price targets whereas Bradshaw and Brown (2006) say analysts have few (if any) incentives to set accurate price targets. These assertions raise doubts about overall price target quality and imply a rather tenuous link between price targets, earnings forecast accuracy and future stock returns. At the extreme, concocted price targets would presumably exhibit little or no predictive ability for future stock returns.

As our final research goal, we extend Loh and Mian (2006) and Ertimur et al. (2007) by investigating whether more accurate EPS forecasts are associated with superior price targets. In so doing, we provide evidence on the extent to which inferred valuation model use amplifies or attenuates the influence of EPS forecast accuracy on price target performance. Forecasting and valuation are two distinct tasks analysts perform and we conjecture that the potential benefits of

[7] Prior research documents that during the 1980's, analysts' forecasts were, on average, optimistic (see, e.g., O'Brien 1988; Butler and Lang 1991). However, firms' ability to meet or beat analysts' earnings forecast benchmarks in recent periods is more consistent with forecast pessimism (see, e.g., DeGeorge, Patel, and Zeckhauser 1999; Bartov, Givoly, and Hayn 2002; Kasznik and McNichols 2002; Matsumoto 2002; Richardson, Teoh, and Wysocki 2004; and Burgstahler and Eames 2006). Sustained differences exist over time in the EPS forecast accuracy of individual analysts (Stickel 1992; Sinha, Brown, and Das 1997). These differences in EPS forecast accuracy can be traced to a variety of analyst, brokerage, and firm characteristics (Brown 2001; Brown and Mohammad 2001; Clement 1999; Mikhail, Walther, and Willis 1997, 1999; Jacob, Lys, and Neale 1999). Despite these differences, analysts' EPS forecasts remain informative for investment purposes. EPS forecasts are more informative when they are issued by analysts with a track record for accuracy, although stock prices do not appear to fully reflect the benefits of superior forecast accuracy by less well known analysts (Gleason and Lee 2003).

superior EPS forecasts for price target quality can be lost if those forecasts are used as inputs to a flawed stock valuation model. Our tests rely on concurrent EPS forecast accuracy (as in Loh and Mian 2006) and control for concurrent Buy/Sell recommendations.

3. Sample selection, measurement issues, and descriptive statistics

Data requirements

Analysts' price targets are from a First Call database of roughly 750,000 price targets issued from 1997 through 2003 by analysts affiliated with 314 distinct brokerage and stock research firms. First Call identifies the brokerage or research firm—but not the individual analyst—submitting the price target. Individual analysts are identified from the I/B/E/S earnings forecast detail file. We require each First Call price target to be associated with a U.S. company, U.S. brokerage or research firm, and calendar month for which we are also able to identify from I/B/E/S the affiliated analyst for that same company and month. We adopt a company-year perspective and limit the sample to price targets in effect at the end of the fourth month after the company's fiscal year end.

Potentially "stale" price targets that are outstanding for more than one year are discarded because most price targets are issued with a 12-month horizon. We require the analyst to update at least one earnings forecast in the subsequent 12 months, which reduces the likelihood that our price targets are from analysts that stop coverage of the firm. We also require analysts' one-year EPS forecasts from I/B/E/S to be "current," meaning newly issued in the fourth month after the company's fiscal year-end or issued previously but confirmed by I/B/E/S—and thus reiterated by the analyst—in that same month or later. This filter reduces the likelihood that stale EPS forecasts contaminate our sample. These data restrictions collectively yield a preliminary price target sample of 64,281 analyst/firm/year observations from the merged First Call and I/B/E/S files.

We require share price to be available from CRSP three days prior to the First Call price target submission date. Consistent with Bradshaw and Brown (2006) and Frankel and Lee (1998), we delete firms with share prices below $1 so that our results are not influenced by stocks with low liquidity and thus high trading costs. The inclusion of stocks with extremely low share prices may have a disproportionate effect on our results because such stocks are often thinly traded. Excluding these stocks from our sample means that our results may not generalize to the population of low-priced, illiquid stocks. We then remove extreme price targets by deleting the top and bottom one percent of observations based on the ratio of price target to pre-submission date share price. This step is intended to mitigate the influence of errors (if any) in the First Call database.

Our research design groups analyst-firm-year price targets by EPS forecast accuracy quintile and the I/B/E/S detail population is used to assign quintile rankings (as described below). This approach ensures that our forecast accuracy measure is not contaminated by any self-selection bias associated with the decision to report price targets to First Call. Analyst-firm-year observations from I/B/E/S are retained for purposes of forming EPS forecast accuracy quintiles if: (1) one-year ahead EPS forecasts are "current" in the fourth month after fiscal year end and actual earnings are subsequently reported; (2) share price at that time is at least $1; (3) the absolute forecast error scaled by share price (denoted *AFE*) is less than 25 percent; and (4) there are at least five unique values of *AFE* for each firm-year.[8] Requirement 3 mitigates the influence

[8] We note that the requirement that actual earnings be announced may impose a survivorship bias. However, this requirement is typical in studies that measure analysts' earnings forecast accuracy. Price targets, share prices, and valuation model inputs (i.e., EPS forecasts and book value per share) are not adjusted for subsequent stock splits to

of I/B/E/S data errors on our accuracy rankings. Requirement 4 ensures that each firm-year combination is represented in each EPS forecast accuracy quintile (Loh and Mian 2006). These restrictions further reduce the sample to 45,693 analyst-firm-year price targets representing 4,086 individual sell-side analysts covering 2,717 distinct U.S. firms.

Analysts' price targets

Table 1 reports descriptive statistics for the price target sample. Panel A describes the frequency of price targets and Buy/Sell recommendations among analysts who supply earnings forecasts to I/B/E/S each year. The I/B/E/S EPS Forecasts sample is comprised of 136,790 analyst-firm-year observations that pass the forecast accuracy (*AFE*) quintile filters described earlier. The Recommendations sample (n = 93,594) is the subset of I/B/E/S EPS Forecasts that also have a Buy/Sell stock recommendation outstanding in the fourth month after the firm's fiscal year-end. Price targets are not required for the two comparison samples. Panel A also reports the average *ex ante* (implied) return associated with analysts' price targets, denoted *PT/P* and defined as the ratio of the analyst's price target (*PT*) to the stock's market price (*P*) three days prior to the price target submission date. Values of *PT/P* greater than one presumably convey the analyst's belief that the stock is an attractive investment opportunity whereas values less than one indicate an unattractive stock.

There are several messages in the Panel A data. Price targets are available from First Call for only about one-third of the I/B/E/S analyst-firm pairs meeting our selection criteria. Price target availability increased markedly during the sample period from a low of 11 percent in

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avoid rounding errors common to the split adjustment process and to ensure that all variables are stated on the same basis.

1997 to 50 percent in 2002 and 2003.[9] By contrast, Buy/Sell recommendations are available for roughly two-thirds of the I/B/E/S analyst-firm pairs, and recommendation availability peaks at 80 percent in 2003.

[Insert Table 1]

The average implied price target return (*PT/P*) for stocks in our sample is 1.32, which means that price targets when first issued exceed share prices by 32 percent on average. This is consistent with the mean recommendation of 2.12 which represents a "Buy" signal. Mean implied return increases from 1.24 in 1997 to 1.40 in 2000—a period often referred to as the "tech bubble"—and then declines to 1.26 by 2003. Buy/Sell recommendations exhibit a similar pattern of increasing then declining optimism. Only about 8 percent of analysts' price targets take a negative view on the stock (*PT/P* less than one). This may indicate that price targets are rarely issued by analysts when the stock is deemed unattractive, or that analysts believed few covered stocks were overvalued during our sample period. Sell and strong sell recommendations are also rare. The increased frequency of sell recommendations (9.8 percent) and pessimistic price targets (12.7 percent) in 2003 compared to earlier years may be due to changes in the regulations governing stock research reports (Barber, Lehavy, McNichols, and Trueman 2006).

Panel B of Table 1 describes the frequency distribution of price target implied return (*PT/P*) for each stock recommendation category. These conditional distributions are derived from a sample of 35,241 analyst-firm-year observations where both price targets and recommendations are available. Price targets are sorted each year into five groups that range from "disfavored" stocks—where *PT/P* is less than one—to "most favored" stocks comprising the top quartile of observations where *PT/P* is greater than one. This sorting process preserves

[9] Price target availability in our broad sample is below the 73 percent reported by Asquith et al. (2005) for stock research reports authored by *Institutional Investor* "All American" analysts during 1997 to 1999. Apparently, the inclusion of explicit price targets in published research reports is one of the hallmarks of "All American" analysts.

the natural distinction between presumably overvalued (*PT/P* < 1) and undervalued (*PT/P* > 1) stocks, and is responsive to the obvious asymmetry in the distribution of observed *PT/P* values.

The central message in panel B is that analysts' Buy/Sell recommendations and price target opinions typically convey a consistent viewpoint regarding the investment value of a given stock; i.e., stocks assigned the highest recommendation also tend to be those most undervalued according to their implied investment return (*PT/P*). A surprising second message is that analysts' price targets and recommendations sometimes provide discordant investment signals. For example, one out of every five of the 181 "Strong Sell" stocks in our sample is also deemed by analysts to be undervalued (*PT/P* > 1) rather than overvalued, and 11 percent of the "Sell" recommended stocks are in the "most favored" *PT/P* group with the highest implied investment return. Discordant investment signals are also present among "Buy" and "Strong Buy" stocks. This pattern echoes earlier findings drawn from limited samples of price targets and recommendations (e.g., Asquith et al. 2005; Bradshaw 2002) and suggest that analysts' price targets and Buy/Sell recommendations are not perfect substitutes for one another as indicators of an analyst's belief about a stock's investment potential.

There are several possible explanations for discordant price targets and recommendations. Even if analysts rely exclusively on price target profitability to determine their recommendations, the panel B data may not cluster tightly along the concordant diagonal if individual brokerage houses (or analysts) differ in the *PT/P* cutoffs used for each recommendation category. Differences in recommendation cutoffs are, however, unlikely to fully explain the directional mismatches evident in the Panel B data.

Discordant investment signals will arise naturally if recommendations are intended to convey the analyst's relative (not absolute) investment opinion. An analyst covering 10 insurance stocks, all of which seem correctly valued from a price target perspective (*PT/P* ≈ 1 for each firm) may still feel compelled to assign a "Strong Buy" to the best one in the group. As an illustration, Allstate Corporation received a "Strong Buy" rating when the CBC Oppenheimer analyst's price target predicted appreciation of only 4.5 percent which places this stock in the "least favored" *PT/P* group in Table 1. Despite the small profit opportunity, the analyst still viewed Allstate as the best stock in the property-casualty personal insurance group of four firms.

Discordant observations can also arise from production errors made by data providers. To investigate the possibility of I/B/E/S (recommendation) and First Call (price target) data errors, we randomly selected 40 discordant observations and traced them to published research reports. We found one price target data coding error but no recommendation coding errors.[10] Published research reports that include a price target also contain the analyst's stock recommendation. This means that the existence of discordant investment signals cannot be traced to the possibility that one or the other signal is somehow stale (see Section 5 for more discussion of signal timeliness). Of course, the possibility of data production errors by analysts or brokerage houses remains.

The discordant signals in our sample tend to be concentrated among analysts that follow a small number of firms. Twenty percent of the discordant "Strong Buy" recommendations involve analysts that cover no other firm that year, and the median number of firms covered by such analysts is three. Analysts with discordant "Strong Buy" recommendation/price target pairs make significantly more "Strong Buy" recommendations than do concordant analysts (50 percent versus 35 percent; chi-square statistic = 205.3, p-value<0.01). The price targets assigned by discordant analysts to their other "Strong Buy" stocks also are less optimistic, on average, than

[10] I/B/E/S assigns a numerical value to the qualitative Buy/Sell opinions analysts submit; e.g., an I/B/E/S rating of 1 denotes a "Strong Buy" recommendation whereas a rating of 5 denotes a "Strong Sell". Brokerage houses and research firms differ in the labels used for these opinion designations, and some employ fewer than five qualitative categories. Our recommendation coding error test found no instances in which the I/B/E/S numerical rating was directionally inconsistent with the analyst's qualitative opinion.

are those assigned by concordant analysts (mean *PT/P* of 1.36 versus 1.42, *t*-statistic = 3.44, *p*-value < 0.01).

Although discordant price target/recommendation pairs occur in large samples such as ours, their precise origin remains indeterminate. Most importantly, discordant observations are comparatively rare and our results are robust to the exclusion of these observations from the sample.

Inferred valuation model use

We consider two stock valuation methodologies—a residual income (RIM) specification of the DCF approach and the PEG ratio heuristic—as candidates for describing how sell-side analysts formulate price targets. The Frankel and Lee (1998) RIM specification is selected as our DCF candidate because it incorporates analysts' multi-period EPS forecasts and because prior research demonstrates its ability to identify mispriced stocks.[11] The PEG ratio is selected as our valuation heuristic because of its reliance on analysts' EPS forecasts, its apparent popularity as a basis for stock recommendations (Easton 2004), and its demonstrated superiority for predicting analysts' actual price targets when compared to industry price-earnings multiples (Bradshaw 2002).[12,13] A *pseudo*-price target is constructed for each valuation approach and analyst-firm-year using the analyst's EPS forecasts. Valuation model use is then inferred by comparing the analyst's actual price target with these two *pseudo*-price targets. This approach, described in

[11] The intellectual foundations for this specification are described in Feltham and Ohson (1995) and Ohlson (1995). All DCF-based valuation models, including RIM, are theoretically equivalent to one another (Copeland et al. 2000; Penman 2007). Implementation differences across analysts can induce differences in price target quality even when the same DCF model is used.

[12] As Easton (2004) points out, the PEG ratio heuristic is not derived formally from fundamental valuation theory but it can be shown, under certain restrictive assumptions, to be inversely related to a stock's expected rate of return. Trombley (2008) demonstrates that PEG ratios can differ markedly from one even though a stock is correctly valued by market participants.

[13] Liu, Nissim, and Thomas (2002) provide large-sample evidence on the ability of PEG and RIM *pseudo*-price targets to explain actual stock prices over the period 1982-1999. They conclude that PEG outperforms RIM in this particular context, although their implementations of the two valuation approaches differ from those used here. They do not provide evidence on the ability of PEG and RIM *pseudo*-price targets to explain analysts' price targets or predict future stock returns.

detail below, relies on the large sample properties of the relation between analysts' price targets and our constructed *pseudo*-price targets.

A RIM *pseudo*-price target is estimated as the discounted present value of expected residual income for the next five years plus a terminal value, calculated as of the end of the fifth forecast year (TV_{t+5}):

$$V_{RIt} = BVPS_t + \sum_{\tau=1}^{5} \frac{E_t[RI_{t+\tau}]}{(1+r)^{\tau}} + \frac{E_t[TV_{t+5}]}{(1+r)^{5}} \tag{1}$$

where V_{RIt} is the *pseudo*-price target at time t, $BVPS$ is equity book value per share, RI is residual income $\left(EPS_{t+\tau} - r * BVPS_{t+\tau-1}\right)$, EPS is earnings per share, and r is the equity cost of capital or discount rate. Our RIM implementation follows Bradshaw (2004) and relies on analysts' forecasts available at the price target issue date. We require one-year and two-year-ahead EPS forecasts and long-term EPS growth estimates (LTG) to be available for each analyst-firm-year. If three-year to five-year EPS forecasts are unavailable, they are constructed by extrapolating the last available EPS forecast using the analyst's long-term EPS growth estimate; e.g., $E[EPS_{t+3}]$ is set equal to the analyst's explicit forecast of EPS_{t+2} multiplied by $(1+LTG)$. Equity book values are extrapolated by presuming that firms maintain their historical dividend payout ratios. This payout ratio is defined as the actual dividend payout ratio of the most recent fiscal year, or the mean payout over the previous three years if the prior year ratio is unreasonable (e.g., less than zero or greater than one). The industry discount rate (r) is the Fama and French (1997) industry-specific risk premium plus the risk-free rate (30-day Treasury bill yield) in effect for the month prior to the price target issue date.

Our terminal value estimate allows RI to fade toward zero over time as a result of possible competitive pressures within the industry. We derive an empirical fade rate (ω) for each Fama and French (1997) industry and sample year using all firms with the requisite data available on Compustat (see Bradshaw 2004 for details). For purposes of these fade rate regressions ($RI_t = \eta + \omega RI_{t-1} + \varepsilon_t$), *RI* is cleansed of special items and scaled by equity market value at the beginning of the year. If residual income after the terminal year is characterized by the industry/year-specific fade rate (ω), then the terminal value estimate is:

$$E_t[TV_{t+5}] = \frac{\omega}{1+r-\omega} E_t[RI_{t+5}] \tag{2}$$

Our inferences regarding valuation model use are unchanged if we instead assume that *RI* persists in perpetuity rather than fades toward zero.

The PEG ratio heuristic is implemented using the two-year-ahead EPS forecast for each analyst-firm-year:

$$V_{PEG} = E_t\left[EPS_{t+2}\right] \times LTG \times 100 \tag{3}$$

where V_{PEG} is the *pseudo*-price target and *LTG* is the analyst's projection of long-term annual earnings-per-share growth (Bradshaw 2004). Scaling the RIM and PEG *pseudo*-price targets (*V*) by share price (*P*) yields a *V*/*P* index of investment potential that is directly comparable to the analyst-based profitability metric *PT/P*. To ensure comparability, the same share price (*P*) is used in scaling *pseudo*-price targets and the analyst's price target. As in Frankel and Lee (1998) and Bradshaw (2004), we eliminate observations where equity book value is negative, return-on-equity (*ROE*) or forecasted *ROE* exceeds 100 percent, or where the *pseudo*-price target is extreme.

The ability of RIM and PEG *pseudo*-price targets to explain cross-sectional variation in analysts' actual price targets is described in panel A of Table 2. The panel reports summary statistics for annual regressions of analysts' price targets on each *pseudo*-price target. Two features of the data are noteworthy. First, RIM and PEG *pseudo*-price targets both exhibit substantial explanatory power for analysts' price targets in that the adjusted R^2 values of the annual regressions are above 50 percent in most years. Explanatory power is moderate, however, in both 2000 and 2001. Second, the explanatory power of RIM *pseudo*-price targets exceeds that for PEG *pseudo*-price targets in every year except 2000. These results indicate that RIM *pseudo*-price targets exhibit greater descriptive validity for our sample than do *pseudo*-price targets constructed from the PEG heuristic.

[Insert Table 2]

Panel A of Table 2 reports summary statistics describing inferred valuation model use as measured, for a given analyst-firm-year, by $\left(|\varepsilon_{RIM}|/|\varepsilon_{PEG}|\right)$ where ε_{RIM} and ε_{PEG} are residuals from the *pseudo*-price target regressions. The intuition behind our use of this valuation model ratio (*VMR*) is straight-forward: the absolute value of the regression residual will depart from zero when the analyst's price target is not well described by the *pseudo*-price target. *VMR* ratio values less than one favor use of RIM by the analyst whereas values greater than one favor use of the PEG heuristic. If RIM and PEG *pseudo*-price targets are equidistant from the actual price target, the *VMR* ratio value will be one and neither approach dominates the other as a description of the price target formation process. This approach to inferring valuation model use takes advantage of the large sample properties of the relation between analysts' price targets and our *pseudo*-price targets, and facilitates inferences about valuation model use even when there are few observations pertaining to a particular analyst. The approach also accommodates instances where the two valuation approaches yield identical *pseudo*-price targets and thus provide an inclusive basis for inferring valuation model use.

Despite its intuitive appeal, our approach to inferring valuation model use has several limitations. One is that our implementation of the RIM and PEG valuation models may not accurately capture how the analysts comprising our sample form their price targets. Research-induced implementation differences may cause the resulting *pseudo*-price targets to deviate from analysts' actual RIM or PEG price targets and this may contribute to error in classifying analysts' valuation approaches. This possibility may be more acute for RIM *pseudo*-price targets than for PEG *pseudo*-price targets given the relative simplicity of the PEG approach. However, our reliance on *VMR* and its large-sample regression estimates of valuation model fit mitigate any systematic bias attributable to implementation differences. Our findings are robust to a battery of RIM model implementation sensitivity tests described later in the paper.

A second limitation is that our *pseudo*-price targets are derived from analysts' published earnings forecasts which may differ from the private forecasts used as inputs to their valuation models. This possibility may also contribute to error in classifying analysts' valuation model approaches. However, our RIM and PEG *pseudo*-price targets are derived from a common set of analysts' EPS forecasts and our tests control for cross-sectional differences in contemporaneous earnings forecast accuracy. The limited availability of analysts' two-year-ahead EPS forecasts and long-term EPS growth estimates—required for *both* RIM and PEG pseudo-price targets, and thus *VMR*—reduces the pseudo-price target sample to 21,202 analyst/firm/year observations.

A third limitation is that our approach ignores the endogeneity of analysts' valuation model use. For example, analysts that rely on a PEG approach may do so because discount rates are required for the implementation of RIM but not for PEG. It is also possible that analysts who use RIM perceive risk (i.e. discount rate) differently than analysts who use PEG valuation. Analysts who in fact use PEG valuation may do so to avoid the problem of estimating a discount rate. Finally, *VMR* only indicates whether analysts' price targets behave "as if" the RIM or PEG approach is being used. It is entirely possible that some analysts employ a third (unidentified) approach that coincidentally results in a price target closely approximating our RIM (or PEG) *pseudo*-price target.

As shown in panel A of Table 2, analysts' actual price targets do not exhibit a consistent pattern of deviation from RIM and PEG *pseudo*-price targets across the sample period. They initially favor RIM use (median *VMR* of 0.76 in 1997), then increasingly favor PEG use (median *VMR* of 1.16 in 2000), before trending back toward RIM use (median *VMR* of 0.97 in 2003). It is noteworthy that RIM *pseudo*-price targets exhibit little explanatory power in both 2000 and 2001 (adjusted R^2 of 0.14 and 0.36, respectively), the two years in which analysts' price targets most strongly favor PEG use. Panel B of Table 2 reports summary *VMR* statistics by price target profitability (*PT/P*) portfolio and Buy/Sell recommendation category. Apparent RIM use is prevalent among stocks in the top ("most favored") *PT/P* profitability portfolio and those with a "Strong Buy" recommendation. PEG use is prevalent among "least favored" and "disfavored" *PT/P* stocks as well as those with a "Hold" rating. Implied valuation model use thus varies over time (panel A) and across *PT/P* profitability portfolios and recommendation categories (panel B).

4. Results

Price target investment performance

To assess the *realized* profitability of analysts' price target predictions, we compute 12-month characteristics-adjusted buy-and-hold abnormal common stock returns (*BHAR*) as in Daniel, Grinblatt, Titman and Wremers (1997):

$$BHAR_i = \left[\prod_{t=1}^{252} (1 + r_{it}) - \prod_{t=1}^{252} (1 + r_{C,t}) \right] \quad (4)$$

where r_{it} is the daily raw return for stock i and $r_{C,t}$ is the daily value-weighted return on the characteristics-sorted benchmark portfolio to which the firm belongs in that year. This approach controls for differences in market-wide share price movements over the investment holding period. We then compute the average *BHAR* for each price target implied return (*PT/P*) portfolio. If differences in the price targets analysts assign to a stock are informative for investment purposes, we should observe a pattern of increasing realized returns across *PT/P* portfolios.

Table 3 reports average *BHAR* for the five price target portfolios. With the exception of stocks assigned to the "disfavored" group where *PT/P* is less than one, investment performance is indeed monotonically increasing across price target portfolios. Stocks in the top ("most favored") *PT/P* portfolio earn a statistically positive 12-month *BHAR* of 5.00 percent compared to the reliably negative -1.42 percent *BHAR* earned by "least favored" Portfolio 2 stocks. The *BHAR* for "disfavored" stocks is indistinguishable from zero even though share prices are predicted by analysts to decline.

[Insert Table 3]

Investment performance and valuation model use

Table 3 also provides evidence on whether valuation model use influences the quality of analysts' price target opinions. To investigate this question, we form portfolios grouped by price target implied return (*PT/P*) and inferred valuation model use (*VMR*). The six *VMR* portfolios are constructed by sorting observations where *VMR* is less (greater) than one into terciles each year. This approach preserves the natural distinction between *VMR* values that favor RIM versus PEG use and controls for the time-series variation in average *VMR* evident in Table 2.

Three features of the data are noteworthy. First, *BHAR* increases monotonically across price target portfolios when *VMR* implies use of a residual income valuation approach (*VMR* Portfolio 1). For example, *VMR* Portfolio 1 stocks belonging to the "disfavored" *PT/P* portfolio earn a 12-month abnormal return of -4.67 percent compared to the reliably positive 10.46 percent

BHAR earned by stocks in the "most favored" *PT/P* portfolio. A similar (but non-monotonic) pattern of returns is evident for the other two *VMR* portfolios that imply RIM use. Second, *BHA*R does not increase across price target portfolios when *VMR* implies use of the PEG valuation approach (*VMR* Portfolio 6). The *BHAR* for "disfavored" stocks in this *VMR* portfolio is 0.80 percent and statistically indistinguishable from zero whereas the "most favored" stocks earn a reliably negative -4.64 percent return. Finally, *VMR* Portfolio 1 (RIM use) stocks outperform *VMR* Portfolio 6 (PEG use) stocks in every price target profitability group, although the performance differential is statistically significant only for "most favored" *PT/P* stocks (*BHAR* of -15.10 percent).

Recall that the explanatory power of RIM and PEG *pseudo*-price targets for actual price targets varies over time (panel A of Table 2), and is especially low in 2000 and 2001. By contrast, the investment performance of *VMR* portfolios is remarkably stable across time. Untabulated tests confirm no detectable change—deterioration or improvement—occurs in *BHAR* investment performance of *VMR* Portfolio 1 (RIM use) stocks during this two-year period. The same holds true for the other *VMR* portfolios, with one exception: there is a statistically significant ($p < 0.01$) decline in *BHAR* investment performance for *VMR* Portfolio 6 (PEG use) stocks during 2000 and 2001. Moreover, the performance decline is evident in each of the Table 3 price target profitability (*PT/P*) categories.

Collectively, the results in Table 3 are consistent with the joint hypothesis that RIM is a superior stock valuation approach for setting price targets and that *VMR* captures information about analysts' actual valuation model use. The results may also reflect the unintended influence of earnings forecast accuracy as a correlated omitted variable. Earnings forecast accuracy has been shown to influence the profitability of analysts' Buy/Sell recommendations (Loh and Mian

2006; Ertimur et al. 2007), and so it is likely to also influence the profitability of analysts' price targets. Moreover, earnings forecasts are key ingredients in both the RIM and PEG approach to price target formulation. The analysis that follows provides evidence on three related issues: (1) whether earnings forecast accuracy is related to valuation model use; (2) whether accuracy influences the profitability of analysts' price targets; and (3) whether this accuracy effect (if present) subsumes the documented influence of valuation model use on price target investment performance.

Valuation model use and earnings forecast accuracy

Do analysts who are better at forecasting annual earnings also employ more rigorous valuation models when formulating price targets? To investigate this question, we adopt the approach of Loh and Mian (2006) and sort all I/B/E/S analysts that cover sample firms into EPS forecast accuracy quintiles for each firm-year according to their unscaled absolute forecast errors:

$$AFE_{ijy} = \left| Actual_{ijy} - Forecast_{ijy} \right| \quad (5)$$

where AFE_{ijy} is analyst i's absolute forecast error for firm j in fiscal year y. AFE is not scaled by share price because analysts are sorted within the same firm-year. Each analyst then receives a relative rank AFE, where the analyst with the smallest AFE for that firm and year gets a rank equal to one. Analysts with the same AFE are assigned the same rank. Next, we transform each assigned rank into a percentile by subtracting 0.25 from the assigned rank and dividing the result by the maximum firm-year rank. Subtracting 0.25 from the assigned rank serves to equalize the observations allocated to extreme quintiles (Loh and Mian 2006). We then sort analysts for a given firm and year into quintiles based on the percentile score.

This approach to measuring *relative* EPS forecast accuracy has several desirable properties when compared to the cross-sectional price deflated absolute forecast error measure common to the literature. In particular, the approach facilitates accuracy comparisons by controlling for the inherent difficulty of the forecasting task, which can vary across companies and over time for a given company. Analysts are assigned to different accuracy quintiles based on their demonstrated ability to forecast EPS for the same firm and year. The approach also has a drawback. It ranks analysts based on ordinal differences in forecast accuracy, ignoring cardinal differences. This may add noise to our tests by muting larger forecast errors or magnifying small performance differences.[14]

Table 4 reports descriptive statistics on the distribution of scaled absolute forecast errors (*AFE*) for both the population of I/B/E/S analysts who cover sample firms and the subsample who submit price targets to First Call. The mean and median scaled *AFE* values increase monotonically (by construction) across earnings forecast accuracy quintiles in both samples. Among analysts who also submit price targets to First Call, the mean scaled *AFE* is 0.024 (i.e., 2.4 percent of share price) in the least accurate earnings forecast group (Quintile 5), or three times larger than the average scaled *AFE* for the most accurate group (0.008 in Quintile 1). This divergence in scaled *AFE* suggests that differences in earnings forecast accuracy among analysts in our sample are likely to be economically meaningful.

[Insert Table 4]

Between-sample *t*-tests in Table 4 document the superior earnings forecast accuracy of analysts who submit price targets to First Call when compared to the larger population of I/B/E/S analysts who provide earnings forecasts and Buy/Sell recommendations (but perhaps no price

[14] Following Loh and Mian (2006), analysts are assigned to EPS forecast accuracy quintiles based on current year forecast performance rather than prior year performance. This feature strengthens the power of our tests by eliminating noise in the accuracy quintiles but the simulated trading strategy is not implementable and thus the investment performance results in Tables 5 and 6 do not reflect returns actually available to investors. As supplemental analysis, we report results obtained when accuracy quintiles are based on prior year forecast performance. This approach adds noise to the accuracy quintiles but renders our stock return findings that control for differences in analyst forecast accuracy more readily interpretable as the investment performance associated with an implementable trading strategy.

target) for sample firms. This result holds for each EPS forecast accuracy quintile and is not driven by differences in firm characteristics because, by construction, the same covered firms are represented in both analyst samples.

Evidence on whether *inferred* valuation model use varies across earnings forecast accuracy (*AFE*) quintiles is provided in Table 5. Analyst-firm-year observations within each *AFE* quintile are sorted by inferred valuation model use (*VMR* portfolio) each year. If analysts who are the most accurate in forecasting EPS issue price targets that more closely resemble RIM rather than PEG *pseudo*-price targets, a disproportionate number of *AFE* Quintile 1 observations will fall into *VMR* Portfolio 1. Similarly, if analysts who are the least accurate in forecasting EPS issue price targets that approximate PEG rather than RIM *pseudo*-price targets, the *AFE* Quintile 5 observations will cluster in *VMR* Portfolio 6.

[Insert Table 5]

The data in panel A of Table 5 refute these predictions. Earnings forecast accuracy is instead uncorrelated with valuation model use. *AFE* quintiles are distributed almost uniformly within each *VMR* portfolio in that each cell of the table contains about 16 percent of the corresponding *AFE* observations. This means that valuation model use is independent of earnings forecast accuracy. Analysts with the most accurate EPS forecasts are neither more nor less likely to use a RIM valuation approach than are analysts with the least accurate earnings forecasts. One implication of this result is that the skills and techniques required for forecasting earnings (and other firm fundamentals) may be quite different from those needed to infer the implications of future earnings for firm value.[15] We examine factors affecting valuation model use in supplemental analysis.

[15] An alternative explanation for this result is that our forecast accuracy quintile assignments may exaggerate small accuracy differences because analysts covering the same firm in a given quarter are forced into each of the five *AFE*

Earnings forecast accuracy and price target profitability

Table 5 panel B reports average *BHAR* by earnings forecast accuracy (*AFE*) quintile and price target (*PT/P*) portfolio, both formed as previously described. If forecast accuracy differences affect the *ex post* profitability of analysts' price targets, investment performance should vary across *AFE* quintiles for a given *PT/P* portfolio. Moreover, price target portfolios constructed from highly accurate earnings forecasts (*AFE* Quintile 1) should outperform those where forecast accuracy is low (*AFE* Quintile 5). Both predictions are supported by the data.

Consider, for example, the investment performance of "most favored" stocks (*PT/P* portfolio 5). As shown in panel B of Table 5, stocks in this portfolio earn, on average, a reliably positive abnormal return of 8.07 percent when they are associated with analysts in the top earnings forecast accuracy group (*AFE* Quintile 1). By contrast, the mean return for this *PT/P* portfolio is a reliably negative -5.45 percent for the bottom forecast accuracy group (*AFE* Quintile 5). Monotonically increasing returns to improved forecast accuracy are most apparent among highly favored stocks (*PT/P* portfolios 4 and 5) and disfavored stocks (*PT/P* portfolio 1, where negative returns are predicted). In fact, *AFE* Quintile 1 stocks reliably outperform the *AFE* Quintile 5 stocks in almost every *PT/P* portfolio based on the Q1-Q5 hedged returns.

A second message in the data is that price targets are informative for investment purposes only when contemporaneous forecast accuracy is relatively high (*AFE* Quintiles 1 and 2). For example, *AFE* Quintile 1 stocks in the most favored *PT/P* portfolio earn a reliably positive average annual return of 8.07 percent compared to an average return of -2.17 percent for *AFE* Quintile 1 stocks in the disfavored *PT/P* portfolio. However, when earnings forecast accuracy is quite low (*AFE* Quintile 5), analysts' price target investment opinions (*PT/P*) are inconsistent

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quintiles. However, as the multivariate results in Table 6 indicate, *AFE* quintiles are predictive of future stock returns. This means that the accuracy differences across quintiles are economically meaningful and casts doubt on the possibility that our methodology is responsible for the apparent independence evident in Table 5.

with the direction and magnitude of realized returns. *AFE* Quintile 5 stocks in the most favored *PT/P* portfolio earn a negative average abnormal return -5.45 percent compared to the positive 8.02 percent return for disfavored stocks.

These results could simply reflect analysts' "lucky guesses" with respect to both price targets and contemporaneous earnings forecasts, although supplemental tests confirm this finding when historical EPS forecast accuracy is instead used. We suspect that price target investment performance derives in part from analysts' valuation model choices. To investigate this possibility, we next provide evidence on whether and how *inferred* valuation model use influences price target profitability after controlling for earnings forecast accuracy.

Incremental influence of valuation model use

Regression analysis is employed to isolate the incremental effects on realized returns (*BHAR*) of differences in analysts' price target investment opinions (*PT/P*), inferred valuation model use (*VMR*), and earnings forecast accuracy (*AFE*). We also control for Buy/Sell recommendation rating (*REC*) because analysts who are superior at forecasting EPS also issue more profitable recommendations (Loh and Mian 2006; Ertimur et al. 2007). The explanatory variables *PT/P_rank*, *VMR_rank*, *AFE_rank*, and *REC_rank* are scaled to range between zero and one, and capture information about the ordinal ranking of the data.[16] This approach means that the regression coefficient estimates associated with each variable can be interpreted as the return to a portfolio formed on that attribute. Interaction terms are included to capture the investment performance of portfolios of specific interest; e.g., the term (*AFE_rank* x *VMR_rank*)

[16] For example, *REC_rank* equals zero if the analyst's stock recommendation is a "Strong Sell" and one when it is a "Strong Buy". Similarly, *PT/P_rank* equals one when the price target opinion denotes as a "most favored" stock, *AFE_rank* equals one for the top quintile ("most accurate") EPS forecasts, and *VMR_rank* equals one when RIM is the inferred valuation approach.

is equal to one for a portfolio characterized by high earnings forecast accuracy and inferred RIM valuation model use. Calendar year fixed-effects are included but not reported.

Full sample regression results are presented in panel A of Table 6.[17] To facilitate interpretation of coefficient estimates, panel B reports contrast tests for differences in portfolio performance. These tests involve linear combinations of the panel A coefficient estimates and use two benchmark portfolios as reference points. One benchmark portfolio is comprised of analyst-firm-year observations involving stocks "most favored" by analysts' price target opinions (*PT/P_rank* = 1), the "most accurate" earnings forecasts (*AFE_rank* = 1), and use of a RIM valuation approach (*VMR_rank* = 1). This portfolio earns a reliably positive 16.68 percent abnormal return over the ensuing 12 months.[18] By contrast, a benchmark portfolio characterized by "disfavored" price target stocks (*PT/P_rank* = 0), the "most accurate" earnings forecasts, and RIM valuation model use earns a reliably negative -4.44 percent return. The returns for these two benchmark portfolios thus confirm our earlier results on the usefulness of analysts' price targets for investment purposes when a RIM valuation approach is used and earnings forecast accuracy is high.

[Insert Table 6]

Panel B also documents the incremental effects on *BHAR* of changes in portfolio composition. Consider the benchmark portfolio of "most favored" *PT/P* stocks, "most accurate"

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[17] The regression model requires a Buy/Sell recommendation for each analyst-firm-year observation and this reduces the sample to 18,804. Observations with studentized residuals greater than three in absolute value are deleted as non-representative outliers, and the statistical significance of individual regression coefficient estimates is assessed using standard errors corrected for within-firm and time-series clustering of observations (Huber 1967; White 1980).

[18] This return is computed as the sum of the coefficient estimates in panel A with the exception of *REC_rank*, which we ignore. Note that the *PT/P* coefficient estimate of -15.00 percent in panel A is correctly interpreted (when combined with the +8.12 percent intercept) as the return to a portfolio characterized by "most favored" price target profitability (*PT/P_rank* = 1) but "least accurate" earnings forecasts (*AFE_rank* = 0) and inferred use of the PEG valuation approach (*VMR_rank* = 0). This portfolio earns a return of -6.88 percent, or (-15.00 percent + 8.12 percent). Including *REC_rank* in the contrast tests in panel B alters the level of the benchmark portfolio return but does not affect the level or significance of incremental returns for changes in portfolio composition.

earnings forecasts, and RIM valuation model use that earns a return of 16.68 percent. *BHAR* falls by 10.66 percent when the portfolio is tilted to PEG use; by 16.30 percent when the portfolio is tilted to the least accurate earnings forecasts; and by 23.57 percent when both valuation model use and earnings forecast accuracy are changed. This sharp deterioration in realized returns confirms the incremental influence of RIM valuation model use and forecast accuracy on the investment performance of analysts' price targets. As in our earlier findings, the *BHAR* for "most favored" *PT/P* stocks is negative (-6.89 percent = 16.68 percent - 23.57 percent) when analysts in the bottom EPS forecast accuracy quintile behave as if they employ a PEG valuation approach in formulating their price targets.

A similar pattern of deteriorating investment performance is evident in the realized returns for stocks disfavored by analysts' price target opinions. Recall that these stocks are seemingly overvalued (*PT/P* < 1) and thus should be sold. The benchmark portfolio abnormal return is -4.44 percent in panel B for disfavored *PT/P* stocks with the "most accurate" earnings forecasts and RIM valuation model use. *BHAR* increases by 5.58 percent when the portfolio is tilted to PEG use; by 10.32 percent when the portfolio involves analysts with the "least accurate" earnings forecasts; and by 12.55 percent when valuation model use and earnings forecast accuracy are both changed. Investors can earn a positive 8.11 percent *BHAR* by purchasing (not selling short) the disfavored *PT/P* stocks in the bottom forecast accuracy quintile when price targets derived using a PEG approach.

The results in panel C of Table 6 further document the incremental effects of earnings forecast accuracy and valuation model use on *BHAR* performance within each *PT/P* group. Benchmark portfolios reflect RIM valuation model use and the "most accurate" earnings forecasts. These data corroborate our full sample findings. For example, stocks in the top ("most favored”) *PT/P* portfolio earn a benchmark return of 34.63 percent while the *BHAR* for “disfavored” *PT/P* stocks is -9.32 percent.[19] This pattern of investment performance underscores the value of analysts’ price targets for stock selection decisions. This value is diminished by low earnings forecast accuracy or PEG valuation model use. For example, the *BHAR* for “most favored” *PT/P* stocks falls by 12.05 percent when analysts’ price targets imply PEG use, and by 17.22 percent when analysts’ earnings forecasts are the least accurate. Similar results hold for stocks in the next most highly favored *PT/P* group. Among “disfavored” *PT/P* stocks, low forecast accuracy reduces the short position *BHAR* by 15.79 percent but PEG model use has no statistically discernable impact on performance.

Collectively, our results document that substantial improvements in price target quality occur when analysts appear to be using a fundamental residual-income valuation technique rather than a PEG valuation heuristic. This improvement in 12-month realized returns is most pronounced among analysts who are also adept at formulating accurate earnings forecasts, a key ingredient in both stock valuation approaches. In supplemental tests described next, we provide evidence on whether these results are robust to the use of historical, rather than concurrent, EPS forecast accuracy. We also provide evidence on factors associated with valuation model use, whether our findings are sensitive to earnings forecast or price target timeliness, and on the relative value of price targets versus Buy/Sell recommendations for investment purposes.

5. Supplemental analysis

Historical forecast accuracy

[19] The benchmark *BHAR*, 34.63 percent in the case of the portfolio of “most favored” *PT/P* stocks, omits any incremental return associated with *REC_rank* (see footnote 18). Inclusion of this omitted return decreases the benchmark *BHAR* for “most favored” stocks to 16.97 percent. There is little cross-sectional variation in analysts’ Buy/Sell recommendations for “most favored” stocks, and this may contribute to the large negative incremental return associated with *REC_rank*.

Our primary findings make use of Loh and Mian's (2006) earnings forecast accuracy metric which means that EPS forecast accuracy is measured concurrently with the stock return holding period. This *ex post* accuracy measure has several research design advantages that are important to our study but its use also means that the differential stock returns documented in Tables 5 and 6 do not reflect investment profits arising from an implementable trading strategy. On the other hand, prior studies find evidence of persistent differences in EPS forecast accuracy across analysts (Stickel 1992; Sinha et al. 1997), which implies that our investment results are likely to be qualitatively robust to the use of *ex ante* (historical) forecast accuracy.

To investigate this question, we re-estimate the Table 6 regression using prior year EPS forecast accuracy where *AFE* portfolios are again formed using Loh and Mian's (2006) method and lagged *AFE*. Data requirements reduce the number of analyst-firm-year observations available for estimation purposes by roughly 40 percent. As expected, the results (not tabulated) from using historical EPS forecast accuracy are qualitatively similar to those reported in panel C of Table 6. In particular, among most favored stocks (top *PT/P* group), RIM-based price target opinions are statistically more profitable for investment purposes than are PEG-based price targets. As in Table 6, this return differential is reduced but not eliminated when EPS forecast accuracy declines. The RIM versus PEG stock returns differentials for the other *PT/P* categories are, for the most part, statistically insignificant but directionally consistent with those in Table 6.

Correlates of valuation model use

Although a comprehensive analysis of the determinants of valuation model use is beyond the scope of this study, we offer preliminary evidence on this question by investigating the association between valuation model use and characteristics of the analyst, brokerage house, and covered firm. We conjecture that a given analyst will use the same RIM or PEG approach for all covered firms, and that analysts employed at the same brokerage house or research firm will tend to use similar valuation methodologies.

Three characteristics of each analysts are considered: prior year forecast accuracy (lagged *AFE*); prior year inferred valuation model use (lagged *VMR*); and *Expertise*, defined as the number of previous years in which the analyst has issued EPS forecasts. All three characteristics are measured at the analyst-firm level. Brokerage house characteristics include *BSize*, defined as the number of I/B/E/S analysts employed that year by the brokerage or research firm, and *Conflict* which captures information about possible investment banking-related conflicts of interest that may influence analysts' opinions. As in Ertimur et al. (2007), our *Conflict* measure is the Carter-Manaster investment banking reputation rankings (Carter and Manaster 1990; Carter, Dark, and Singh 1998) as updated by Loughran and Ritter (2004). Analysts employed by brokerage firms with significant investment banking business are regarded for test purposes as potentially conflicted. Covered firm characteristics include: *FSize*, measured as the beginning-of-year market value of equity; the beginning-of-year book-to-market (*BM*) ratio; and *HighTech*, an indicator variable denoting firms in the high technology industries (SIC codes between 7370 and 7379). With the exception of *HighTech* and *Conflict*, all variables are sorted into quintiles and then scaled to range between zero and one. Three *Conflict* categories are defined: a value of one is assigned if the brokerage firm has the top investment banking reputational rank; lower reputational ranks are assigned a value of 0.5; and zero is assigned to brokerage and research firms that do not have a Carter-Manaster reputation ranking. *HighTech* remains an industry indicator variable.

The results (not tabulated) of regressing analyst, brokerage, and firm characteristics on *VMR* reveal that *inferred* RIM valuation model use exhibits a statistically positive association with prior year RIM use (lagged *VMR*, $t = 20.07$, $p \leq 0.01$) and a reliably negative association with brokerage firm size (*BSize*, $t = -2.26$, $p \leq 0.05$). The regression coefficients associated with the other analyst/brokerage characteristics are statistically indistinguishable from zero. Two covered firm characteristics exhibit reliably negative associations with RIM use: *FSize* ($t = -4.89$, $p \leq 0.01$) and book-to-market ratio (*BM*, $t = -4.67$, $p \leq 0.01$). The *HighTech* coefficient is positive but not statistically different from zero. Although we are somewhat guarded about drawing inferences from these results given the preliminary nature of the analysis, the data suggest that valuation model use may be a relatively persistent attribute of the analyst/firm pairing. Moreover, RIM use is somewhat more prevalent among analysts employed at small brokerage houses and among analysts who cover small firms or firms with low book-to-market ratios. On the other hand, PEG use is more prevalent among analysts at large brokerage houses and those who cover large firms or firms with high book-to-market ratios.

Valuation model use as an analyst trait

If valuation model use is a relatively persistent trait, the investment performance superiority of price targets associated with inferred RIM model use evident in Table 6 (derived from analyst/firm/year observations) should also be present in portfolios constructed at the analyst level. To investigate this question, we construct a composite *VMR* across years and covered firms for each analyst and then again sort observations where *VMR* is less (greater) than one into terciles. This approach again controls for the possibility that the RIM and PEG valuation approaches yield similar *pseudo*-price targets. The Table 6 results are robust to this substitution and confirm that *BHAR* performance declines when price target portfolios are tilted toward PEG rather than RIM valuation model use by the analyst.

Timely price targets and earnings forecasts

Returning to our primary tests and findings, untabulated results show that the beginning-of-year price targets issued by analysts in the bottom EPS forecast accuracy group (*AFE* Quintile 5) are 15 trading days older on average than those issued by analysts in the top *AFE* group ($p \leq 0.01$). There is no statistical difference across *AFE* quintiles in price targets timeliness when benchmarked against EPS forecast release dates. There is also no difference in price target timeliness across valuation model (*VMR*) quintiles. Stale price targets are negatively related to realized returns ($p \leq 0.10$), a result that could be due to their concentration in the low EPS forecast accuracy quintile, but the Table 6 results are qualitatively unchanged when *PT* timeliness is incorporated into the regression model. Prior research has shown that analysts' stale earnings forecasts are less accurate than are timelier forecasts (e.g., Brown, Griffin, Hagerman, and Zmijewski 1987; O'Brien 1998; Brown, Richardson, and Schwager 1987; Lys and Soo 1995). Untabulated results for our sample indicate that analysts in the bottom earnings forecast accuracy group (*AFE* Quintile 5) issue less timely annual EPS forecasts than do those in the top *AFE* quintile. On average, the beginning-of-year EPS forecasts of *AFE* Quintile 5 analysts are 15 trading days older than those of *AFE* Quintile 1 analysts, a difference that is statistically significant ($p \leq 0.01$). This finding means that forecast timeliness may be partially responsible for differences across *AFE* quintiles in realized returns (*BHAR*). As was the case with stale price targets, stale earnings forecasts are negatively related to realized returns ($p \leq 0.10$) but the Table 6 results are qualitatively unchanged when forecast timeliness is incorporated into the regression model.

Our earnings forecast timeliness measure is derived using initial issuance dates rather than the more timely reiteration dates implicit in the monthly consensus, and thus overstates the extent to which "old" earnings forecasts, price targets, and recommendations are in fact stale. Apparent differences in the relative timeliness of analysts' recommendations and price targets stem from the use of so-called initial "announcement" dates provided by I/B/E/S and First Call. In aligning recommendations and price targets, we require the analyst's price target announcement date from First Call to fall between the analyst's I/B/E/S recommendation announcement and review dates, where the review date denotes the most recent date the recommendation was confirmed by I/B/E/S as accurate. This process can, for example, align a price target first announced in April 2000 with a "Strong Buy" recommendation first announced in July 1997 because the recommendation is unchanged as of April 2000 and confirmed as accurate. Although the mean difference between recommendation and price target announcement dates in our sample is 173 days (median 79 days), there is no actual difference in the timeliness of these two data items because each Buy/Sell recommendation is reiterated by the analyst in the first published report that contains the price target.[20] Our conclusions about the incremental explanatory power of price targets and recommendations for returns (Table 6) are robust to excluding observations where the difference in announcement dates is greater than 90 days.

Recommendation quality

The full sample regression results (panel A of Table 6) provide evidence on the incremental influence of Buy/Sell recommendations on portfolio investment performance. Stocks with a "Strong Buy" recommendation earn 5.12 percent *less* than do "Strong Sell" stocks after controlling for price target opinions, earnings forecast accuracy, and inferred valuation model use. In other words, more favorable recommendations are associated with an incremental

[20] As another example of how a researcher's use of initial "announcement" (issue) dates can lead to false inferences about the data, the mean difference between recommendation and price target announcement dates for discordant investment opinions (i.e., Buy/Sell and *PT/P* mismatches) is 255 days although each recommendations is reiterated with initial publication of the price target. Using announcement dates for research purposes can sometimes result in incorrect inferences about timeliness.

reduction in portfolio performance. This counter-intuitive result is confirmed in untabulated tests where we mimic the analysis in panel C for each earnings forecast accuracy quintile. Buy/Sell recommendations have no incremental association with realized returns for stocks in the top forecast accuracy quintile after controlling for *PT/P_rank* and inferred valuation model use. *PT/P_rank* does exhibits a strong and positive association with realized returns in this untabulated analysis. This means that price targets are a more profitable investment tool than are Buy/Sell recommendations when earnings forecast accuracy is high. Buy/Sell recommendations exhibit a reliably negative incremental association with realized returns in the bottom two "least accurate" *AFE* quintiles, consistent with the full sample results in panel A, and are insignificant in quintiles 2 and 3.

RIM pseudo-price targets

Bradshaw (2004) finds that investors would earn higher returns over a one-year holding period by relying on RIM *pseudo*-price targets that incorporate analysts' consensus earnings forecasts rather than analysts' consensus Buy/Sell recommendations alone. Our data point to a similar conclusion regarding the superior investment performance of RIM *pseudo*-price targets when compared to analysts' actual price targets.

To investigate this question, scaled quintile measures of RIM and PEG *pseudo*-price target profitability are constructed in the same manner as that used to construct actual price target (*PT/P)* portfolios. The Table 6 regression specification is then augmented to include main and interaction effects associated with these RIM and PEG *pseudo*-price target portfolios. We retain the *PT/P* portfolio variable so that the coefficients associated with the *pseudo*-price targets provide evidence about the incremental *BHAR* investment performance. Untabulated results show that the RIM pseudo-price target portfolio coefficient is reliably positive ($t = 4.25$, $p \leq 0$

.01) whereas the PEG coefficient is not statistically different from zero. The pattern of results for other variables in the *BHAR* regression, including the pseudo-price target interaction terms, is qualitatively identical to that reported in Table 6.[21]

RIM implementation sensitivities

As in Bradshaw (2004), we gauge the sensitivity of our results to various RIM implementation alternatives. In addition to the industry-specific discount rates used in our primary tests, we consider three fixed discount rates (8 percent, 12 percent and 16 percent) and a firm-specific discount rate based on CAPM beta.[22] The RIM forecast horizon for all tabulated results is five years (see equation 1). As alternatives, we consider forecast horizons of two and ten years, where EPS growth beyond year 5 is assumed to either be zero or to adhere to the analyst's long-term growth forecast. We also consider an alternative RIM terminal valuation calculation where residual income in the terminal year is capitalized as a perpetuity rather than adhering to the fade rates assumed in our primary tests. None of the inferences drawn from our primary findings are qualitatively altered by these perturbations to RIM and PEG implementation.

6. Summary and conclusions

This study investigates the influence of inferred valuation model use on the investment performance of sell-side equity analysts' published price targets. Our results document that

[21] Untabulated results also confirm that our primary findings are robust to common alternative abnormal stock return measures and to restricting the sample by averaging observations across analysts for a given firm and year within each *AFE* quintile.

[22] The CAPM discount rate for a particular firm and year is calculated as $r_f + \beta \times E[r_M - r_f]$, where r_f is the risk-free rate proxied by the 30-day treasury bond yield in effect in the most recent calendar month, β is a rolling 60-month estimate of the stock's systematic risk, and the equity risk premium ($E[r_M - r_f]$) is proxied by the historical average equity risk premia for each estimation year as reported by Ibbotson Associates (2010). The historical equity risk premium ranges from 8.25 percent to 8.93 percent during our sample period.

substantial improvements in price target quality occur when analysts appear to be using a residual-income valuation technique rather than a PEG valuation heuristic. This improvement in 12-month realized returns is most pronounced among analysts who are also adept at formulating accurate earnings forecasts, a key ingredient in both stock valuation approaches. Our findings thus confirm that departures from RIM valuation model use and inferior earnings forecasts both detract from the realized returns associated with analysts' price targets. The central message from our data is that the investment value of analysts' price target opinions is reduced substantially when those price targets are seemingly derived from a valuation heuristic using inferior earnings forecasts.

Our results and conclusions are subject to several important caveats. First, the sample is concentrated in years that correspond to the "technology bubble" in share prices of firms traded on U.S. stock exchanges. Analysts' optimistic price targets and recommendations may have contributed to, or been affected by, the bubble in ways that limit the generalizability of our results to other time periods. Second, the portfolio performance documented by our primary findings does not reflect the actual profits available to investors from implementable trading strategies nor was that our intent. Some (but not all) price target portfolios are formed using information about concurrent EPS forecast accuracy that is not available to investors until year-end. Third, we offer no conclusions about whether investors are efficient in their use of analysts' price targets (or Buy/Sell recommendations), or in differentiating among analysts according to their earnings forecast accuracy or valuation model use. Efficiency questions are beyond the scope of this paper.

Our results suggest several fruitful avenues for future research. One obvious avenue is to explore whether price target superiority, like recommendation profitability (Ertimur et al. 2007), is influenced by the valuation relevance of earnings and by analysts' conflicts of interest. Our understanding of factors that determine analysts' valuation model use could also benefit from future research using more refined conjectures and tests than those used here in our preliminary analysis of the question. For example, analysts who are less confident about their medium-term (i.e., three- to five-year ahead) earnings forecasts may favor valuation heuristics such as a forward price/earnings ratio that are insensitive to those forecasts. Analysts employ heuristics presumably because they provide a "fast and frugal" (Gigerenzer, Todd, and the ABC Research Group 1999) mechanism for reducing the complex equity valuation task to a simpler judgmental operation. In general, heuristics are quite useful but sometimes they lead to severe and systematic errors. Future research could build on the results obtained in other judgment and decision-making settings (e.g., Kahneman, Slovic, and Tversky 1982; Hogarth 1990) to investigate more fully analysts' use (and misuse) of valuation heuristics. Those of a more practical bent may wish to explore the implications of our findings for identifying profit opportunities associated with implementable trading strategies.

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TABLE 1
Descriptive statistics on the price target sample

Panel A: The frequency of EPS forecasts, buy/sell stock recommendations, and price targets by year

	I/B/E/S EPS Forecasts			I/B/E/S Buy/Sell Recommendations			First Call Price Targets		
Year	# Firms	# Analysts	Mean analysts per firm	% w/REC	Mean REC	% Sell REC	% w/*PT*	Mean *PT/P*	% *PT/P* < 1
1997	1,548	2,858	13.0	64%	2.16	3.2%	11%	1.24	6.6%
1998	1,583	3,182	12.5	65%	2.11	2.1%	24%	1.26	6.7%
1999	1,649	3,449	12.7	71%	2.07	1.6%	29%	1.33	7.7%
2000	1,735	3,669	12.7	69%	1.90	1.0%	34%	1.40	5.0%
2001	1,537	3,401	12.6	64%	2.02	0.9%	42%	1.38	7.2%
2002	1,480	3,306	12.3	69%	2.14	2.9%	50%	1.28	9.7%
2003	1,285	2,912	12.4	80%	2.50	9.8%	50%	1.26	12.7%
Overall	3,418	7,639	12.6	68%	2.12	3.0%	33%	1.32	8.3%

Notes:
This panel describes the frequency of price targets (denoted % w/*PT*) and Buy/Sell recommendations (% w/REC) among analysts who supply earnings forecasts to I/B/E/S each year as well as the average *ex ante* (implied) return associated with the 45,693 price targets retained in the sample. Implied return (denoted *PT/P*) is the ratio of the price target (*PT*) to share price (*P*) three days before the price target issue date. The I/B/E/S EPS Forecasts sample is comprised of 136,790 analyst-firm-year observations that meet the sample selection requirements used in constructing the price target sample except that no published price target is required. Specifically, each I/B/E/S analyst-firm-year is required to have a “current” one-year-ahead EPS forecast in the fourth month after firm’s fiscal year-end, share price is at least $1, the absolute forecast error scaled by share price is less than 25 percent, and each firm-year is required to have at least 5 unique values of EPS forecast accuracy. I/B/E/S analyst-firm-year observations that also have a Buy/Sell stock recommendation outstanding in the fourth month after firm’s fiscal year-end are retained in the Recommendations sample (n = 93,594). REC is the Buy/Sell recommendation rating (1 = Strong Buy, 5 = Strong Sell) and % Sell REC is the percentage of Sell and Strong Sell recommendations.

TABLE 1 (Continued)
Panel B: Implied price target profitability (*PT/P*) and buy/sell stock recommendations

	Frequency of Implied Return Category (*PT/P*<1 and then *PT/P* Quartiles) by Recommendation						
Stock	Disfavored	Least favored			Most favored	Frequency of	
Recommendation	1	2	3	4	5	Recommendation	N
Strong Sell	80%	7%	6%	4%	4%	0.5%	181
Sell	42%	30%	11%	7%	11%	2.0%	709
Hold	20%	38%	17%	13%	14%	26.0%	9,163
Buy	4%	23%	27%	24%	21%	35.3%	12,446
Strong Buy	3%	11%	24%	30%	32%	36.2%	12,742
Mean Implied Return	-15.87	9.53	20.99	33.38	81.59		
Mean *BHAR*	2.46**	-1.08**	-0.32	3.33**	3.15**		
N	3,017	8,056	8,056	8,081	8,031		35,241

Notes:
This panel describes the conditional distribution of implied price target profitability (*PT/P*) by stock recommendation category for 35,241 analyst-firm-year sample observations where a Buy/Sell recommendation is available in the fourth month after the firm's fiscal year end. Observations with *PT/P* less than one are assigned to a single group of "disfavored" stocks and observations with *PT/P* greater than or equal to one are sorted into quartiles (group 2 through 5, where 5 denotes "most favored" stocks). For each recommendation category, we report the percentage of observations in each *PT/P* group. The panel also reports the average implied return (*PT/P* minus 1, expressed as a percentage) and 12-month buy-and-hold abnormal return (*BHAR*) for each *PT/P* group. *BHAR* is computed as the difference between the one-year buy-and-hold return for firm *i* and the (size, book-to-market and momentum) characteristic portfolio return to which firm *i* belongs in that year (Daniel, et. al. 1997). Returns are accumulated over a 12-month period that begins on either the price target issue date or 30 days after the fiscal year-end for price targets issued prior to that date. Significance levels for two-tailed *t*-tests of the null hypothesis that portfolio returns are zero are denoted as *, **, and *** for rejection at the 0.10, 0.05, and 0.01 level, respectively.

TABLE 2
Inferred valuation model use

Panel A: Estimation of inferred valuation model use (*VMR*)

	RIM Valuation			PEG Valuation			Descriptive Statistics $VMR = \lvert\varepsilon_{RIM}\rvert / \lvert\varepsilon_{PEG}\rvert$				
Year	α	β	Adjusted R^2	α	β	Adjusted R^2	Mean	Median	25th	75th	Std. Dev.
1997	6.40^{***}	1.95^{***}	0.82	8.82^{***}	0.85^{***}	0.66	0.78^{***}	0.76^{***}	0.35	1.85	6.35
1998	5.62^{***}	2.44^{***}	0.75	11.61^{***}	0.89^{***}	0.49	0.73^{***}	0.72^{***}	0.32	1.62	6.30
1999	5.78^{***}	2.46^{***}	0.63	7.29^{***}	1.17^{***}	0.51	0.90^{***}	0.91^{***}	0.43	1.93	6.03
2000	24.71^{***}	1.70^{***}	0.14	13.59^{***}	1.08^{***}	0.24	1.22^{***}	1.16^{***}	0.70	2.00	7.02
2001	15.70^{***}	1.94^{***}	0.36	18.52^{***}	0.81^{***}	0.30	1.12^{***}	1.11^{***}	0.63	1.98	7.27
2002	11.21^{***}	1.63^{***}	0.62	14.64^{***}	0.85^{***}	0.52	1.05^{**}	1.04^{**}	0.50	2.06	7.43
2003	3.57^{***}	1.60^{***}	0.69	9.95^{***}	0.85^{***}	0.54	0.96^{*}	0.97^{*}	0.43	2.10	7.03
All Years	12.74^{***}	1.76^{***}	0.41	12.68^{***}	0.92^{***}	0.40	0.99	1.01	0.48	1.98	6.91

Notes:
This panel reports summary statistics for regression estimates of the relation between analysts' price targets (*PT*) and either RIM *pseudo*-price targets (V_{RIM}) or PEG *pseudo*-price targets (V_{PEG}). Also reported are descriptive statistics for inferred valuation model use, defined as the ratio *VMR* (= $\lvert\varepsilon_{RIM}\rvert / \lvert\varepsilon_{PEG}\rvert$), where ε_{RIM} is the residual from regressing *PT* on V_{RIM}, and ε_{PEG} is the residual from regressing *PT* on V_{PEG}. Values of *VMR* less than one denote inferred RIM model use whereas values greater than one denote inferred PEG model use. The limited availability of analysts' two-year-ahead EPS forecasts and long-term EPS growth estimates required for RIM and PEG *pseudo*-price targets reduces the sample to 21,202 analyst-firm-year observations. Significance levels for *t*-tests of the null hypothesis that the regression coefficient estimate equals zero denoted as *, **, and *** for rejection at the 0.10, 0.05, and 0.01 level, respectively. Significance levels for *t*-tests (sign tests) of the null hypothesis that the mean (median) *VMR* equals one are similarly denoted.

TABLE 2 (Continued)

Panel B: Inferred valuation model use (*VMR)* by price target profitability and stock recommendation

Implied Price Target Profitability (*PT/P*) Portfolio				Buy/Sell Stock Recommendation			
Category	N	Mean *VMR*	Median *VMR*	Category	N	Mean *VMR*	Median *VMR*
5 (Most favored)	4,462	0.85***	0.92***	Strong Buy	7,300	0.92***	0.97**
4	4,919	0.97	0.99	Buy	7,288	1.01	1.03**
3	5,175	1.03	1.02	Hold	3,896	1.12***	1.09***
2 (Least favored)	5,103	1.05**	1.07***	Sell	250	1.05	1.08*
1 (Disfavored)	1,543	1.13***	1.12***	Strong Sell	70	0.96	1.02
All categories	21,202	0.99	1.01		18,804	1.00	1.02

Notes:
This panel reports summary statistics for inferred valuation model use (*VMR*), as defined in panel A, grouped according to the implied profitability of analysts' price targets (*PT/P*) and by their Buy/Sell recommendations. Sample observations with *PT/P* less than one are assigned to a single group of "disfavored" stocks and observations with *PT/P* greater than or equal to one are sorted into quartiles (category 2 through 5, where 5 denotes "most favored" stocks) based on the population of price targets in Table 1. We require each Buy/Sell recommendation to be current in the fourth month after the firm's fiscal year end. Significance levels for *t*-tests (sign tests) of the null hypothesis that the mean (median) *VMR* equals one are denoted as *, **, and *** for rejection at the 0.10, 0.05, and 0.01 level, respectively.

TABLE 3
Price target investment performance and valuation model use.

		Price Target Implied Return Category (*PT/P*<1 and then *PT/P* Quartiles)					
		Disfavored	Least favored			Most favored	
	N	1	2	3	4	5	MF - D
Mean *BHAR*	21,202	2.07	-1.42^{**}	0.18	2.20^{**}	5.00^{***}	2.93^{**}
Mean Implied Return	21,202	-10.02	9.05	20.34	31.48	61.80	71.82
Valuation Model Use Portfolio							
1 (Favors RIM)	3,507	-4.67	-2.79^{*}	3.08	8.23^{**}	10.46^{***}	15.13^{**}
2	3,511	3.22	-0.38	0.03	2.59	4.61^{*}	1.40
3	3,511	2.39	-1.70	-0.30	1.49	9.34^{***}	6.94
4	3,556	5.70^{*}	-0.68	-1.21	-0.37	2.17	-3.52
5	3,559	3.09	0.11	0.31	-1.10	6.06^{**}	2.97
6 (Favors PEG)	3,558	0.80	-3.22^{***}	-0.75	2.12	-4.64^{**}	-5.44^{*}
P1 – P6		-5.48	0.43	3.84	6.11	15.10^{***}	

Notes:
This table reports average 12-month buy-and-hold abnormal returns (*BHAR*) by valuation model use (*VMR*) and price target implied return (*PT/P*). Observations with *PT/P* less than one are assigned to a single profitability group ('least favored") and observations with *PT/P* greater than or equal to one are sorted into quartiles (group 2 through 5, where 5 denotes "most favored"). Valuation model use portfolios are based on *VMR* = ($|\varepsilon_{RIM}|$ / $|\varepsilon_{PEG}|$) as described in Table 2. The six portfolios are centered at *VMR* = 1 and are formed by sorting observations where *VMR* is less (greater) than one into terciles each year. *BHAR* is computed as the difference between the one-year buy-and-hold return for firm *i* and the size, book-to-market and momentum characteristic portfolio return to which firm *i* belongs in that year (Daniel, et. al. 1997). Returns are accumulated over a 12-month period that begins on either the price target issue date or 30 days after the fiscal year-end for price targets issued prior to that date. Hedged portfolio returns are computed for the difference between extreme valuation model use quintiles (Q1 minus Q5) or extreme *PT/P* categories (Most Favored minus Disfavored). Significance levels for two-tailed *t*-tests of the null hypothesis that portfolio returns are zero are denoted as *, **, and *** for rejection at the 0.10, 0.05, and 0.01 level, respectively.

TABLE 4
Earnings forecast accuracy

	All I/B/E/S Analysts Covering Sample Firms				I/B/E/S Analysts Providing Price Targets				Mean
	Mean	Median	Std. Dev.	N	Mean	Median	Std. Dev.	N	Difference
Earnings Forecast Accuracy Quintile									
1 (most accurate)	0.009	0.002	0.020	16,012	0.008	0.002	0.019	7,895	0.001**
2	0.012	0.003	0.023	21,343	0.011	0.003	0.020	10,905	0.001***
3	0.015	0.005	0.026	21,037	0.013	0.005	0.024	10,482	0.001***
4	0.018	0.007	0.031	19,584	0.017	0.007	0.028	9,490	0.001***
5 (least accurate)	0.026	0.011	0.041	15,618	0.024	0.010	0.037	6,921	0.003***
Overall	0.016	0.005	0.029	93,594	0.014	0.005	0.026	45,693	0.002***

Notes:
This table describes the conditional distribution of absolute one-year-ahead EPS forecast error (*AFE*, scaled by share price) for earnings forecast accuracy quintiles constructed from the I/B/E/S detail population of analysts who issue Buy/Sell recommendations for sample firms and for the subset of analysts who also provide price targets to First Call. Each firm-year is required to have at least 5 unique *AFE* value. We compute the mean scaled *AFE* across analysts for each firm-year in a given quintile, and then average across firm-years within each quintile. Significance levels for two-tailed between-sample *t*-tests of the null hypothesis of mean equality are denoted as *, **, and *** for rejection at the 0.10, 0.05, and 0.01 level, respectively.

TABLE 5
Valuation model use and earnings forecast accuracy

Panel A: Valuation model use within earnings forecast accuracy quintiles

		Valuation Model Use ($VMR = \lvert\varepsilon_{RIM}\rvert / \lvert\varepsilon_{PEG}\rvert$) Portfolio						
		Favors RIM					Favors PEG	
	N	1	2	3	4	5	6	Overall
Earnings forecast accuracy quintile								
1 (most accurate)	3,633	16%	16%	17%	17%	17%	17%	100%
2	5,241	16%	16%	17%	18%	16%	17%	100%
3	5,047	16%	17%	16%	17%	17%	17%	100%
4	4,433	17%	17%	16%	16%	17%	16%	100%
5 (least accurate)	2,848	18%	17%	17%	16%	17%	16%	100%
Mean *VMR*		0.12	0.47	0.80	1.22	2.01	7.88	
Population base rate		16.5%	16.6%	16.6%	16.7%	16.8%	16.8%	100%

Notes:
This panel describes the conditional distribution of inferred valuation model use ($VMR = \lvert\varepsilon_{RIM}\rvert / \lvert\varepsilon_{PEG}\rvert$) by earnings forecast accuracy (*AFE*) quintile for the sample of 21,202 analyst-firm-year observations. Each cell reports the proportion of analyst-firm-year observations in a particular *AFE* quintile that fall into each valuation model (*VMR*) portfolio where *VMR* Portfolio 1 favors RIM use and Portfolio 5 favors PEG use. The *VMR* six portfolios are centered at *VMR* = 1 and are formed by sorting observations where *VMR* is less (greater) than one into terciles each year. *AFE* quintiles are also determined annually from the I/B/E/S detail population for covered sample firms using one-year-ahead EPS forecasts with each firm-year required to have at least 5 unique values of *AFE*.

TABLE 5 (Continued)

Panel B: Price target investment performance by earnings forecast accuracy quintile

		Price Target Implied Return Category (*PT/P*<1 and then *PT/P* Quartiles)					
		Disfavored	Least favored			Most Favored	
	N	1	2	3	4	5	MF - D
Earnings Forecast Accuracy Quintile							
1 (most accurate)	7,659	-2.17	-2.37***	1.67	5.11***	8.07***	10.24***
2	10,665	-2.56**	-1.48**	1.10	3.75***	6.04***	8.60***
3	10,251	3.73*	-0.95	-0.58	3.08***	2.37*	-1.36
4	9,271	6.85***	-1.80**	-0.94	1.49	1.39	-5.46
5 (least accurate)	6,740	8.02***	1.76	-2.52**	-1.46	-5.45***	-13.47***
Q1- Q5		-10.19***	-4.12**	4.18**	6.57***	13.52***	
Mean *BHAR* over all quintiles		2.35**	-1.13***	-0.14	2.58***	2.57***	

Notes:
This panel reports average 12-month buy-and-hold abnormal returns (*BHAR* as defined in Table 3) by earnings forecast accuracy (*AFE*) quintile and each price target implied return (*PT/P*) category for the entire price target sample. *AFE* quintiles are determined annually using one-year-ahead forecasts from the I/B/E/S detail population and procedures described in the text. This quintile assignment process yields unbalanced sample sizes. Observations with *PT/P* less than one are assigned to a single profitability group ("least favored") and observations with *PT/P* greater than or equal to one are sorted into quartiles (group 2 through 5, where 5 denotes "most favored"). Hedged portfolio returns are computed for the difference between extreme *AFE* quintiles (Q1 minus Q5) or extreme *PT/P* categories (Most Favored minus Disfavored). Significance levels for two-tailed *t*-tests of the null hypothesis that portfolio returns are zero are denoted as *, **, and *** for rejection at the 0.10, 0.05, and 0.01 level, respectively.

TABLE 6
The incremental effects on price target investment performance of valuation model use and earnings forecast accuracy

Panel A: Full sample regression.

Coefficient Estimates										
Intercept	*PT/P_rank*	*REC_rank*	*AFE_rank*	*VMR_rank*	*PT/P_rank x AFE_rank*	*PT/P_rank x VMR_rank*	*AFE_rank x VMR_rank*	*PT/P_rank x AFE_rank x VMR_rank*	Adjusted R^2	N
8.12***	-15.00***	-3.66*	-6.97**	-2.24	19.88***	9.50*	-3.35	6.74	2.0%	18,804

Notes:
This panel reports the results obtained from buy-and-hold annual abnormal return (*BHAR* as defined in Table 3) regression tests of the incremental effects of valuation model use (*VMR*) and earnings forecast accuracy (*AFE*) after controlling for price target implied return (*PT/P*) and Buy/Sell stock recommendation rating. The variables *PT/P_rank*, *REC_rank*, *AFE_rank*, and *VMR_rank* are scaled to range between zero and one, and capture information about the ordinal ranking of the data. Specifically, *VMR_rank* equals one when the data imply use of the RIM valuation approach, *AFE_rank* is one for the quintile of most accurate EPS forecasts, *REC_rank* is zero when the analyst's recommendation is a "Strong Sell" and one when it is a "Strong Buy", and *PT/P_rank* is one for "most favored" stocks. Year fixed-effects are included but not reported. The availability of Buy/Sell recommendations limits the sample to 18,804 analyst-firm-years. Observations with studentized residuals greater than 3 in absolute value are deleted in each regression. Significance levels for *t*-tests of the null hypothesis that the regression coefficient is zero are denoted as *, **, and *** for rejection at the 0.10, 0.05, and 0.01 level, respectively.

Panel B: Portfolio return estimates from the full sample regression model

		Incremental *BHAR* from Change in Portfolio Composition		
Benchmark Portfolio	*BHAR*	*VMR* = PEG	*AFE* = Least accurate	*VMR* = PEG and *AFE* = Least accurate
PT/P = Most favored, *AFE* = Most accurate, *VMR* = RIM	16.68***	-10.66***	-16.30***	-23.57***
PT/P = Disfavored, *AFE* = Most accurate, *VMR* = RIM	-4.44**	5.58*	10.32***	12.55***

Notes:
This panel reports buy-and-hold abnormal returns (*BHAR*) to benchmark portfolios and the incremental returns associated with changes in the composition of the benchmark portfolios. Portfolio returns and incremental returns are computed as linear combinations of the full sample regression (panel A) coefficient estimates with the exception of *REC_rank*, which we ignore. Significance levels for *F*-tests of the null hypothesis that the portfolio return or incremental return is zero are denoted as *, **, and *** for rejection at the 0.10, 0.05, and 0.01 level, respectively.

TABLE 6 (Continued)

Panel C: Portfolio return estimates from *PT/P* category regression models

			Incremental *BHAR* from Change in Portfolio Composition		
Benchmark Portfolio	*PT/P* Group	*BHAR*	*VMR* = PEG	*AFE* = Least accurate	*VMR* = PEG and *AFE* = Least accurate
VMR = RIM, *AFE* = Most Accurate	1 (Most favored)	34.63^{***}	-12.05^{***}	-17.22^{***}	-22.60^{***}
VMR = RIM, *AFE* = Most Accurate	2	17.44^{***}	-6.91^{**}	-8.36^{**}	-14.54^{***}
VMR = RIM, *AFE* = Most Accurate	3	-4.46	0.30	-1.68	-4.97^{**}
VMR = RIM, *AFE* = Most Accurate	4 (Least favored)	-0.86	0.12	-1.77	1.61
VMR = RIM, *AFE* = Most Accurate	5 (Disfavored)	-9.32^{**}	5.22	15.79^{***}	16.93^{***}

Notes:
Portfolio returns and incremental portfolio returns are computed as linear combinations of the regression coefficient estimates obtained for each *PT/P* group, consistent with panel B. Significance levels for *F*-tests of the null hypothesis that the portfolio return or incremental return is zero are denoted as *, **, and *** for rejection at the 0.10, 0.05, and 0.01 level, respectively.

Do financial analysts' long-term growth forecasts matter? Evidence from stock recommendations and career outcomes

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ABSTRACT: Prior literature refers to economic incentives to generate investment banking business and trading commissions as explanations for analyst publication of forecasts of firms' long-term earnings growth (LTG). Prior research also documents wildly optimistic LTG forecasts and a negative relation between LTG forecasts and subsequent excess returns. Thus, the literature portrays analysts' LTG forecasts as nonsensical from a valuation perspective. We introduce and investigate a new perspective on the value-relevance of analyst publication of LTG forecasts. We hypothesize that analysts issuing LTG forecasts signal relatively high effort and ability in developing perspective of the subject firms' long-term prospects. Consistent with this hypothesis, we find that the stock market responds more strongly to the stock recommendation revisions of analysts who publish accompanying LTG forecasts. In addition, we hypothesize and find that analysts issuing LTG forecasts are less likely to leave the profession or move to smaller brokerage houses. Consistent with Reg. FD's intention to restrict analyst access to insider information and promote fundamental analysis of the valuation implications of firms' long-term prospects, we find that post-Reg. FD observations drive most of our results. Overall, we identify previously undocumented benefits accruing to analysts who publish LTG forecasts.

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Do financial analysts' long-term growth forecasts matter? Evidence from stock recommendations and career outcomes

1. Introduction

This paper investigates whether analysts who choose to issue long-term growth forecasts signal effective effort to gain value-relevant perspective of the long-term prospects of the firms they follow. We hypothesize that, if so, the stock recommendations of these analysts yield a greater market response and the analysts have better career prospects than analysts who choose not to issue long-term growth (hereafter LTG) forecasts. We find results generally consistent with our hypotheses. Thus, we identify previously undocumented benefits accruing to analysts who issue LTG forecasts.

Prior literature generally demonstrates that LTG forecasts are optimistically biased, grossly inaccurate and, from a valuation perspective, essentially meaningless (e.g., La Porta 1996; Chan et al. 2003; Barniv et al. 2009). Research suggests that optimism in analysts' forecasts reflects analysts' opportunistic incentives to stimulate investment banking business, generate trading commissions and gain access to managers' private information (e.g., Francis and Philbrick 1993; Lin and McNichols 1998; Cowen et al. 2006). Chan et al. (2003) show that after accounting for dividend yield differences, analysts do not effectively distinguish firms with high versus low future earnings growth rates. Bradshaw (2004) and Barniv et al. (2009) document that analysts' consensus LTG forecasts largely explain the variation in consensus stock recommendations, but trading strategies consistent with those recommendations do not generate positive stock returns.[1] In fact, La Porta (1996), Bradshaw (2004), and Barniv et al. (2009) report that LTG forecasts are *negatively* related to future excess returns. In addition, Liu and Thomas

[1] Other studies of the investment value of stock recommendations provide somewhat mixed results depending on the samples and research designs. The studies generally indicate that trading strategies based on stock recommendations generate positive risk-adjusted returns, but only if implemented promptly on the date of recommendation.

(2000) find that LTG forecast revisions add little to revisions in forecasts of next year's earnings in explaining the variation in annual returns. Hence, the prior literature suggests that analysts' LTG forecasts potentially lead investors astray. Perhaps consequently, prior studies fail to find a relation between LTG forecast accuracy and analyst compensation (Dechow et al. 2000).[2]

Overall, the extant literature implies that LTG forecasts do not come from a sophisticated process that provides investors with useful information about firms' long-term earnings prospects. Questions that remain puzzling, but unexplored include: why investors are consistently misled by LTG forecasts over many years (e.g., La Porta 1996; Barniv et al. 2009); why *any* or *not all* analysts publish LTG forecasts; and, most puzzling of all, why stock analysts invest effort in a process of producing seemingly nonsensical LTG forecasts and use them in formulating stock recommendations (Bradshaw 2004; Ke and Yu 2009). Our paper attempts to address these issues by introducing a new perspective on the value-relevance of publication of LTG forecasts.

We develop hypotheses as follows. First, the limitation of analysts' time, effort, and resources *and* greater difficulty in forecasting longer-term performance imply that forecasting LTG is costly for all analysts and more costly for less able analysts. The empirical evidence that LTG forecasts issued by Value Line analysts are more accurate than several other metrics computed by Rozeff (1983) and the fact that not all analysts publish LTG forecasts support our description of costs involved in producing and reporting LTG forecasts. Thus, we expect LTG forecast publication to signal analyst ability in generating value-relevant long-term oriented information about firms' prospects. More importantly, we expect the analyst research process that produces LTG forecasts to produce inputs to other summary metrics, such as stock recommendations, that incorporate long-term oriented information, beyond the information in the

[2] See Ramnath et al. (2008a, 2008b) for more extensive reviews of the analyst forecasting literature.

LTG forecasts themselves.[3] Since stock recommendations are the ultimate product of analysts' research (Schipper 1991), we choose stock recommendations as the primary focus of our study, and hypothesize that stock recommendations accompanied by LTG forecasts are more informative than those unaccompanied by LTG forecasts.

Second, if publication of LTG forecasts signals effort leading to more informative stock recommendations, we expect that analysts exerting such effort have better career prospects. More specifically, we hypothesize that analysts engaging in effort to gain informative long-term perspective of firms' prospects signal such effort with the publication of LTG forecasts and increase (decrease) the probability of upward (downward) mobility in their careers.

Third, if analysts publishing LTG forecasts engage in relatively more informative fundamental analysis of firms' long term prospects we expect the rewards to be greater when regulation precludes access to inside information. Therefore, we hypothesize stronger differential market response to stock recommendations accompanied by LTG forecasts after the October 2000 promulgation of Reg. FD. Similarly, we hypothesize a stronger relation between career outcomes and the publication of LTG forecasts after Reg. FD.

Consistent with the first hypothesis, we find that over the three trading days beginning with the recommendation publication date, the stock market response to recommendation revisions is stronger when the recommendations are accompanied by LTG forecasts and, consistent with our third hypothesis, post-Reg. FD observations drive these results. As described in section 5, these results are robust to a battery of tests that examine alternative explanations, alternative variable specifications, and additional control variables. Section 5 also includes a test

[3] Our review of a random sample of analyst research reports obtained from Investext Plus supports our conjecture. The appendix describes that review in more detail.

for market inefficiency and we find no evidence of either market overreaction or underreaction to recommendation revisions accompanied by LTG forecasts.

Consistent with our second hypothesis, we find that analysts who issue LTG forecasts are less likely to experience downward mobility and, consistent with our third hypothesis, this result is more pronounced in the post-Reg. FD period. As described in section 5, these results are robust to excluding a period of active consolidation in the brokerage firm industry that likely creates measurement error in our career outcome proxies.

Overall, our evidence is consistent with the inference that issuance of LTG forecasts signals an underlying process whereby analysts effectively gain long-term perspective of the firm's prospects which leads to more value-relevant stock recommendations and greater job security. Our results also suggest that publication of LTG forecasts leads to more efficient resource allocation in capital markets, as market participants recognize and respond to more informative accompanying stock recommendations.

This paper proceeds as follows. Section 2 develops our hypotheses, section 3 describes the models used to test our hypotheses, and section 4 describes the sample and reports the main results. Section 5 provides supplementary test results, and section 6 concludes.

2. Hypotheses

2.1. Value-relevance of stock recommendation revisions (H1)

We investigate whether analysts publishing LTG forecasts engage in a process that uncovers value-relevant information about a firm's long-term prospects. As we describe in the introduction, such a process suggests that stock recommendation revisions accompanied by analysts' LTG forecasts are more informative and, therefore, have a greater contemporaneous impact on stock prices. We examine this research question with the hypothesis below.

H1: The stock market reacts more strongly to revisions in analysts' stock recommendations accompanied by LTG forecasts published by the same analysts.

2.2. Career outcomes (H2)

If LTG forecast publication reflects analysts' effective effort towards making more value-relevant recommendations, we expect analysts to be rewarded with higher compensation and/or favorable career outcomes. Since we cannot directly observe analyst compensation, following prior literature (e.g., Mikhail et al. 1999; Hong and Kubik 2003), the following hypotheses focus on how the publication of LTG forecasts influences analysts' career outcomes.

H2a: Among analysts who issue stock recommendations, those that also issue LTG forecasts are less likely to be terminated.

H2b: Among analysts who issue stock recommendations, those that also issue LTG forecasts are less likely to be demoted.

H2c: Among analysts who issue stock recommendations, those that also issue LTG forecasts are more likely to be promoted.

2.3. Implications of Regulation Fair Disclosure (H3)

Reg. FD requires management to disclose all material information simultaneously to all market participants. Many studies conclude that Reg. FD succeeded in changing the information environment. For example, Mohanram and Sunder (2006) find that, on average, after Reg. FD analysts generate more precise idiosyncratic information, rely less on information supplied directly by management, cover fewer firms more intensely, and shift coverage towards firms where their efforts at developing idiosyncratic information have bigger payoffs. Bailey et al. (2003) similarly find evidence suggesting that analysts must rely more heavily on their own independent research following Reg. FD.[4] Thus, after Reg. FD, analysts' effort to gain

[4] For additional evidence that Reg. FD achieved its intended purpose, see Shane et al. (2001), Gintschel and Markov (2004), and Eleswarapu et al. (2004).

perspective on firms' long-term prospects could have bigger rewards in terms of both the value-relevance of the analysts' stock recommendations and analysts' career outcomes.

We investigate whether analysts have more to gain by capable development of perspective on firms' longer horizon prospects after Reg. FD than before Reg. FD. We expect so because: (1) with a leveled playing field, analysts can no longer rely on private access to management information to improve their forecasts; and (2) Reg. FD mitigates opportunistic incentives to bias LTG forecasts (e.g., to gain access to private information from management). Thus, we hypothesize that after Reg. FD, publication of LTG forecasts more strongly signals analysts' ability. In particular, we test the following hypotheses.

> **H3a:** The market response to analysts' stock recommendation revisions accompanied by LTG forecasts, as compared to the market response to recommendation revisions unaccompanied by LTG forecasts, increases after the promulgation of Reg. FD.
>
> **H3b:** The degree to which analysts publishing LTG forecasts experience more favorable career outcomes, relative to analysts who do not issue LTG forecasts, increases after the promulgation of Reg. FD.

Evidence supporting H3a and H3b further supports our conjecture that publication of LTG forecasts signals effective effort at developing long-term perspective of firms' prospects, the market recognizes the value of this long-term perspective, and analysts effectively incorporating this long-term perspective in their recommendations experience more favorable career outcomes.

3. Models

3.1. Models for tests of H1 – market response to recommendation revisions

If investors attach more value to stock recommendations accompanied by analysts' LTG forecasts (H1), then we expect $\alpha_3 > 0$ in model (1) below.

$$CAR_{ijt} = \alpha_0 + \alpha_1 LTGISS_{ijt} + \alpha_2 \Delta REC_{ijt} + \alpha_3 \Delta REC_{ijt} * LTGISS_{ijt} + \alpha_4 \Delta REC_{ijt} * CFISS_{ijt} +$$

$$\sum_{k=5}^{10} (\alpha_k \; \Delta REC_{ijt} * R\_ANALYST\ CHARACTERISTIC_k) +$$

$$\sum_{k=11}^{16}(\alpha_k * \Delta REC_{ijt} * R\_FIRM\ CHARACTERISTIC_k) + \alpha_{17} CFISS_{ijt} +$$
$$\sum_{k=18}^{23}(\alpha_k * R\_ANALYST\ CHARACTERISTIC_k) +$$
$$\sum_{k=24}^{29}(\alpha_k * R\_FIRM\ CHARACTERISTIC_k) +$$
$$\text{Industry effects} + \text{Year effects} + \varepsilon_{ijt} \quad (1)$$

where:

CAR_{ijt} = cumulative abnormal stock return over the three trading days beginning on the date of analyst *j*'s stock recommendation revision for firm *i* in year *t*. We calculate CAR by subtracting the value-weighted market return from the firm's raw stock return.[5]

ΔREC_{ijt} = the change in cardinal recommendation measures. Recommendation changes between "Strong buy" (= 5), "Buy" (= 4), "Hold" (= 3), "Underperform" (= 2), and "Sell" (= 1) are assigned numeric values between −4 and +4, depending on the difference between the cardinal measure attached to the current recommendation and the cardinal measure attached to the previous recommendation for analyst *j* following firm *i*. For example, a downgrade from "Buy" to "Underperform" receives a value of −2 (= 2 − 4).

$LTGISS_{ijt}$ = 1 if analyst *j* issues a LTG forecast for firm *i* during the half-year ending on the day of the analyst's recommendation revision, and 0 otherwise.

$CFISS_{ijt}$ = 1 if analyst *j* issues a cash flow forecast for firm *i* during the half-year ending on the day of the analyst's recommendation revision, and 0 otherwise. $CFISS_{ijt}$ controls for the possibility that cash flow forecasts signal analyst ability.

ANALYST CHARACTERISTIC refers to the following six analyst characteristic variables which control for factors that could affect investors' perceptions of the value-relevance of analysts' recommendation revisions.

$FIRM\#_{jt}$ = number of firms analyst *j* follows in year *t*.

$IND\#_{jt}$ = number of industries analyst *j* follows in year *t*.

$BSIZE_{jt}$ = number of analysts employed by analyst *j*'s brokerage house in year *t*.

$FIRM\_EXP_{ijt}$ = number of years analyst *j* issued one or more firm *i* annual earnings forecasts.

[5] Results are robust to using buy-and-hold stock returns and abnormal returns based on the market model regression, the Fama and French three-factor model, and raw stock returns minus the same stock's prior mean returns, with all parameters estimated over the 100 trading days prior to recommendation revision date.

$EPS\_ACCUR_{ij,t-1}$ = absolute value of the difference between year $t-1$ earnings and analyst j's most recent forecast of those earnings.

EPS_FREQ_{ijt} = analyst j's annual earnings forecast frequency for firm i in year t.

We collectively refer to all scaled control variables representing analyst characteristics as R_ANALYST CHARACTERISTIC in model (1). FIRM# and IND# proxy for time constraints, and BSIZE proxies for resources available (Clement 1999). FIRM_EXP proxies for company-specific experience and EPS_ACCUR proxies for innate general forecasting ability (Brown and Mohammad 2010). EPS_FREQ proxies for firm-specific familiarity and effort (Jacob et al. 1999; Clement and Tse 2003).

Equation (2) below scales $FIRM\#_{jt}$, $IND\#_{jt}$, $BSIZE_{jt}$, $FIRM\_EXP_{ijt}$, and EPS_FREQ_{ijt} to fall between 0 and 1 within the same firm-year (Clement and Tse 2003).

$$R\_VARIABLE_{ijt} = \frac{\text{RAW MEASURE OF VARIABLE}_{ijt} - \text{MIN(RAW MEASURE OF VARIABLE}_{it})}{\text{MAX(RAW MEASURE OF VARIABLE}_{it}) - \text{MIN(RAW MEASURE OF VARIABLE}_{it})} \qquad (2)$$

where, MAX(RAW MEASURE OF $VARIABLE_{it}$) and MIN(RAW MEASURE OF $VARIABLE_{it}$) are, respectively, the maximum and minimum values of each independent variable measured among all analysts following firm i in year t.

Equation (3) scales $EPS\_ACCUR_{ij,t-1}$ to fall between 0 and 1, with 1 (0) corresponding to the most (least) accurate forecast.

$$R\_EPS\_ACCUR_{ij,t-1} = \frac{\text{MAX}(|\text{EPS FORECAST ERROR}_{i,t-1}|) - |\text{EPS FORECAST ERROR}_{ij,t-1}|}{\text{MAX}(|\text{EPS FORECAST ERROR}_{i,t-1}|) - \text{MIN}(|\text{EPS FORECAST ERROR}_{i,t-1}|)} \qquad (3)$$

where, MAX(|EPS FORECAST $ERROR_{i,t-1}$|) and MIN(|EPS FORECAST $ERROR_{i,t-1}$|) are the maximum and minimum absolute earnings forecast errors, respectively, for all analysts following firm i in year $t-1$.

In equation (1), FIRM CHARACTERISTIC refers to the six variables explained below (COMPUSTAT labels in parentheses). These variables control for factors that potentially create variation across firms in the market's response to recommendation changes, e.g., large or old firms may have a richer information environment and weaker response to stock recommendation revisions. Similar to analyst characteristics, with the exception of the variable indicating whether or not firm *i* has a net loss in year *t*, we use equation (2) above to scale all firm characteristic control variables to fall between 0 and 1 within the same analyst-year.

MB_{it} = firm *i*'s market to book ratio at the end of fiscal year *t* (= PRCC_F*CSHO / CEQ).

$ALTMANZ_{it}$ = Altman's (1968) Z-score, measured as [1.2*net working capital / total assets (= WCAP / AT) + 1.4*retained earnings / total assets (= RE / AT) + 3.3*earnings before interest and taxes / total assets (= PI / AT) + 0.6*market value of equity / book value of liabilities (= PRCC_F*CSHO /LT) + 1.0*sales / total assets (= SALE /AT)].

$LOSS_{it}$ = 1 for firms with a net loss in year *t*, and 0 otherwise (= IB).

AGE_{it} = the number of years firm *i* has been publicly traded, per CRSP files.

$lnMV_{it}$ = the natural log of firm *i*'s market value at the end of year *t* (= PRCC_F*CSHO).

$\%INST_{it}$ = percent of firm *i*'s common shares held by institutional investors in year *t*. We use the average of four quarterly amounts reported by institutional managers.

Model (1) includes year and industry dummies constructed following Fama and French (1997).

3.2. Models for tests of H2a, H2b and H2c – analyst career outcomes

Model (4) tests whether publishing a LTG forecast signals underlying ability related to subsequent career outcomes.

$$\text{Probability } (TERMINATION_{j,t+1}, \text{ or } DEMOTION_{j,t+1}, \text{ or } PROMOTION_{j,t+1}) = \beta_0 + \beta_1 LTGISS_{jt} + \beta_2 EPS\_ACCUR_{jt} + \beta_3 BOLD_{jt} + \beta_4 LNEXP_{jt} + \beta_5 LN\#FIRM_{jt} + \beta_6 LN\#ANALYST_{jt} + \text{Brokerage house effects} + \text{Year effects} + \varepsilon_{jt} \quad (4)$$

where:

Year *t* is the period between July 1 of year *t*−1 and June 30 of year *t*, and $TERMINATION_{j,t+1}$, $DEMOTION_{j,t+1}$, and $PROMOTION_{j,t+1}$ are proxies for analyst *j*'s job status in year *t*+1, which begins on July 1 of year *t*.

$TERMINATION_{j,t+1}$ = 1 if year *t* is the last year any of analyst *j*'s forecasts and recommendations appear on the I/B/E/S database, and 0 otherwise.

$DEMOTION_{j,t+1}$ ($PROMOTION_{j,t+1}$) = 1 if analyst *j* works for a large (small) brokerage house in year *t* and works for a small (large) brokerage house in year *t*+1, and 0 otherwise. A large (small) brokerage house employs more than 25 (25 or fewer) analysts. When $DEMOTION_{j,t+1}$ ($PROMOTION_{j,t+1}$) is the dependent variable, we eliminate observations where analysts work for small (large) brokerage houses in year *t* because they cannot be demoted (promoted) by definition. We also eliminate observations where analysts are demoted (promoted) in year *t*+2 because it is ambiguous whether the demotion (promotion) is associated with year *t* activity.

$LTGISS_{jt}$ = 1 if analyst *j* issues a LTG forecast for any firm during year *t*, and 0 otherwise.[6]

EPS_ACCUR_{jt} = the average of $R\_EPS\_ACCUR_{ijt}$ across all firms followed by analyst *j* in year *t*. We measure $R\_EPS\_ACCUR_{ijt}$ according to equation (3) above for the last annual earnings forecast issued prior to the announcement of year *t* earnings.

$BOLD_{jt}$ = the average boldness rank of analyst *j*'s first annual earnings forecast for all firms followed in year *t*. Boldness equals the absolute deviation between analyst *j*'s first forecast of firm *i*'s annual earnings since the firm's most recent annual earnings announcement and the mean of all other analysts' earliest earnings forecasts for the same firm and year. We, then, use equation (2) to rank analyst *j*'s boldness relative to the average boldness of all analysts following the same firm in year *t*. The ranks are then averaged across all firms followed by analyst *j* in year *t*.

$LNEXP_{jt}$ = the natural log of the number of years since analyst *j*'s first I/B/E/S forecast.

$LN\#FIRM_{jt}$ = the natural log of the number of firms followed by analyst *j* in year *t*.

$LN\#ANALYST_{jt}$ = the natural log of the average number of analysts following the firms covered by analyst *j* in year *t*.

When the dependent variable is $PROMOTION_{j,t+1}$ ($DEMOTION_{j,t+1}$ or $TERMINATION_{j,t+1}$), a positive (negative) coefficient on $LTGISS_{jt}$ supports our hypothesis that the effort underlying LTG forecasts is rewarded with favorable career outcomes (H2). Definitions of variables in model (4) follow prior literature (e.g., Hong et al. 2000; Ke and Yu 2006).

Prior literature documents that earnings forecast accuracy (EPS_ACCUR_{jt}), boldness ($BOLD_{jt}$), and analyst experience ($LNEXP_{jt}$) are related to career outcomes. We therefore include

[6] Because career outcomes are measured annually, we use a window of a year to measure LTGISS. Results are robust to identifying LTG forecasting activity with reference to 180-day periods ending on recommendation dates during the year before the career outcome year.

those variables as control variables. Given the ways forecast accuracy and boldness are measured, analysts who follow firms with thin coverage or who follow few firms are more likely to have extreme values of the two measures (Hong et al. 2000). Thus, we also control for the number of firms followed by an analyst ($LN\#FIRM_{jt}$), and the average number of analysts following firms followed by analyst *j* ($LN\#ANALYST_{jt}$). In addition, including these variables controls for their correlation with LTG forecast publication. For example, Bradshaw (2004) documents that firms with intensive analyst coverage are more likely to have a LTG forecast.

3.3. Tests of the implications of Reg. FD (H3)

To test H3a and H3b, we compare the results of estimating models (1) and (4) separately on subsamples before and after promulgation of Reg. FD. We define a pre-Reg. FD (post-Reg. FD) observation as one with a recommendation issued before (after) October 23, 2000.

4. Data, descriptive statistics, and empirical results

4.1. Data

We collect earnings forecasts, LTG forecasts, stock recommendations, and other analyst-related variables from the I/B/E/S database. Data on all firm characteristics come from COMPUSTAT, except institutional investors' shareholdings data, which come from Thomson Reuters. Stock returns come from CRSP. All of our tests begin with the population of analyst-level stock recommendation changes available on the I/B/E/S database. For each hypothesis test described in section 4 and each of the additional analyses described in section 5, additional constraints necessary to estimate our models narrow the sample further. As recommendation data are available from 1993, and each observation requires at least a half-year of lead time to assess LTG forecasting activity our sample period begins in 1994. Given the two-year period needed to evaluate career outcomes, the sample period extends through 2006. As described in section 3, tests evaluating the value-relevance of stock recommendations refer to the six-month period ending on the recommendation date to determine whether the stock recommendation has an accompanying LTG forecast. Tests evaluating career outcomes refer to the year prior to the year identified with the career outcome to determine whether the analyst engaged in LTG forecasting prior to the career outcome.

Data requirements to estimate model (1) result in a sample of 33,275 recommendation revisions used to test for a relation between LTG forecast publication and the information content of analyst recommendations (H1). Data requirements for estimating model (4) result in 22,678 analyst-year observations used to investigate whether LTG forecasting activity affects career outcomes (H2).

4.2. Tests of the market response to stock recommendation revisions (H1)

4.2.1. Descriptive statistics

The sample used for tests of H1 consists of all recommendation changes for which we can estimate all analyst and firm characteristics defined in model (1). To mitigate independence issues, if two or more analysts have the same current recommendations on the same day for the same firm and the same prior recommendations, we remove them from tests of H1.[7]

Table 1 presents descriptive statistics separately for observations with and without LTG forecasts. Panel A shows that out of all analyst recommendation revisions, 28% (= 9,307/33,275) are accompanied or preceded by at least one LTG forecast published by the same analyst over the 180-day period ending on the recommendation revision date. On average, recommendations with LTG forecasts are more favorable than those without LTG forecasts, but the medians of both groups represent "Buy". The mean of recommendation revisions (ΔREC) with LTG forecasts is not significantly different from that of recommendation changes without LTG forecasts.

[7] Sensitivity tests based on all recommendation changes produce similar results. To further mitigate independence issues, we re-estimate model (1) after eliminating all recommendation changes that are distributed within 5 days of a recommendation change by a different analyst (Jegadeesh and Kim 2010). Our results are robust to this treatment.

Panel A also reports that the cumulative (3-day) stock market reactions (CARs) around recommendation revisions do not differ between the subsamples with and without LTG forecasts. The difference in means could be misleading due to averaging more negative stock market reactions to downgrades accompanied by LTG forecasts with more positive stock market reactions to upgrades accompanied by LTG forecasts. Figure 1 depicts CAR by the sign and magnitude of recommendation changes and whether or not a LTG forecast accompanies the recommendation revision. More than 98% of the recommendations are revised within an absolute magnitude of 2. Consistent with H1, CAR is more negative (positive) for all recommendation downgrades (upgrades) accompanied by LTG forecasts, except for the few upgrades with a magnitude of 4. The descriptive evidence in figure 1 is consistent with our hypothesis that recommendation revisions accompanied by LTG forecasts are more informative.

As compared to recommendation revision observations without accompanying LTG forecasts, observations with LTG forecasts are significantly ***less*** likely to have a cash flow forecast; i.e., the decision to publish a LTG forecast is negatively correlated with the decision to publish a cash flow forecast. If analysts publish cash flow forecasts when earnings quality is low (DeFond and Hung 2003), then perhaps the likelihood of publishing a LTG forecast increases with the quality of earnings. We leave exploration of this possibility for future research, but recognize the need to control for the presence (or not) of a cash flow forecast.

At the analyst-year level, analysts forecasting LTG work for larger brokerage houses and cover fewer firms and industries, suggesting that to some extent, publication of LTG forecasts is negatively related to time and effort constraints *and* positively related to resources available. At the firm-year level, analysts following larger profitable firms with lower probability of bankruptcy and higher institutional holdings are more likely to make LTG forecasts.[8] At the analyst-firm-year level, it appears that analysts with more firm-specific experience are less likely to publish LTG forecasts along with their stock recommendation revisions. Finally, there is no significant difference in annual earnings forecast accuracy (EPS_ACCUR) between the subsample with LTG forecasts and the subsample without LTG forecasts, suggesting that stock analysts forecasting LTG do not necessarily have better ability in forecasting short-term earnings.

Table 1, Panel B provides Pearson and Spearman correlation coefficients for the various combinations of control and test variables. The correlations between LTGISS and other variables are generally consistent with Panel A. For example, LTGISS is negatively correlated with cash flow availability, and the number of firms or industries an analyst covers, and positively correlated with recommendation levels and brokerage house size. The low to modest correlations among independent variables to be used in the models mitigate concerns about multicollinearity.

4.2.2. Multivariate test

Table 2 presents results of estimating model (1). The coefficient on the interaction of $LTGISS_{ijt}$ and ΔREC_{ijt} is significantly positive (one-tailed p-value < 0.0001),[9] indicating that the stock market reacts more to recommendation revisions with accompanying LTG forecasts than to other recommendation revisions. The relation is also economically significant. Publication of a LTG forecast increases the market reaction to the analyst's stock recommendation by 27% (=

[8] The combination of descriptive statistics in table 1 suggests the possibility of a self-selection bias, whereby analysts with more favorable views and greater resources issue LTG forecasts to support their favorable recommendations regarding the prospects of larger profitable firms with lower probability of bankruptcy. Thus, an alternative explanation for the existence of LTG forecasts is that analysts use them to generate interest in stocks for which they have favorable views. However, this explanation does not negate the hypotheses that analysts issuing the forecasts effectively signal relatively high effort and ability in developing perspective of the subject firms' long-term prospects leading to more informative stock recommendations and better career outcomes. An interesting follow-up study might examine hypotheses about the factors leading some analysts to engage in the effort underlying publication of long-term growth forecasts; however, such a study is beyond the scope of this paper.

[9] For convenience, all tables contain two-tailed p-values. However, hypotheses are one-tailed and, therefore, it is appropriate to divide the tabled p-values associated with hypotheses tests by 2.

0.4% /1.5%). This result supports H1 that the market perceives recommendation revisions accompanied by LTG forecasts to contain more information than recommendations without accompanying recommendations.

Several control variables have statistically significant coefficients. The market responds less to recommendation revisions accompanied by analysts' cash flow forecasts. The market responds more to recommendation revisions issued by analysts covering more firms and fewer industries, working for larger brokerage houses, having more firm-specific experience, and publishing forecasts of annual earnings more frequently. The market also responds more to recommendations associated with firms that grow more slowly, have losses, and have smaller market capitalization.

4.3. Tests of analysts' career outcomes (H2)

4.3.1. Descriptive statistics

The sample used for tests of H2 consists of all analyst-year observations with both recommendation revisions data and data needed to measure the analyst characteristics described in model (4). Table 3 presents descriptive statistics for tests of H2a through H2c. Panel A shows that, on average, the percentage of analysts who issue LTG forecasts in year *t* and are terminated or demoted (promoted) in year *t*+1 is significantly smaller (larger) than the percentage of analysts without LTG forecasts who are terminated or demoted (promoted). Analysts with LTG forecasts issue less bold earnings forecasts, have longer general experience, follow more firms, and the firms they follow tend to have higher analyst coverage. Correlation results in Panel B are consistent with the differences in means and medians in Panel A, and there is no evidence of significant multicolinearity issues.

4.3.2. Multivariate test

Results of estimating equation (4) are presented in Table 4. Consistent with the descriptive statistics in Table 3 (and H2a and H2b), LTG forecast publication is associated with a significantly smaller likelihood of job termination and demotion (one-tailed p-values are 0.004 and 0.045, respectively). The test statistic related to the odds of promotion for analysts who issue LTG forecasts versus those who do not is insignificant and does not support H2c. Thus, the evidence implies that the effort in publishing LTG forecasts is rewarded with higher likelihood of job survival and lower likelihood of demotion, but not with a higher likelihood of promotion. The results related to promotions do not support our prediction, but are consistent with the argument in Ke and Yu (2006) that effective analyst effort more likely leads to retention (i.e., avoidance of demotion or termination) than promotion, because "the analyst's current employer will try to offer monetary incentives to retain him" (Ke and Yu 2006, fn 4).[10] Overall, we document that the analyst effort underlying LTG forecasts to gain long-term perspective regarding a firm's prospects is associated with greater job security.

4.4. Tests of the implications of Reg. FD (H3)

To test H3a and H3b, we re-estimate models (1) and (4) separately for the pre- and post-Reg. FD periods and compare coefficients on test variables across the two periods. Table 5 shows the results of tests of whether the difference between the market reaction to recommendation revisions accompanied by LTG forecasts and that not accompanied by LTG forecasts increases after Reg. FD. If recommendations with LTG forecasts are more value-relevant after Reg. FD, the coefficient on $\Delta REC_{ijt} \cdot LTGISS_{ijt}$ will be significantly larger in the post-Reg. FD period. The number of recommendation revisions used to estimate model (1) in the pre- (post-) Reg. FD period is 13,752 (19,523). Consistent with our prediction, the coefficient on $\Delta REC_{ijt} \cdot LTGISS_{ijt}$ is

[10] Wu and Zang (2009) argue that the termination and promotion variables contain measurement error, because I/B/E/S codes neither retirements nor promotions to research director positions. To the extent this occurs in our sample, we have measurement error, which could explain the lack of evidence supporting H2c and (later) H3b.

significantly positive in the post-Reg. FD period (coefficient = 0.470, one-tailed p-value < 0.0001) and less positive in the pre-Reg. FD period (coefficient = 0.261, one-tailed p-value = 0.009). The difference in coefficients is significant at 0.090 (one-tailed).[11]

Table 6 presents results of examining analysts' career outcomes in the pre- versus post-Reg. FD periods. Relative to analysts who do not publish LTG forecasts, analysts who do publish them are significantly less likely to be terminated or demoted in the post-Reg. FD period (one-tailed p-values = 0.009 and 0.004, respectively); whereas, in the pre-Reg. FD period, analysts issuing LTG forecasts are only marginally significantly less likely to be terminated and not significantly less likely to be demoted (one-tailed p-values = 0.092 and 0.307, respectively). The differences from the pre- to post-Reg. FD period are only significant with respect to the demotion variable (one-tailed p-value = 0.018). Thus, we have strong (weak) support for H3a (H3b).[12]

Surprisingly, the coefficient on LTGISS in the model explaining promotions is significantly positive in the pre-Reg. FD period, but insignificant in the post-Reg. FD period. One possible explanation for this surprising result is that these analysts' LTG forecasts are more optimistic in the pre-Reg. FD period and the analysts are rewarded for gaining investment banking service or acquiring private information from management. Because the promulgation of Reg. FD limits the advantages of LTG forecast optimism and, thus, discourages such opportunistic behavior, we expect less optimism in LTG forecasts in the post-Reg. FD period. To investigate this possibility, we compare LTG forecast optimism between the pre- and post-Reg. FD periods, measuring LTG forecast optimism as the difference between forecasted and actual LTG. The mean of LTG forecast optimism is 5.12% in the six years prior to 2000 and 1.05% in

[11] When using the alternative abnormal return measures described in footnote 5, the coefficients on ΔREC*LTGISS are significantly higher in the post-Reg. FD period. One-tailed p-values for the difference in the coefficients range from 0.049 to 0.082.

[12] Using a 180-day period prior to stock recommendation dates to identify LTG forecasting activity during the year prior to the year of terminations and demotions, the coefficients on LTGISS are significantly negative only in the post-Reg. FD period.

the three years subsequent to 2000.[13] The difference of 4.07% is statistically and economically significant (p-value < 0.0001), supporting our conjecture that analysts could be rewarded with promotion for issuing more optimistic LTG forecasts in the pre-Reg. FD period. We leave further investigation of this unexpected result for future research.

Overall, our results suggest that analyst publication of LTG forecasts signals more effective effort toward developing a long-term perspective that informs their recommendations and this effort pays off more in the post-Reg. FD period when management is restricted from selectively feeding value-relevant information to favored analysts. We also find some evidence that analysts' job security is more positively associated with the publication of LTG forecasts in the post-Reg. FD period.

5. Supplemental analysis

5.1. Does I/B/E/S systematically exclude certain LTG forecasts?

The results described above are consistent with the interpretation that analysts who publish LTG forecasts signal greater ability to incorporate meaningful long-term perspective of firms' prospects into more informative stock recommendations. An alternative explanation for our results is that I/B/E/S selectively publishes the LTG forecasts of better analysts and excludes the LTG forecasts of other analysts.[14] This subsection explores whether I/B/E/S selection bias exists and, if so, whether it affects our inferences.

[13] Following prior literature, actual LTG is calculated based on the slope coefficient from a regression of the natural logarithm of a firm's actual annual earnings on an independent variable taking on values of one through six, where one refers to year *t*, two refers to year *t*+1, and so on (La Porta 1996; Dechow et al. 2000). Dechow et al. (2000) note that I/B/E/S calculates actual LTG using this same OLS method. As 2003 is the last year for which six years' actual earnings are available, our analysis is based on fiscal years 1994 through 2003.
[14] Another selection bias occurs if some analysts choose not to supply certain forecast data to I/B/E/S. If less capable analysts choose not to supply data to I/B/E/S, this behavior is consistent with our hypotheses that analysts publishing LTG forecasts have more informative stock recommendations and better career outcomes. On the other hand, if more capable analysts choose not to supply their LTG forecasts to I/B/E/S, that works against the power of our tests.

Among sample firms (firm-analysts) with a LTG forecast in any of our sample years, 87% (93%) have a LTG forecast in all sample years. Thus, LTG forecasts are unlikely to suffer from bias due to change in I/B/E/S's data input process over time. Below we further evaluate possible selection bias effects that may persist over time.

We begin by cross-checking I/B/E/S records with analyst research reports from Investext Plus. Given the cost of hand-collecting data from Investext Plus, we decided to obtain a sample of 200 actual analyst research reports selected randomly with reference to the recommendation observations that we had coded as ***not having*** accompanying LTG forecasts on I/B/E/S. If we identify a LTG forecast in any of these 200 research reports, we further examine the apparent I/B/E/S misclassification. About 85% of I/B/E/S observations do not appear in Investext Plus, and we needed to search the Investext database 1,288 times in order to identify a random sample of 200 matching I/B/E/S-Investext Plus observations.[15]

In our sample of 200 I/B/E/S-Investext observations matched on the existence of a recommendation revision, recommendation date, analyst, and company name, we confirmed that 172 of the Investext reports did not contain LTG forecasts in that report or in any other Investext report issued by that analyst for that firm. In 28 cases, in spite of I/B/E/S reporting no LTG forecast for that analyst-company-recommendation observation, we ***did find*** a corresponding LTG forecast in the research report obtained from Investext Plus. In all 28 of these cases, the LTG forecast came from the research report with the same date as the stock recommendation date on I/B/E/S.

Based on the sample described above, we estimate that 86% (= 172/200) of the stock recommendations appearing on I/B/E/S without accompanying LTG forecasts come from analyst

[15] While our matching procedure did not require this, the level of the recommendation on Investext matched the level on I/B/E/S 100% of the time.

research reports that confirm the absence of the LTG forecasts. Our concern is with the estimated 14% that I/B/E/S misclassifies. We investigate whether misclassified observations potentially drive our inference that stock recommendations without accompanying LTG forecasts contain less value-relevant information than stock recommendations with accompanying LTG forecasts.

If systematic I/B/E/S exclusion of worse analysts' LTG forecasts drives our results, then we expect: (a) I/B/E/S to also systematically exclude other long-term forecasts for these analysts; (b) the misclassified observations to systematically differ from correctly classified observations with respect to analyst and company characteristics typically associated with forecasting ability; and (c) any significant differences discovered in (b) to be associated with the informativeness of the stock recommendations in our sample. We investigate (a) and (b) by comparing another random sample of 28 observations correctly classified as having LTG forecasts (hereafter the correct classification group) to the 28 observations we found where I/B/E/S does not report the LTG forecast published in an analyst report (hereafter the misclassification group). We then use our entire I/B/E/S sample to examine whether any systematic bias discovered in (b) drives our overall finding regarding the informativeness of analysts' stock recommendations.

First, we assess the availability of two-year ahead EPS forecasts, three-year ahead EPS forecasts, and target price forecasts, and find that the proportion of observations with any one of these long-horizon forecasts in the 28-observation misclassification group does not differ significantly from the proportion in the 28-observation correct classification group.[16]

Second, we compare the correct classification group with the misclassification group in terms of the following analyst and company characteristics: number of firms followed, number of industries followed, brokerage firm size, firm-specific analyst forecasting experience, accuracy of

[16] We find that 96.4% (100%), 57.1% (75%), 92.9% (85.7%) of the observations in the misclassification (correct classification) group have stock recommendations with accompanying 2-year ahead earnings forecasts, 3-year ahead earnings forecasts, and target price forecasts, respectively.

current year EPS forecasts, annual frequency of current year EPS forecasts, market-to-book ratios, Altman's (1968) Z-score for companies followed, whether the observation occurs in a company loss year, and the company's age, market value, and percentage of shares held by institutions. Out of all these variables, we find significant differences only in the firm-specific experience variable; i.e., as compared to the 28 correctly classified observations, the 28 misclassified observations have stock recommendations and LTG forecasts issued by analysts with significantly less firm-specific experience. Thus, it is possible that I/B/E/S selectively omits LTG forecasts for (lower ability) inexperienced analysts.

While model (1) controls for firm-specific experience and thus, mitigates the possible misclassification bias, we further examine this issue as follows. We estimate model (1) for two subsamples. Both subsamples include the 9,307 observations classified as having LTG forecasts per I/B/E/S. One subsample adds 8,405 recommendation revisions published by inexperienced analysts and coded (per I/B/E/S) as recommendations unaccompanied by LTG forecasts (the possible misclassification group).[17] The other subsample adds 15,563 recommendation revisions distributed by experienced analysts and coded (per I/B/E/S) as unaccompanied by LTG forecasts (the likely correct classification group).

Suppose I/B/E/S systematically assumes that inexperienced analysts are inept when it comes to forecasting LTG and, therefore, I/B/E/S excludes those analysts' LTG forecasts from the database. If that assumption is correct, then we expect a relatively large coefficient relating the interaction term, LTGISS*ΔREC, to CAR in the subsample where no-LTG forecast (LTGISS=0) observations come only from inexperienced analysts. In fact, we find a coefficient

[17] We divide experienced from inexperienced analysts with reference to the median firm-specific experience of analysts for the whole sample.

of 0.202 (one-tailed p-value = 0.028) on LTGISS*ΔREC (untabulated)[18] when we estimate model (1) with the inexperienced analyst no-LTG forecast comparison group. Using the whole sample with both experienced and inexperienced no-LTG forecast observations, table 2 reports a coefficient of 0.402 (one-tailed p-value < 0.0001) on LTGISS*ΔREC, and when we run the analysis with only experienced analysts in the no-LTG forecast comparison group, the coefficient on LTGISS*ΔREC jumps to 0.544 (one-tailed p-value < 0.0001). This evidence is inconsistent with systematic I/B/E/S misclassification driving our overall results.

Overall, the evidence in this section suggests that the absence of some LTG forecasts in I/B/E/S is more likely due to random error than a systematic attempt to include only the LTG forecasts of better analysts. In any case, it does not appear that a systematic data selection bias, if present in I/B/E/S, drives our results.

5.2. Time lag between dates of the LTG forecast and the stock recommendation

Our primary analysis assumes that LTG forecasts issued within the six month period ending on the stock recommendation revision date signals effective analysis of the long-term prospects of the firm, and that analysis adds value to the stock recommendation. The value added can occur, for example, if the analyst directly incorporates the LTG forecast in a valuation model or incorporates the underlying long-term perspective in the process of developing the recommendation. The choice of six months balances: (1) the power provided by a sufficiently large number of recommendations preceded by LTG forecasts; and (2) the need for a short enough window to reasonably associate the long-term perspective represented by LTG forecast publication with the corresponding stock recommendation. If LTG forecasts issued early in the

[18] For the sake of brevity, most results reported throughout section 5 are untabulated. More detailed tables are available from the authors upon request.

six-month window are disconnected from the analysis underlying the stock recommendation revision, then this detracts from the power of our tests.

We evaluate this issue in two ways. First, we add the variable LEAD0DAY to model (1), where LEAD0DAY = 1 when I/B/E/S associates the LTG forecast with the same day as the stock recommendation, and LEAD0DAY = 0 otherwise. In an extended version of model (1), we include both the main effect of LEAD0DAY and its interaction with ΔREC. The coefficient on LEAD0DAY*ΔREC captures the stock market reaction to recommendations accompanied by LTG forecasts published on the same day incremental to the stock market reaction to recommendations accompanied by LTG forecasts published during the 180 days preceding the stock recommendation publication date. In the extended model, the coefficient on LTGISS*ΔREC is 0.301 (one-tailed p-value < 0.001) and the coefficient on LEAD0DAY*ΔREC is 0.449 (one-tailed p-value = 0.001). These results are consistent with the interpretation that LTG forecasts issued within six months of the stock recommendation (per I/B/E/S) reflect value-relevant analysis of the long-term prospects of the firm and more-so when I/B/E/S reports that the LTG forecast and stock recommendation are issued on the same day.[19]

Second, in model (1) we remove LTGISS and add four binary variables – LTGISS0, LTGISS180, LTGISS360, and LTGISS540 − and their interactions with ΔREC. LTGISS0 equals 1 when the most recent LTG forecast prior to a recommendation distributed by the same analyst leads the recommendation by 0 to 180 days. LTGISS180, LTGISS360 and LTGISS540 are defined analogously using windows of 181 to 360 days, 361 to 540 days, and more than 540 days, respectively.[20] We find that the coefficients (one-tailed p-values) on LTGISS0*ΔREC,

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[19] In our I/B/E/S sample of stock recommendations with accompanying LTG forecasts, the LTG forecasts have the same date as the corresponding recommendations 23% of the time, and they occur in the first, second, third, fourth, fifth, and sixth months prior to the recommendation 16%, 14%, 13%, 13%, 11%, and 11% of the time, respectively.
[20] For our sample, 40%, 20%, 13%, and 27% of all most recent LTG forecasts are issued, respectively, within 180 days, 181 to 360 days, 361 to 540 days, and more than 540 days prior to the corresponding recommendation date.

LTGISS180*ΔREC, LTGISS360*ΔREC, and LTGISS540 *ΔREC are 0.466 (<0.0001), 0.232 (0.015), 0.127 (0.157), and −0.058 (0.560), respectively. The coefficient on LTGISS0*ΔREC is significantly larger than coefficients on the other three interactions terms (p-values less than 5%).

Overall, the above results suggest that it is reasonable to associate the long-term perspective represented by LTG forecast publication within the six-month period preceding a recommendation with the corresponding stock recommendation.

5.3. LTG forecast levels

Our primary analysis treats all publications of LTG forecasts equally. Our justification is that the act of publishing the forecast signals ability to incorporate value-relevant long-term perspective of the firm's prospects into the analysis underlying the stock recommendation. However, we recognize that the magnitude of the LTG forecast varies across observations and might be associated with the market's confidence in the corresponding stock recommendation. In other words, investors might take an upgrade to a strong buy recommendation accompanied by a large LTG forecast more seriously than a similar upgrade accompanied by a small LTG forecast. This section evaluates robustness to controlling for the level of the LTG forecast.

We expand model (1) to include both the main effect and the interaction of LTGLEVEL with ΔREC. For recommendation revisions without LTG forecasts within the 180-day window, we use the latest consensus LTG forecast to measure LTGLEVEL. Untabulated results from estimating the expanded model show that the interaction of LTGISS with ΔREC is 0.399, which remains highly significant (p-value < 0.0001). The coefficient on the interaction of LTGLEVEL with ΔREC is 0.029 (p-value < 0.0001). Estimation results for the periods before and after Reg. FD show that with LTGLEVEL and its interaction with ΔREC in the model, the coefficient on the interaction of LTGISS with ΔREC remains significantly larger in the post- versus pre-Reg.

FD period (0.483 versus 0.220, one-tailed p-value = 0.042). We conclude that, while investors respond to the magnitude of the LTG forecast accompanying a recommendation, the mere act of publishing a LTG forecast signals ability corresponding to greater stock recommendation informativeness.

5.4. Recommendation levels

We recognize that the level of a recommendation, even when it reiterates the analyst's prior recommendation, contains information. Thus, the hypothesis for revisions also applies to levels, and we evaluate the coefficient on LTGISS in model (5).

$$CAR'_{ijt} = \beta_0 + \beta_1 LTGISS_{ijt} + \beta_2 CFISS_{ijt} + \sum_{k=3}^{8} (\beta_i \text{ *R\_ANALYST CHARACTERISTIC}_k) + \sum_{k=9}^{14} (\beta_i \text{ *R\_FIRM CHARACTERISTIC}_k) + \text{Industry effects} + \text{Year effects} + \varepsilon_{ijt} \quad (5)$$

where:

CAR'_{ijt} = cumulative abnormal stock return over the three trading days beginning with the day on which analyst *j* issues a stock recommendation for firm *i* in year *t*. We calculate CAR′ by subtracting the value-weighted market return from the firm's raw stock return. For "Hold," "Sell," or "Strong Sell" recommendations, we take the negative of the cumulative market-adjusted returns (Barber et al. 2007; Fang and Yasuda 2009).[21]

Other independent variables are as previously defined. A significantly positive β_1 is consistent with stronger market reaction to the level of analysts' stock recommendations accompanied by the same analysts' LTG forecasts. β_0 estimates trading profits on a (non-implementable) strategy that takes long positions on the day of "Strong Buy" or "Buy" recommendations without accompanying LTG forecasts and short positions on the day of "Hold", "Sell" or "Strong Sell" recommendations without accompanying LTG forecasts, where both positions are held for three trading days. β_1 estimates incremental trading profit on a (non-implementable) strategy that only considers recommendations accompanied by LTG forecasts.

[21] We obtain similar results using the four alternative abnormal stock return measures described in footnote 5.

Table 7 reports results from estimating model (5). The coefficient on LTGISS is significantly positive (one-tailed p-value <0.0001), consistent with analysts publishing LTG forecasts producing more informative stock recommendations. The sum of the intercept (= 0.419) and the coefficient (= 0.394) on LTGISS is 0.813, almost twice the magnitude of the intercept. We also estimate model (5) separately in pre-and post-Reg. FD periods. The coefficient on LTGISS is significantly larger in the post-Reg. FD period (one-tailed p-value = 0.002).

5.5. Market efficiency

We find significantly larger 3-day contemporaneous market reactions to analysts' stock recommendations accompanied by LTG forecasts. In this section, we evaluate the efficiency of the market's reaction. The larger market response could represent an overreaction to the incremental informativeness of recommendations accompanied by LTG forecasts. Alternatively, while the market reacts more strongly to recommendations accompanied by LTG forecasts, this could represent an underreaction with the possibility of long-term trading profits from following recommendations accompanied by LTG forecasts. If the market either underreacts or overreacts, then we should observe long-term drifts in returns either in the same or opposite direction as the initial market reaction.

To investigate the possibility of market inefficiency, we examine the cumulative market-adjusted return from following recommendations over the one-year period that starts from 3 days after the report date. Untabulated results show no difference in profitability from following recommendations accompanied by LTG forecasts relative to recommendations unaccompanied by LTG forecasts over this one-year period. Therefore, we conclude that the significantly larger contemporaneous market reaction to stock recommendations accompanied by LTG forecasts represents efficient market reaction to incrementally informative recommendations.

5.6. Consolidation in the brokerage firm industry

Mergers and acquisitions create measurement error in our promotion and termination variables. For example, an analyst working for a target firm in a merger could appear to get a promotion (termination) if the analyst stays with (leaves) the consolidated firm and this may have nothing to do with the analyst's ability. Intense consolidation in the brokerage industry occurred during the period from 1997 through 2001 (Wu and Zang 2009). To evaluate the importance of this phenomenon in tests of our career outcomes hypothesis, we remove all observations in the 1997 through 2001 period and re-run the analysis.

We find that analysts publishing LTG forecasts are less likely to be terminated (one-tailed p-value = 0.055) or demoted (one-tailed p-value = 0.006), but we find no evidence to suggest that these analysts are more likely to be promoted. When we split the sample into observations before and after Reg. FD, we find significant results only in the post-Reg. FD period. The one-tailed p-value associated with termination (demotion) is 0.022 (0.003), and the coefficient associated with promotion is insignificant, confirming similar results in our primary analysis.

5.7. Other forecasts accompanying stock recommendations

This section considers whether results of tests for the value-relevance of stock recommendation revisions accompanied by LTG forecasts are sensitive to incorporation of other forecasts. In particular, we consider analysts' forecasts of annual earnings for years t+1 through t+5, and analysts' target price forecasts, generally believed to have a one-year horizon (Bradshaw and Brown 2007; Kerl 2011).

5.7.1. Target price forecasts

Like LTG forecasts, target price forecasts are overly optimistic (Bradshaw 2002; Brav and Lehavy 2003; Bradshaw and Brown 2007) and grossly inaccurate (Bradshaw and Brown 2007; Bonini et al. 2010; Kerl 2011). Unlike research related to LTG forecasts, we do not find a rich literature identifying analysts' opportunistic incentives to issue target price forecasts for reasons divorced from an attempt to gain value-relevant perspective on the firm's prospects. Furthermore, target price forecasts provide investors with useful information over and above the information in stock recommendations and earnings forecasts (Brav and Lehavy 2003; Asquith et al. 2005); whereas, investors appear to overreact to the implications of LTG forecasts for future earnings (La Porta 1996; Bradshaw 2004). Finally, LTG forecasts cover a longer horizon than target price forecasts and this study focuses on the ability of analysts to gain long-term perspective of a firm's prospects. Hence, our main analysis focuses on LTG forecasts and we examine target prices in this supplemental analysis section.

As described above, prior literature documents that target price forecasts provide investors with useful information over and above the information in stock recommendations and earnings forecasts, and Bradshaw (2002) finds that analysts use target prices to support their stock recommendations. On the other hand, Bradshaw's analysis suggests that analysts use simple heuristics to generate target price forecasts, and analysts use these forecasts to justify their recommendations only when the two signals are consistent. Analysts tend not to publish target prices when they are not consistent with the stock recommendation. Thus, like LTG forecasts, whether target prices forecasts reflect underlying value-relevant analyst research associated with more informative stock recommendations is questionable. We are unaware of any studies addressing this question. We investigate it in this section.

Forty-four percent of the 33,275 stock recommendation revisions in our sample have accompanying target price forecasts during the 180-day period prior to the date of the recommendation revision; whereas, 28% have accompanying LTG forecasts. Only 47% of the observations with LTG forecasts also have accompanying target price forecasts. The correlation between the analyst's decision to issue a LTG forecast (LTGISS) and the decision to issue target price forecast (TPISS) is only 4% in our sample, and these decisions appear to come from different processes. Indeed, when we add the terms, TPISS and TPISS*ΔREC to model (1), we find that the coefficient on LTGISS*ΔREC remains statistically significant (p-value < 0.0001) and the coefficient declines insignificantly from 0.402 (table 2) to 0.347. Thus, controlling for the issuance of target price forecasts, our results indicating a larger price reaction to recommendation changes accompanied by LTG forecasts continue to hold. Interestingly, we also find a statistically significant coefficient (0.980) on TPISS*ΔREC (p-value < 0.0001), suggesting that, like LTG forecasts, analyst publication of target price forecasts appears to reflect underlying value-relevant analyst research.

5.7.2. Other long-term earnings forecasts

We also examine the sensitivity of our inferences, regarding the value-relevance of stock recommendations accompanied by LTG forecasts, to inclusion of variables representing analysts' decisions to issue other long-term earnings forecasts. Specifically, we add the variable, $EPSISS^{k}_{ijt}$, indicating whether analyst *j* issued a *k*-year ahead forecast of firm *i*'s EPS at any time during the six-month period ending with an analyst *j* recommendation. $EPSISS^{k}_{ijt}$ is a binary variable that equals 1 for recommendations accompanied or preceded by issuance of a two- (k=2), three- (k=3), four- (k=4), or five-year (k=5) ahead earnings forecast. For our sample, 89.81%, 20.88%, 2.96%, and 1.72% of all recommendations are accompanied or preceded by two-, three-, four-, and five-year ahead earnings forecasts, respectively, where two-year ahead refers to forecasts of earnings for the year following the current year. To examine whether the issuance of other long-term earnings forecasts explains our results, in an untabulated test, we add the $EPSISS^{k}_{ijt}$ main effect, along with the interactions of $EPSISS^{k}_{ijt}$ with ΔREC_{ijt} to equation (1). Including these variables does not change the significance of the coefficient on the test variable, suggesting that publication of LTG forecasts signals an information gathering process distinct from the process underlying other long-term earnings forecasts.

We also examine whether earnings forecast revisions published in the same report as the stock recommendation capture the information signaled by issuance of accompanying LTG forecasts. Among the 33,275 recommendation changes, 37.45%, 36.26%, 6.09%, 1.13%, and 0.72% have simultaneously issued one-, two-, three-, four-, and five-year ahead earnings forecasts, respectively. We add an additional variable indicating whether earnings forecast revisions agree or disagree with the direction of the analyst's simultaneously issued stock recommendation revision. The indicator variable equals one (zero) for upward (downward) earnings forecast revisions issued on the same day as the publication of upward stock recommendation revisions. For the downward stock recommendation revisions, the indicator variable is defined analogously. We interact the indicator variable with ΔREC_{ijt}. After controlling for earnings forecast revisions, the coefficient on $LTGISS_{ijt}*\Delta REC_{ijt}$ is 0.392 (one-tailed p-value < 0.0001), versus 0.402 without these controls. Thus, publication of LTG forecasts appears to signal effective analyst effort and ability with respect to gaining a long-term perspective that adds value to the analyst's stock recommendation beyond the information in the analyst's earnings forecasts over various forecast horizons.

6. Conclusion

Long-term growth (LTG) forecasts are widely used by financial analysts in developing stock recommendations (Bradshaw 2004) and in firm valuation by investors and researchers (Gebhardt et al. 2001). In addition, several empirical models require LTG forecasts to compute the cost of equity capital (Botosan and Plumlee 2005).

Despite the importance of LTG forecasts in accounting and finance, we have very limited knowledge about whether they reflect information that enhances price discovery in capital markets. In fact, prior research documenting incentives-related biases, inaccuracy, and value-irrelevance of analysts' LTG forecasts leaves many readers with the impression that LTG forecasts are irrelevant and should be ignored by astute investors. This impression contradicts the conventional wisdom that analysts expending effort to produce and publish LTG forecasts (or any other statistic) would not survive if the forecasts had no value. To the best of our knowledge, this study makes a first attempt to demonstrate the value added by analysts who expend effort to produce and publish LTG forecasts.

We speculate that publication of LTG forecasts signals effective analyst investment in a process that provides the analyst with a valuable long-term perspective of firms' prospects, and more so in the post-Reg. FD period when analysts have a more level playing field. We document robust results consistent with this conjecture. We find that stock recommendations accompanied by LTG forecasts elicit a stronger market reaction than recommendations unaccompanied by LTG forecasts. In addition, analysts publishing LTG forecasts are less likely to leave the profession or be demoted from large to smaller brokerage houses. Finally, post-Reg. FD observations drive most of our results.

Since we also find no evidence of market under- or overreaction to stock recommendation revisions accompanied by LTG forecasts, we conclude that publication of LTG forecasts plays a meaningful role in promoting price discovery and efficient allocation of resources in capital markets.

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Appendix

Bradshaw (2004) finds that analyst recommendations are largely explained by simple heuristics and relying on these heuristics leads to inferior returns relative to the returns earned by relying on residual income valuation models. Bradshaw's results suggest that superior recommendations emerge from more sophisticated valuation methodologies. To gain more insight into how the issuance of LTG forecasts affects the way analysts formulate their stock recommendations, we examined contextual descriptions used to justify the stock recommendations in a random sample of analyst research reports available from Investext Plus.

This appendix portrays six examples of reports with explicit descriptions of analysts' valuation methodologies, three of which include LTG forecasts and three of which do not. Similar to the reports in this appendix, the larger sample of reports we examined suggest that analysts who do not issue LTG forecasts generally rely on earnings multiples (e.g., price to earnings ratio, price to sales ratio, PEG ratio) to justify their recommendations; whereas analysts issuing LTG forecasts tend to support their stock recommendations with more sophisticated methods of estimating intrinsic equity value (e.g., the earnings-based and discounted free cash flow valuation models). Our analysis of a random sample of research reports is well-represented by the excerpts of six recent analyst reports obtained from Investext Plus and described below.

1. Stock recommendations unaccompanied by LTG forecasts

1.1 Home Depot (NYSE: HD): Justification of valuation is mainly based on P/E multiples.

Rating: BUY **Current Price:** \$26.99 **Price Target**: \$32.00
Date of analysts' report: November 18, 2009
Brokerage house: Jefferies and Company, Inc
Stock analysts: Daniel Binder, CFA, John Marrin, and Justin L. Kantrowitz

Valuation: "Our \$32 price target is based on the shares selling at about 19x our FY11 EPS estimate of \$1.70. HD shares are currently trading at about 16x out-year earnings, which is slightly above the company's 3-year average P/E of approximately 15x. We believe the market will continue to put a richer multiple on depressed earnings, but we need to be sensitive to rising mortgage rates. Our target multiple is predicated on continued improvement in housing prices, better turnover and continued sequential improvements in comp store sales."

1.2 Boston Scientific Corp. (NYSE: BSX): Justification of valuation is mainly based on P/E multiples.
Rating: NEUTRAL **Current Price:** $8.31 **Price Target:** $8.00
Date of analysts' report: November 11, 2009 **Brokerage house:** WEDBUSH
Stock analyst: Phillip Nalbone

Valuation: "We believe BSX is already fully-valued. Our $8 12-month price target represents a multiple of about 13 times our 2010 EPS estimate, which is in line with the group multiple for the large-cap med tech peer group."

1.3 Apple Inc. (Nasdaq: AAPL): Justification of valuation is mainly based on the PEG ratio which incorporates a forecast of the company's one-year ahead EPS growth rate.
Rating: NEUTRAL **Current Price:** $94.0 **One year Price Target**: $106.40
Date of analysts' report: December 8, 2008 **Brokerage house**: ValueEngine
Stock analysts: no information available

Valuation: "Portfolio managers and professionals traditionally rely on market ratios to gauge whether a stock is fair valued or overvalued. On this page, we present such a valuation based on one of three market ratios: PEG (price to trailing 4 quarter earnings ratio, divided by the consensus analyst forecasted next year EPS growth), P/E (price to forward 4 quarter earnings ratio), and P/S ratio (price to trailing 4 quarter sales). Among the three, PEG is the most informative as it reflects both the price/earnings ratio and expected future EPS growth, while P/E is better than P/S."

"To establish a valuation standard, we use both (i) the average historical market ratio of the stock over the past 10 years, and (ii) the average market ratio today of five comparable stocks in the same sector and from companies of similar size. These two alternative perspectives should give you a good idea about where this stock's valuation stands today."

2. Stock recommendations accompanied by LTG forecasts

2.1. Wal-Mart Stores (NYSE: WMT): The analyst reports a five-year EPS growth forecast of 13% on page 1. For valuation, the analyst uses both P/E multiples and a discounted earnings (or dividend) model that employs the LTG forecast.
RATING: BUY **Current price:** $51.28 **Price target**: $65.00
Date of analysts' report: November 6, 2009 **Brokerage house**: ARGUS
Stock Analyst: Chris Graja, CFA,

Valuation: "The current share price is about 14.5-times our FY10 EPS forecast and 13.7-times our FY11 forecast. We believe that the shares are attractively valued at a discount to the S&P 500's multiple of 20-times our earnings forecast for the current fiscal year. WMT's trailing P/E is 14.7, well below the five-year average of 17.5. On a relative basis, WMT's trailing multiple is 0.68 of the S&P's multiple this is well below the five-year median of 1.5-times and very close to the period low of 0.66 that was set in mid-October. The price/sales ratio of 0.5 is below the five-year average of 0.6. Based on a simple discounted earnings model that assumes earnings will grow 13% annually for the next five years and that the shares trade at a terminal multiple of 16, the Wal-Mart shares would be worth $67. Using the Bloomberg dividend discount model, fair value for Wal-Mart would be about $55-$75 per share, with a point estimate of about $65. In our opinion, a key issue is the sustainability of the company's growth and profitability. WMT shares are currently trading at an enterprise value of about 10.25-times trailing EBIT, versus a five-year average of 12.5. We think the current multiple is attractive for a retailer with WMT's market position and financial strength. At about 12.5-times our EBIT forecast for the current fiscal year, the shares would be worth about $66."

2.2. Cisco Systems (Nasdaq: CSCO): The analyst reports a three - five year net income growth forecast of 17% on page 1 and uses a discounted cash flow model to value Cisco's stock.

Rating: OUTPERFORM
Current price (close 11/4/09): $23.29
12-Month Price Target: $28.00
Date of analysts' report: November 5, 2009
Brokerage house: WEDBUSH
Stock analysts: Matthew Robison and Leo Choi

Valuation: The analyst note claims that the price target reflects the calculation of the present value of future cash earnings, including a 3-5 year net income growth forecast of 17% on page 1. The note includes a section describing how to compute the present value (page 8, Exhibit 5). The price target is based on this present value computation.

2.3. Corning Inc. (NYSE: GLW): The analyst reports a five-year EPS growth forecast of 13.00% on page 1. For valuation, the analyst uses both P/E multiples and a discounted cash flow model.

Rating: BUY
Current price (close 10/23/09): $15.65
12-Month Price Target: $22.00
Date of analysts' report: October 27, 2009
Brokerage house: Argus
Stock analysts: Jim Kelleher

Valuation: "GLW is trading at 11.7-times our 2009 pro forma EPS estimate and at 10.4 times our 2010 forecast, below the five-year average P/E of 18.6 for 2004-2008 and the average of 31.2 for 2003-2007. After a period of heavy investment spending on glass capacity, Corning is curtailing capital spending for 3-5 years. Given the reduction in capex, valuation based on discounted free cash flow valuation is increasingly attractive. Our discounted free cash flow model renders a value for GLW in the mid $40s. As investors recognize the company's financial strength and prospects for a recovery in global demand for LCD TVs, we expect GLW to outperform the market. Our 12-month target price on GLW is $22. On October 27 at midday, BUY-rated GLW traded at $15.10, down $0.42."

Table 1
Descriptive statistics for variables used in testing H1

Panel A: Descriptive statistics of the variables used in tests of H1

	$LTGISS_{ijt}$=1					$LTGISS_{ijt}$=0					Total sample
Variable	**N**	**Mean**	**Q1**	**Median**	**Q3**	**N**	**Mean**	**Q1**	**Median**	**Q3**	**N**
By recommendation											
REC_{ijt}	9307	3.784 [a]	3.000	4.000 [a]	5.000	23968	3.745	3.000	4.000	5.000	33275
ΔREC_{ijt}	9307	-0.128	-1.000	-1.000	1.000	23968	-0.133	-1.000	-1.000	2.000	33275
CAR_{ijt}	9307	-0.006	-0.038	-0.002	0.034	23968	-0.006	-0.036	-0.002	0.033	33275
$CFISS_{ijt}$	9307	0.099 [a]	0.000	0.000 [a]	0.000	23968	0.125	0.000	0.000	0.000	33275
By analyst-year											
$FIRM\#_{jt}$	4267	15.477 [a]	11.000	14.000 [a]	18.000	8401	16.039	11.000	15.000	19.000	12668
$IND\#_{jt}$	4267	3.762 [b]	2.000	3.000	5.000	8401	3.875	2.000	3.000	5.000	12668
$BSIZE_{jt}$	4267	71.161 [a]	23.000	47.000 [a]	91.000	8401	66.013	20.000	43.000	86.000	12668
By firm-year											
MB_{it}	4048	5.040	1.765	2.771 [a]	4.485	6299	4.924	1.653	2.618	4.248	10347
$ALTMANZ_{it}$	4048	6.258 [b]	2.426	4.264 [a]	7.155	6299	5.799	2.175	3.854	6.773	10347
$LOSS_{it}$	4048	0.195 [a]	0.000	0.000 [a]	0.000	6299	0.221	0.000	0.000	0.000	10347
AGE_{it}	4048	15.546	5.000	10.000	21.000	6299	15.634	5.000	10.000	21.000	10347
$lnMV_{it}$	4048	7.477 [a]	6.346	7.383 [a]	8.545	6299	7.317	6.195	7.257	8.364	10347
$\%INST_{it}$	4048	61.628 [b]	47.432	64.112 [b]	78.269	6299	60.596	45.683	63.284	77.630	10347
By analyst-firm-year											
$FIRM\_EXP_{ijt}$	6944	3.461 [b]	1.000	2.000 [a]	5.000	17217	3.584	1.000	2.000	5.000	24161
$EPS\_ACCUR_{ij,t-1}$	6944	0.564	0.000	0.667	1.000	17217	0.561	0.000	0.667	1.000	24161
EPS_FREQ_{ijt}	6944	4.850	3.000	5.000	6.000	17217	4.837	3.000	5.000	6.000	24161

Table 1 (Continued)

Panel B: Pearson correlation (lower half) and Spearman correlation (upper half) among variables used in tests of H1 (N = 33,275)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
LTGISS(1)	1	0.001	0.016	-0.000	-0.036	-0.083	-0.030	0.026	-0.025	0.005	0.001	0.050	0.079	-0.038	-0.022	0.020	0.005
ΔREC(2)	0.002	1	0.734	0.372	0.006	0.001	-0.005	-0.012	0.025	-0.010	0.001	0.073	0.047	-0.051	0.029	0.071	0.005
REC(3)	0.018	-0.728	1	-0.270	-0.042	0.000	0.036	-0.044	-0.026	0.011	-0.023	0.001	0.034	-0.016	-0.068	-0.054	-0.033
CAR_1(4)	0.001	0.317	-0.219	1	0.003	-0.010	-0.002	0.000	0.019	0.001	-0.005	0.069	0.051	-0.062	0.026	0.068	0.009
CFISS(5)	-0.036	0.006	-0.041	0.015	1	0.044	-0.094	0.154	0.062	0.006	0.155	-0.052	-0.127	-0.027	0.076	0.077	0.093
FIRM#(6)	-0.080	0.006	-0.003	0.002	0.014	1	0.407	0.058	0.236	-0.009	0.044	-0.041	-0.079	-0.042	0.072	-0.003	-0.007
IND#(7)	-0.045	-0.003	0.027	0.010	-0.098	0.521	1	-0.194	0.087	-0.019	-0.056	-0.075	0.018	-0.115	0.038	-0.133	0.000
BSIZE(8)	0.012	-0.024	-0.028	-0.010	0.275	-0.030	-0.168	1	0.093	0.037	0.074	-0.001	-0.071	0.013	0.036	0.136	0.056
FIRM_ EXP(9)	-0.018	0.020	-0.020	0.023	0.061	0.197	0.086	0.068	1	0.015	0.009	0.005	-0.069	-0.100	0.364	0.228	0.043
EPS_ ACCUR(10)	0.004	-0.008	0.006	-0.001	0.018	-0.030	-0.043	0.033	0.022	1	0.023	0.007	0.006	-0.011	0.009	0.020	0.002
EPS_FREQ (11)	0.001	0.004	-0.023	-0.003	0.187	-0.003	-0.088	0.066	0.017	0.041	1	-0.093	-0.051	0.032	0.056	0.038	0.107
MB(12)	-0.002	0.013	-0.008	0.020	0.000	0.000	-0.001	-0.002	0.001	-0.004	-0.008	1	0.532	-0.239	0.062	0.453	-0.005
ALTMANZ (13)	0.038	0.038	0.028	0.050	-0.075	-0.050	-0.013	-0.042	-0.073	-0.004	-0.041	0.017	1	-0.349	-0.047	0.181	0.042
LOSS(14)	-0.038	-0.053	-0.024	-0.075	-0.027	-0.031	-0.101	0.026	-0.095	-0.009	0.016	0.018	-0.177	1	-0.193	-0.290	-0.072
AGE(15)	-0.023	0.022	-0.051	0.025	0.059	0.099	0.054	0.045	0.381	0.019	0.040	0.015	-0.103	-0.156	1	0.451	0.060
lnMV(16)	0.023	0.076	-0.047	0.083	0.069	0.007	-0.115	0.107	0.250	0.051	0.051	0.007	0.169	-0.292	0.417	1	0.097
%INST(17)	0.006	0.005	-0.028	0.002	0.071	-0.051	-0.038	0.057	0.002	0.009	0.097	0.003	0.005	-0.070	-0.066	0.083	1

Table 1 (Continued)

Panel A of this table compares analyst and firm characteristics in the two categories of our sample observations: stock recommendation revisions accompanied by LTG forecasts and stock recommendation revisions unaccompanied by LTG forecasts. Panel B contains coefficients of correlation among the variables. In Panel A, [a], [b], and [c] indicate that the mean and median differences between the two groups, categorized based on the availability of a LTG forecast, is significant at 0.01, 0.05, and 0.10 levels (two-tailed), respectively. In Panel B, to indicate the Pearson or Spearman correlation that is significant at 0.01, 0.05, and 0.10 levels (two-tailed), we use bold italicized, bold unitalicized, and unbold italicized numbers respectively. The unbold unitalicized numbers are insignificant.

Definition of variables (Compustat labels, where applicable, in parentheses):

At the analyst-firm-recommendation level:

$LTGISS_{ijt}$ = 1 if analyst *j* issues a LTG forecast for firm *i* during the half-year ending on the day of the analyst's recommendation revision, and 0 otherwise.

CAR_{ijt} = cumulative abnormal stock return over the three trading days beginning on the date of analyst *j*'s stock recommendation revision for firm *i* in year *t*. We calculate CAR by subtracting the value-weighted market return from the firm's raw stock return.

REC_{ijt} = the level of the recommendation issued by analyst *j* for firm *i* in year *t*. The corresponding cardinal values for recommendations of "Sell," "Underperform," "Hold," "Buy", and "Strong buy" are 1 to 5, respectively.

ΔREC_{ijt} = the change in cardinal recommendation measures, assigned numeric values between −4 and +4, depending on the difference between the cardinal measure attached to the current recommendation and the cardinal measure attached to the previous recommendation for analyst *j* following firm *i*. For example, a downgrade from "Buy" to "Underperform" receives a value of −2 (= 2 − 4).

$CFISS_{ijt}$ = 1 if analyst *j* issues a cash flow forecast for firm *i* during the half-year ending on the day of the analyst's recommendation revision, and 0 otherwise..

$FIRM\_EXP_{ijt}$ = number of years analyst *j* issued one or more firm *i* annual earnings forecasts.

$EPS\_ACCUR_{ij,t-1}$ = absolute value of the difference between year *t*−1 earnings and analyst *j*'s most recent forecast of those earnings. It is a scaled to fall between 0 and 1 with smaller absolute forecast errors corresponding to more accurate forecasts. The scaling procedure subtracts the absolute difference from the similarly computed maximum absolute forecast error for all analysts following firm *i* in year *t*−1 and divides the result by the range of all absolute errors in forecasts of firm *i*'s year *t*−1 earnings. See equation (3) in the text.

EPS_FREQ_{ijt} = analyst *j*'s annual earnings forecast frequency for firm *i* in year *t*.

At the analyst-year level:

$FIRM\#_{jt}$ = number of firms analyst *j* follows in year *t*.

$IND\#_{jt}$ = number of industries analyst *j* follows in year *t*.

$BSIZE_{jt}$ = number of analysts employed by analyst *j*'s brokerage house in year *t*.

At the firm-year level:

MB_{it} = firm *i*'s market to book ratio at the end of fiscal year *t* (= PRCC_F*CSHO / CEQ).

$ALTMANZ_{it}$ = Altman's (1968) Z-score, measured as [1.2*net working capital / total assets (= WCAP / AT) + 1.4*retained earnings / total assets (= RE / AT) + 3.3*earnings before interest and taxes / total assets (= PI / AT) + 0.6*market value of equity / book value of liabilities (= PRCC_F*CSHO /LT) + 1.0*sales / total assets (= SALE /AT)].

$LOSS_{it}$ = 1 for firms with a net loss in year *t*, and 0 otherwise (= IB).

AGE_{it} = the number of years firm *i* has been publicly traded, per CRSP files.

$lnMV_{it}$ = the natural log of firm *i*'s market value at the end of year *t* (= PRCC_F*CSHO).

$\%INST_{it}$ = percent of firm *i*'s common shares held by institutional investors in year *t*. We use the average of four quarterly amounts reported by institutional managers.

Table 2
Contemporaneous stock market reaction to recommendation revisions (H1)

Variable	Coefficient*100	*t*-value	*p*-value
INTERCEPT	-0.529	-1.48	0.139
$LTGISS_{ijt}$	0.096	0.88	0.380
ΔREC_{ijt}	1.478	11.09	<.0001
$\Delta REC_{ijt} \cdot LTGISS_{ijt}$	**0.402**	**5.46**	**<.0001**
$\Delta REC_{ijt} \cdot CFISS_{ijt}$	-0.342	-3.32	0.001
$\Delta REC_{ijt} \cdot R\_FIRM\#_{jt}$	0.493	5.04	<.0001
$\Delta REC_{ijt} \cdot R\_IND\#_{jt}$	-0.221	-2.45	0.014
$\Delta REC_{ijt} \cdot R\_BSIZE_{jt}$	0.791	8.93	<.0001
$\Delta REC_{ijt} \cdot R\_FIRM\_EXP_{ijt}$	0.171	2.05	0.040
$\Delta REC_{ijt} \cdot R\_EPS\_ACCUR_{ij,t-1}$	0.075	0.98	0.325
$\Delta REC_{ijt} \cdot R\_EPS\_FREQ_{ijt}$	0.507	6.00	<.0001
$\Delta REC_{ijt} \cdot R\_MB_{it}$	-0.161	-1.74	0.081
$\Delta REC_{ijt} \cdot R\_ALTMANZ_{it}$	0.074	0.82	0.415
$\Delta REC_{ijt} \cdot R\_LOSS_{it}$	1.069	12.48	<.0001
$\Delta REC_{ijt} \cdot R\_AGE_{it}$	-0.084	-0.97	0.331
$\Delta REC_{ijt} \cdot R\_lnMV_{it}$	-0.866	-8.97	<.0001
$\Delta REC_{ijt} \cdot R\_\%INST_{it}$	-0.066	-0.76	0.446
$CFISS_{ijt}$	0.055	0.32	0.746
$R\_FIRM\#_{jt}$	-0.341	-2.35	0.019
$R\_IND\#_{jt}$	0.139	1.04	0.298
R_BSIZE_{jt}	0.136	1.06	0.290
$R\_FIRM\_EXP_{ijt}$	0.063	0.51	0.610
$R\_EPS\_ACCUR_{ij,t-1}$	0.019	0.17	0.865
$R\_EPS\_FREQ_{ijt}$	0.037	0.30	0.767
R_MB_{it}	0.423	3.10	0.002
$R\_ALTMANZ_{it}$	0.008	0.06	0.955
$LOSS_{it}$	-0.798	-5.97	<.0001
R_AGE_{it}	-0.255	-1.99	0.046
R_lnMV_{it}	0.467	3.26	0.001
$R\_\%INST_{it}$	0.029	0.23	0.820
Industry Fixed Effects			YES
Year Fixed Effects			YES
N			33,275
Adj. R-Squared			12.42%

Table 2 (Continued)

Table 2 examines whether stock recommendation revisions accompanied by LTG forecasts are more value relevant than recommendation revisions unaccompanied by LTG forecasts in terms of the stock market reaction to recommendation revisions. This table contains the result of estimating the following regression:

$$
\begin{aligned}
CAR_{ijt} = {} & \alpha_0 + \alpha_1 LTGISS_{ijt} + \alpha_2 \Delta REC_{ijt} + \alpha_3 \Delta REC_{ijt}{*}LTGISS_{ijt} + \alpha_4 \Delta REC_{ijt}{*}CFISS_{ijt} \\
& + \sum_{k=5}^{10} (\alpha_k\ \Delta REC_{ijt}{*}R\_ANALYST\ CHARACTERISTIC_k) + \\
& \sum_{k=11}^{16} (\alpha_k\ {*}\Delta REC_{ijt}{*}R\_FIRM\ CHARACTERISTIC_k) + \alpha_{17} CFISS_{ijt} + \\
& \sum_{k=18}^{23} (\alpha_k\ {*}R\_ANALYST\ CHARACTERISTIC_k) + \sum_{k=24}^{29} (\alpha_k\ {*}R\_FIRM\ CHARACTERISTIC_k) \\
& + \text{Industry effects} + \text{Year effects} + \varepsilon_{ijt} \qquad (1)
\end{aligned}
$$

The dependent variable CAR_{ijt} and independent variables ΔREC_{ijt}, $LTGISS_{ijt}$, and $CFISS_{ijt}$ are as described in Table 1.

R_ANALYST CHARACTERISTIC refers to six variables that control for analyst characteristics: $FIRM\_EXP_{ijt}$, $EPS\_ACCUR_{ij,t-1}$, EPS_FREQ_{ijt}, $FIRM\#_{jt}$, $IND\#_{jt}$, $BSIZE_{jt}$. These variables are as defined in Table 1. In this table, they are scaled to fall between 0 and 1 among analysts within the same firm-year. R_FIRM#, R_IND, R_BSIZE, R_FIRM_EXP, and R_EPS_FREQ are transformed measures of FIRM#, IND, BSIZE, FIRM_EXP, and EPS_FREQ in accordance with equation (2) in the text and R_EPS_ACCUR is transformed from EPS_ACCUR in accordance with equation (3) in the text.

R_FIRM CHARACTERISTIC refers to six variables that control for the following firm characteristics: MB_{it}, $ALTMANZ_{it}$, $LOSS_{it}$, AGE_{it}, $lnMV_{it}$, $\%INST_{it}$, These six variables are as defined in Table 1. In this table, all of them, except the $LOSS_{it}$ indicator variable, are transformed to fall between 0 and 1 among firms followed by the same analyst during the same year and denoted as R_MB_{it}, $R\_ALTMANZ_{it}$, R_AGE_{it}, R_lnMV_{it}, and $R\_\%INST_{it}$, respectively. The transformation follows equation (2) in the text.

Table 3
Descriptive statistics for variables used in testing H2a through H2c

Panel A: Descriptive statistics of the variables used in tests of H2a through H2c

	Analyst-years with LTG forecast publication ($LTGISS_{jt}$=1)					Analyst-years without LTG forecast publication ($LTGISS_{jt}$=0)				
Variable	N	Mean	Q1	Median	Q3	N	Mean	Q1	Median	Q3
$Termination_{t+1}$	14240	0.104 [a]	0.000	0.000 [a]	0.000	8438	0.115	0.000	0.000	0.000
$Demotion_{t+1}$	5751	0.065 [a]	0.000	0.000 [a]	0.000	2492	0.095	0.000	0.000	0.000
$Promotion_{t+1}$	3166	0.116 [a]	0.000	0.000 [a]	0.000	3005	0.092	0.000	0.000	0.000
EPS_ACCUR_{jt}	14240	0.681 [a]	0.600	0.697 [a]	0.784	8438	0.655	0.566	0.673	0.771
$BOLD_{jt}$	14240	0.330 [a]	0.240	0.317 [a]	0.403	8438	0.355	0.252	0.337	0.437
$LNEXP_{jt}$	14240	1.553 [a]	1.099	1.609 [a]	2.303	8438	1.406	0.693	1.386	2.079
$LN\#FIRM_{jt}$	14240	2.235 [a]	1.946	2.303 [a]	2.565	8438	2.151	1.792	2.197	2.565
$LN\#ANALYST_{jt}$	14240	2.680 [a]	2.410	2.716	2.993	8438	2.650	2.332	2.719	3.034

Panel B: Pearson correlation (in the lower half) and Spearman correlation (in the upper half) among variables used in tests of H2a through H2c

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$Termination_{t+1}$(1)	1.000	-	-	***-0.017***	-0.001	**0.014**	*-0.013*	***-0.046***	-0.005
$Demotion_{t+1}$(2)	-	1.000	-	***-0.050***	-0.016	***0.054***	0.006	***-0.047***	***-0.029***
$Promotion_{t+1}$(3)	-	-	1.000	***0.048***	***0.035***	-0.012	***-0.039***	-0.011	***0.052***
$LTGISS_{jt}$(4)	***-0.017***	***-0.050***	***0.048***	1.000	***0.070***	***-0.075***	***0.085***	***0.064***	0.005
EPS_ACCUR_{jt}(5)	-0.005	*-0.019*	**0.033**	***0.075***	1.000	***-0.125***	-0.005	0.002	***0.245***
$BOLD_{jt}$(6)	***0.018***	***0.071***	-0.003	***-0.084***	***-0.122***	1.000	*-0.012*	***0.035***	***-0.262***
$LNEXP_{jt}$(7)	*-0.013*	0.005	***-0.040***	***0.083***	***0.031***	***-0.026***	1.000	***0.165***	***0.046***
$LN\#FIRM_{jt}$(8)	***-0.053***	***-0.049***	-0.017	***0.070***	***0.034***	***-0.019***	***0.163***	1.000	-0.002
$LN\#ANALYST_{jt}$(9)	*-0.012*	***-0.036***	***0.056***	***0.030***	***0.241***	***-0.268***	***0.061***	***0.024***	1.000

Table 3 (Continued)

Panel A of this table compares analyst characteristics in the two categories of analyst-year observations: those that have LTG forecasts and those that do not. Panel B presents the correlation among these variables. In Panel A, [a], [b], and [c] indicate that the mean and median differences between the two groups categorized based on the availability of a LTG forecast is significant at 0.01, 0.05, and 0.10 levels (two-tailed), respectively. In Panel B, to indicate the Pearson or Spearman correlation that is significant at 0.01, 0.05, and 0.10 levels (two-tailed), we use bold italicized, bold unitalicized, *and* unbold italicized numbers respectively. The unbold unitalicized numbers are insignificant.

$TERMINATION_{j,t+1}$ = 1 if year *t* is the last year any of analyst *j*'s forecasts and recommendations appear on the I/B/E/S database, and 0 otherwise.

$DEMOTION_{j,t+1}$ (**$PROMOTION_{j,t+1}$**) = 1 if analyst *j* works for a large (small) brokerage house in year *t* and works for a small (large) brokerage house in year *t*+1, and 0 otherwise. A large (small) brokerage house employs more than 25 (25 or fewer) analysts. When $DEMOTION_{j,t+1}$ ($PROMOTION_{j,t+1}$) is the dependent variable, we eliminate observations where analysts work for small (large) brokerage houses in year *t* because they cannot be demoted (promoted) by definition. We also eliminate observations where analysts are demoted (promoted) in year *t*+2 because it is ambiguous whether the demotion is associated with year *t* activity.

$LTGISS_{jt}$ = 1 if analyst *j* issues a LTG forecast for any firm during year *t*, and 0 otherwise.

EPS_ACCUR_{jt} = the average of $R\_EPS\_ACCUR_{ijt}$ across all firms followed by analyst j in year t. $R\_EPS\_ACCUR_{ijt}$ is measured according to equation (3) in the text for the last annual earnings forecast issued prior to the announcement of year *t* earnings.

$BOLD_{jt}$ = the average boldness rank of analyst *j*'s first annual earnings forecast for all firms followed in year *t*. Boldness equals the absolute deviation between analyst *j*'s first forecast of firm *i*'s annual earnings since the firm's most recent annual earnings announcement and the mean of all other analysts' earliest earnings forecasts for the same firm and year. We, then, use equation (2) in the text to rank analyst j's boldness relative to the average boldness of all analysts following the same firm in year *t*. The ranks are then averaged across all firms followed by analyst *j* in year t.

$LNEXP_{jt}$ = the natural log of the number of years since analyst j's first I/B/E/S forecast.

$LN\#FIRM_{jt}$ = the natural log of the number of firms followed by analyst *j* in year *t*.

$LN\#ANALYST_{jt}$ = the natural log of the average number of analysts following the firms covered by analyst *j* in year *t*.

Table 4
The effect of LTG forecast publication on subsequent career outcomes (H2a through H2c)

	Panel A: Termination			Panel B: Demotion			Panel C: Promotion		
	Coef.	Chi-Sq.	p-value	Coef.	Chi-Sq.	p-value	Coef.	Chi-Sq.	p-value
$LTGISS_{jt}$	**-0.174**	**7.12**	**0.008**	**-0.292**	**2.89**	**0.089**	**0.286**	**1.72**	**0.190**
EPS_ACCUR_{jt}	0.016	0.01	0.915	-0.620	2.51	0.113	0.139	0.09	0.763
$BOLD_{jt}$	0.131	0.56	0.456	1.150	7.37	0.007	0.205	0.12	0.728
$LNEXP_{jt}$	0.044	2.26	0.133	0.156	4.10	0.043	-0.242	6.17	0.013
$LN\#FIRM_{jt}$	-0.308	44.02	<.0001	-0.631	30.63	<.0001	-0.105	0.37	0.540
$LN\#ANALYST_{jt}$	-0.043	0.50	0.480	-0.106	0.45	0.502	0.350	2.75	0.098
Brokerage house fixed effects			YES			YES			YES
Year fixed effects			YES			YES			YES
N (number of analyst-years)			22,678			8,243			5,417
Max-rescaled R-Squared			0.25%			3.84%			2.03%

This table tests whether publishing LTG forecasts affects an analyst's subsequent career path. The following model is used:

Probability ($TERMINATION_{j,t+1}$, or $DEMOTION_{j,t+1}$, or $PROMOTION_{j,t+1}$) =

$$\beta_0 + \beta_1 LTGISS_{jt} + \beta_2 EPS\_ACCUR_{jt} + \beta_3 BOLD_{jt} + \beta_4 LNEXP_{jt} + \beta_5 LN\#FIRM_{jt} + \beta_6 LN\#ANALYST_{jt} + \text{Brokerage house effects} + \text{Year effects} + \varepsilon_{jt} \quad (4)$$

All variables are as defined in Table 3.

Table 5
Contemporaneous stock market reaction to recommendation revisions in pre- and post-Regulation FD periods (H3a)

	Pre-Regulation FD			Post-Regulation FD		
Variable	**Coefficient*100**	***t*-value**	***p*-value**	**Coefficient*100**	***t*-value**	***p*-value**
INTERCEPT	-0.356	-0.82	0.415	-1.307	-3.61	0.000
$LTGISS_{ijt}$	0.171	1.07	0.284	0.058	0.39	0.696
ΔREC_{ijt}	0.828	4.21	<.0001	1.859	10.32	<.0001
ΔREC_{ijt}·$LTGISS_{ijt}$	**0.261**	**2.36**	**0.018**	**0.470**	**4.78**	**<.0001**
ΔREC_{ijt}·$CFISS_{ijt}$	-0.533	-2.25	0.025	-0.526	-4.32	<.0001
ΔREC_{ijt}·$R\_FIRM\#_{jt}$	0.395	2.77	0.006	0.594	4.46	<.0001
ΔREC_{ijt}·$R\_IND\#_{jt}$	-0.156	-1.15	0.251	-0.219	-1.83	0.067
ΔREC_{ijt}·R_BSIZE_{jt}	1.359	10.36	<.0001	0.562	4.68	<.0001
ΔREC_{ijt}·$R\_FIRM\_EXP_{ijt}$	-0.045	-0.37	0.709	0.432	3.81	0.000
ΔREC_{ijt}·$R\_EPS\_ACCUR_{ij,t-1}$	0.109	0.96	0.339	0.046	0.45	0.653
ΔREC_{ijt}·$R\_EPS\_FREQ_{ijt}$	0.540	4.40	<.0001	0.429	3.70	0.000
ΔREC_{ijt}·R_MB_{it}	-0.003	-0.02	0.982	-0.270	-2.24	0.025
ΔREC_{ijt}·$R\_ALTMANZ_{it}$	-0.080	-0.58	0.563	0.082	0.68	0.499
ΔREC_{ijt}·R_LOSS_{it}	0.678	5.12	<.0001	1.202	10.65	<.0001
ΔREC_{ijt}·R_AGE_{it}	-0.011	-0.08	0.935	-0.103	-0.89	0.372
ΔREC_{ijt}·R_lnMV_{it}	-0.642	-4.26	<.0001	-0.926	-7.32	<.0001
ΔREC_{ijt}·$R\_\%INST_{it}$	-0.059	-0.45	0.650	-0.103	-0.88	0.377
$CFISS_{ijt}$	0.292	0.78	0.438	-0.122	-0.62	0.538
$R\_FIRM\#_{jt}$	-0.358	-1.72	0.086	-0.312	-1.57	0.117
$R\_IND\#_{jt}$	0.156	0.79	0.428	0.109	0.61	0.543
R_BSIZE_{jt}	-0.072	-0.39	0.694	0.290	1.63	0.102
$R\_FIRM\_EXP_{ijt}$	0.051	0.29	0.774	0.173	1.03	0.305
$R\_EPS\_ACCUR_{ij,t-1}$	0.098	0.59	0.553	0.001	0.00	0.997
$R\_EPS\_FREQ_{ijt}$	-0.146	-0.83	0.408	0.166	0.96	0.338
R_MB_{it}	0.248	1.19	0.235	0.554	3.07	0.002
$R\_ALTMANZ_{it}$	0.124	0.62	0.536	-0.049	-0.27	0.790
$LOSS_{it}$	-0.847	-4.18	<.0001	-0.799	-4.43	<.0001
R_AGE_{it}	0.028	0.15	0.882	-0.418	-2.40	0.016
R_lnMV_{it}	0.484	2.21	0.027	0.514	2.70	0.007
$R\_\%INST_{it}$	-0.288	-1.51	0.130	0.247	1.41	0.157
Industry Fixed Effects			YES			YES
Year Fixed Effects			YES			YES
N			13,752			19,523
Adj. R-Squared			9.21%			15.30%

This table estimates equation (1) below separately for pre- and post- Regulation FD periods. All variables are defined in previous tables.

$$CAR_{1ijt} = \alpha_0 + \alpha_1 LTGISS_{ijt} + \alpha_2 \Delta REC_{ijt} + \alpha_3 \Delta REC_{ijt} * LTGISS_{ijt} + \alpha_4 \Delta REC_{ijt} * CFISS_{ijt} + \sum_{k=5}^{10} (\alpha_k * \Delta REC_{ijt} * R\_ANALYST\ CHARACTERISTIC_k) + \sum_{k=11}^{16} (\alpha_k * \Delta REC_{ijt} * R\_FIRM\ CHARACTERISTIC_k) + \alpha_{17} CFISS_{ijt} + \sum_{k=18}^{23} (\alpha_k * R\_ANALYST\ CHARACTERISTIC_k) + \sum_{k=24}^{29} (\alpha_k * R\_FIRM\ CHARACTERISTIC_k) + \text{Industry effects} + \text{Year effects} + \varepsilon_{ijt} \quad (1)$$

Table 6
The effect of LTG forecast publication on subsequent career outcomes in pre and post- Regulation FD periods (H3b)

	Pre- Regulation FD								
	Panel A.1: Termination			Panel A.2: Demotion			Panel A.3: Promotion		
	Coef.	Chi-Sq.	p-value	Coef.	Chi-Sq.	p-value	Coef.	Chi-Sq.	p-value
$LTGISS_{jt}$	**-0.138**	**1.77**	**0.183**	**0.130**	**0.25**	**0.614**	**0.536**	**3.33**	**0.068**
EPS_ACCUR_{jt}	-0.118	0.27	0.605	-0.880	2.33	0.127	0.725	1.35	0.245
$BOLD_{jt}$	0.099	0.14	0.705	1.286	4.25	0.039	0.044	0.00	0.953
$LNEXP_{jt}$	-0.011	0.06	0.812	0.212	3.81	0.051	-0.217	2.95	0.086
$LN\#FIRM_{jt}$	-0.385	31.25	<.0001	-0.741	22.51	<.0001	-0.189	0.81	0.369
$LN\#ANALYST_{jt}$	-0.116	1.57	0.211	-0.040	0.03	0.856	0.533	3.68	0.055
Brokerage house fixed effects			YES			YES			YES
Year fixed effects			YES			YES			YES
N			10,878			4,631			2,707
Max-rescaled R-Squared			1.23%			4.89%			4.32%

	Post- Regulation FD								
	Panel B.1: Termination			Panel B.2: Demotion			Panel B.3: Promotion		
	Coef.	Chi-Sq.	p-value	Coef.	Chi-Sq.	p-value	Coef.	Chi-Sq.	p-value
$LTGISS_{jt}$	**-0.202**	**5.75**	**0.017**	**-0.625**	**6.99**	**0.008**	**-0.097**	**0.08**	**0.778**
EPS_ACCUR_{jt}	0.100	0.25	0.614	-0.404	0.55	0.460	-0.790	1.23	0.267
$BOLD_{jt}$	0.130	0.29	0.590	1.068	3.19	0.074	0.502	0.25	0.616
$LNEXP_{jt}$	0.088	5.03	0.025	0.133	1.43	0.231	-0.331	4.10	0.043
$LN\#FIRM_{jt}$	-0.234	13.39	0.000	-0.511	8.79	0.003	0.003	0.00	0.993
$LN\#ANALYST_{jt}$	0.040	0.24	0.621	-0.194	0.70	0.402	0.008	0.00	0.982
Brokerage house fixed effects			YES			YES			YES
Year fixed effects			YES			YES			YES
N			11,800			3,612			2,710
Max-rescaled R-Squared			0.58%			3.70%			2.17%

This table estimates equation (4) below separately for pre- and post- Regulation FD periods. All variables are defined in previous tables.

$$\text{Probability } (TERMINATION_{j,t+1}, \text{ or } DEMOTION_{j,t+1}, \text{ or } PROMOTION_{j,t+1}) = \beta_0 + \beta_1 LTGISS_{jt} + \beta_2 EPS\_ACCUR_{jt} + \beta_3 BOLD_{jt} + \beta_4 LNEXP_{jt} + \beta_5 LN\#FIRM_{jt} + \beta_6 LN\#ANALYST_{jt} + \text{Brokerage house effects} + \text{Year effects} + \varepsilon_{jt} \quad (4)$$

Table 7
Contemporaneous stock market reaction to recommendation levels

Variable	Coefficient*100	*t*-value	*p*-value
INTERCEPT	0.419	1.32	0.188
$LTGISS_{ijt}$	**0.394**	**4.16**	**<.0001**
$CFISS_{ijt}$	-0.235	-1.56	0.119
$R\_FIRM\#_{jt}$	0.299	2.31	0.021
$R\_IND\#_{jt}$	-0.055	-0.46	0.646
R_BSIZE_{jt}	0.381	3.35	0.001
$R\_FIRM\_EXP_{ijt}$	0.389	3.56	0.000
$R\_EPS\_ACCUR_{ij,t-1}$	0.044	0.44	0.660
$R\_EPS\_FREQ_{ijt}$	0.269	2.42	0.016
R_MB_{it}	-0.047	-0.39	0.699
$R\_ALTMANZ_{it}$	0.203	1.66	0.096
$LOSS_{it}$	0.536	4.60	<.0001
R_AGE_{it}	0.054	0.46	0.643
R_lnMV_{it}	-0.785	-6.05	<.0001
$R\_\%INST_{it}$	-0.159	-1.36	0.173
Industry Fixed Effects			YES
Year Fixed Effects			YES
N (number of recommendations)			42,215
Adj. R-Squared			1.00%

This table examines whether stock recommendations accompanied by LTG forecasts are more value relevant than recommendations unaccompanied by LTG forecasts in terms of the stock market reaction to the level of recommendations. This table shows result of estimating the following regression:

$$CAR'_{ijt} = \beta_0 + \beta_1 LTGISS_{ijt} + \beta_2 CFISS_{ijt} + \sum_{k=3}^{8}(\beta_i \text{ *R\_ANALYST CHARACTERISTIC}_k) +$$

$$\sum_{k=9}^{14}(\beta_i \text{ * R\_FIRM CHARACTERISTIC}_k) + \text{Industry effects} + \text{Year effects} + \varepsilon_{ijt} \quad (5)$$

Dependent variable: CAR'_{ijt} = cumulative abnormal stock return over the three trading days beginning with the day on which analyst *j* issues a stock recommendation for firm *i* in year *t*. We calculate CAR′ by subtracting the value-weighted market return from the firm's raw stock return. For "Hold," "Sell," or "Strong Sell" recommendations, we take the negative of the cumulative market-adjusted returns.

Independent variable of interest $LTGISS_{ijt}$ and **control variables** for analyst characteristics and firm characteristics are as defined in Tables 1 and 2.

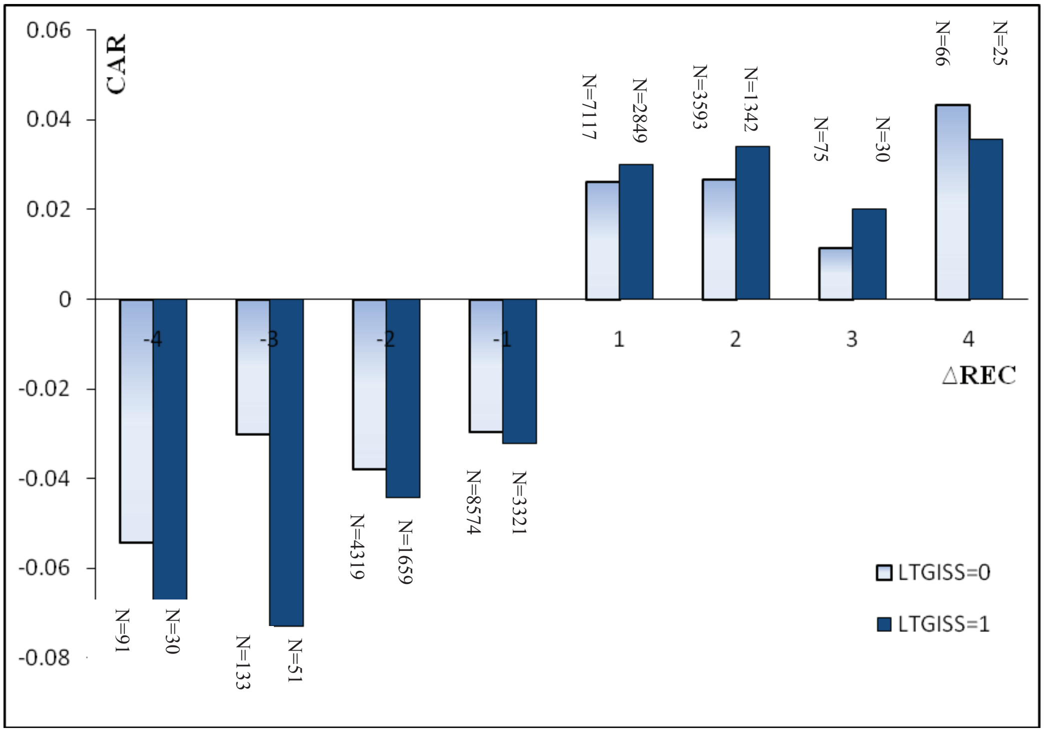

Figure. 1. Abnormal 3-day stock market returns around recommendation changes with and without LTG forecasts
CAR, LTGISS, and ∆REC are defined in Table 1.

REDACTED VERSION

[redacted]

REDACTED VERSION

[redacted]

REDACTED VERSION

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PENNSYLVANIA PUBLIC UTILITY COMMISSION

Public Meeting held January 17, 2018

Docket Number: M-2018-3006643

BUREAU OF TECHNICAL UTILITY SERVICES

REPORT ON THE QUARTERLY EARNINGS

OF JURISDICTIONAL UTILITIES

FOR THE YEAR ENDED

September 30, 2018

TABLE OF CONTENTS

Introduction:

On September 20, 1991, the Commission initiated a rulemaking at L-00910061 pertaining to earnings disclosures by the public utilities subject to its jurisdiction. At that docket, the Commission stated that the submission of accurate, reliable and complete earnings disclosure reports, at regular intervals, is essential to the fulfillment of the broad regulatory oversight responsibilities entrusted to the Commission by the Legislature in the Public Utility Code. The earnings disclosure regulations promulgated by the Commission were adopted October 1, 1992, and published January 23, 1993, at 23 Pa.B. 463. Based upon those regulations, codified at 52 Pa. Code, Chapter 71, a reporting format was developed and distributed to the jurisdictional fixed utilities of Pennsylvania.

All fixed utilities having jurisdictional revenues of $1,000,000 or more, for a calendar year, are required to file the report by March 31 of each year. Such reports are to be based upon the results of operations for the 12-month period ending December 31 of the prior year. Utilities having more than $10,000,000 in jurisdictional revenues are also required to file reports for the 12 months ending on March 31, June 30, and September 30 of each year. On November 30, 2004, however, the Pennsylvania General Assembly signed into law Act 183 concerning alternative telecommunications regulation and broadband deployment. As a result of Act 183, the reporting requirements for the PUC jurisdictional telecommunications companies of Pennsylvania have been streamlined at section 3015(e) of the Public Utility Code. A quarterly earnings report is not listed among those reports now required of PUC jurisdictional telecommunications utilities in Pennsylvania and, therefore, this report does not address telephone company earnings.

The reports have been filed for the period ended June 30, 2018.[1] The Finance Staff of the Bureau of Technical Utility Services has reviewed the reports and has prepared this summary report for public release. This report sets forth the achieved return on equity for each company, the last allowed return for that utility, a market return as determined through the analysis of the barometer group data and the most recent returns allowed, per industry, by the Pennsylvania Public Utility Commission and by other regulatory bodies. Where a utility has not filed a report, the reasons for not filing are indicated.

Questions pertaining to the preparation and contents of this Report should be directed to Ms. Erin Laudenslager, Manager - Finance, Bureau of Technical Utility Services, at (717) 705-4364.

[1] UGI Utilities, Inc. – Electric Division, Duquesne Light Company, PECO Energy - Electric, Columbia Gas, York Water, SUEZ water, and Aqua Pennsylvania have pending rate filings at Docket Nos. R-2017-2640058, R-2018-3000124, R-2018-3000164, R-2018-2647577, R-2018-3000019, R-2018-3000834, and R-2018-3003068 respectively, and filed a letter with the Secretary in place of a report in accordance with 52 Pa. Code § 71.4.

The equity return summaries that follow in Attachment A are, for each quarter;

ACTUAL

1. Based on actual results of operations

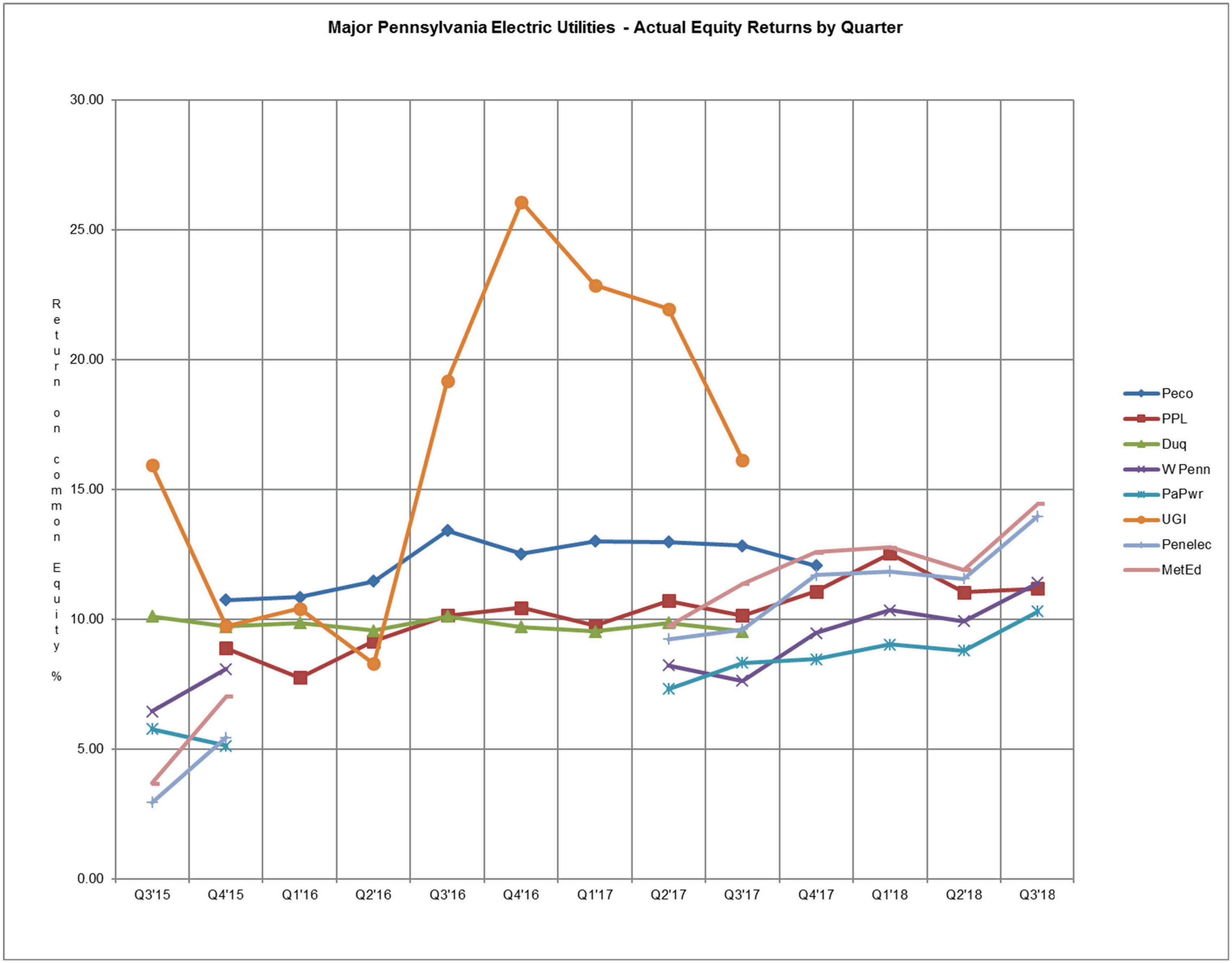
and

ADJUSTED

2. Based on company proposed pro forma and ratemaking adjustments

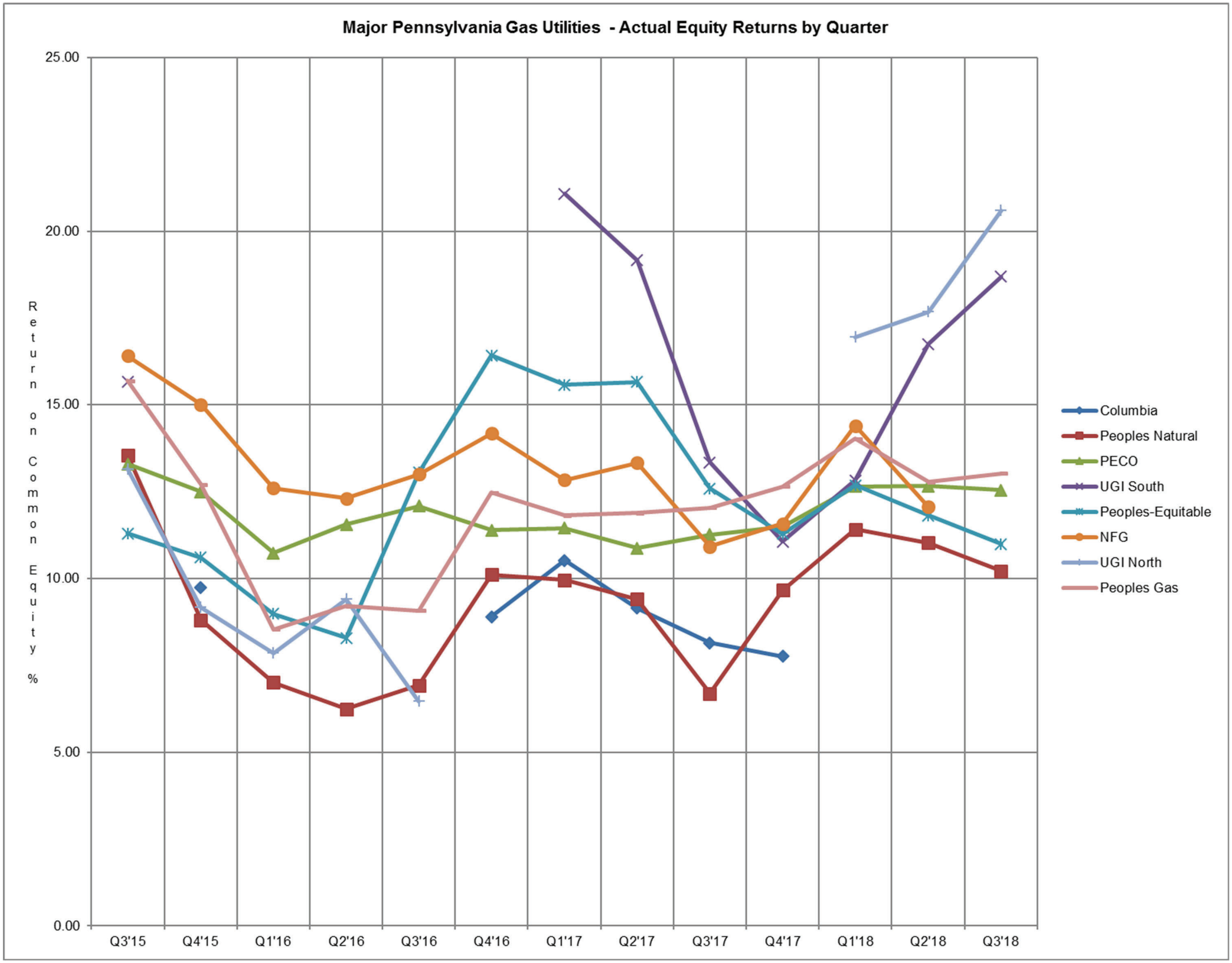
ELECTRIC UTILITIES
EQUITY RETURNS BY QUARTER

QTR	END	PECO		PPL		Duq		W Penn		PaPwr		UGI		Penelec		MetEd	
		ACT	ADJ	ACT	ADJ	ACT	ADJ	ACT	ADJ	ACT	ADJ	ACT	ADJ	ACT	ADJ	ACT	ADJ
2012	4	11.55	11.56	6.02	4.88	10.27	9.24	9.54	9.54	8.41	8.27	14.60	8.98	5.41	7.74	5.39	6.81
2013	1	11.92	11.27	7.56	6.24	10.12	9.74	9.23	9.23	8.89	8.74	12.77	9.84	5.30	7.67	5.01	6.47
	2	11.40	10.74	7.80	7.37			12.34	12.34	8.85	8.70	11.53	10.49	5.86	8.21	5.36	6.79
	3	11.09	10.96	8.67	8.38			9.13	9.13	8.49	8.34	10.74	10.65	-0.77	2.07	-12.43	-10.43
	4	11.97	10.52	10.01	9.79			13.73	13.73	14.49	14.30	14.25	11.99	4.85	2.99	-6.06	-7.87
2014	1	9.97	10.34	10.02	10.04			11.58	9.45	15.28	15.04	13.36	10.25	5.17	3.34	-6.40	-8.13
	2	10.05	10.08	9.50	10.09	9.77	9.29					12.64	9.21				
	3	8.93	9.25	10.07	9.99	9.97	9.48					8.76	9.22				
	4	8.23	9.58			9.77	9.40					9.01	10.00				
2015	1					10.08	9.65					10.88	10.39				
	2					9.80	9.42					13.57	9.49				
	3					10.11	9.73	6.45	6.45	5.77	5.77	15.93	7.57	2.94	2.94	3.69	3.69
	4	10.74	8.84	8.89	8.48	9.73	9.36	8.09	8.09	5.13	5.13	9.74	9.21	5.45	5.45	7.04	7.04
2016	1	10.86	9.74	7.75	6.94	9.87	9.89					10.41	8.69				
	2	11.46	10.15	9.15	8.51	9.57	9.47					8.29	8.10				
	3	13.42	11.44	10.15	9.59	10.12	9.46					19.18	6.99				
	4	12.52	10.65	10.45	10.29	9.71	9.01					26.07	7.30				
2017	1	13.01	11.40	9.76	8.49	9.53	8.99					22.86	6.81				
	2	12.98	11.40	10.71	9.70	9.86	9.24	8.23	7.38	7.32	7.97	21.96	6.74	9.23	9.20	9.74	9.35
	3	12.84	10.52	10.15	9.30	9.53	9.23	7.63	7.24	8.32	9.08	16.13	5.22	9.61	9.50	11.37	10.97
	4	12.07	9.11	11.07	10.63			9.47	9.12	8.46	8.19			11.70	10.93	12.58	11.67
2018	1			12.53	11.36			10.35	9.08	9.03	8.08			11.84	9.93	12.77	11.38
	2			11.05	9.49			9.92	8.52	8.79	7.57			11.56	9.39	11.90	10.26
	3			11.19	9.83			11.41	6.74	10.30	5.80			13.97	8.44	14.46	9.62


Major Pennsylvania Electric Utilities - Actual Equity Returns by Quarter
Return on common Equity %
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Q3'15
Q4'15
Q1'16
Q2'16
Q3'16
Q4'16
Q1'17
Q2'17
Q3'17
Q4'17
Q1'18
Q2'18
Q3'18
Peco
PPL
Duq
W Penn
PaPwr
UGI
Penelec
MetEd

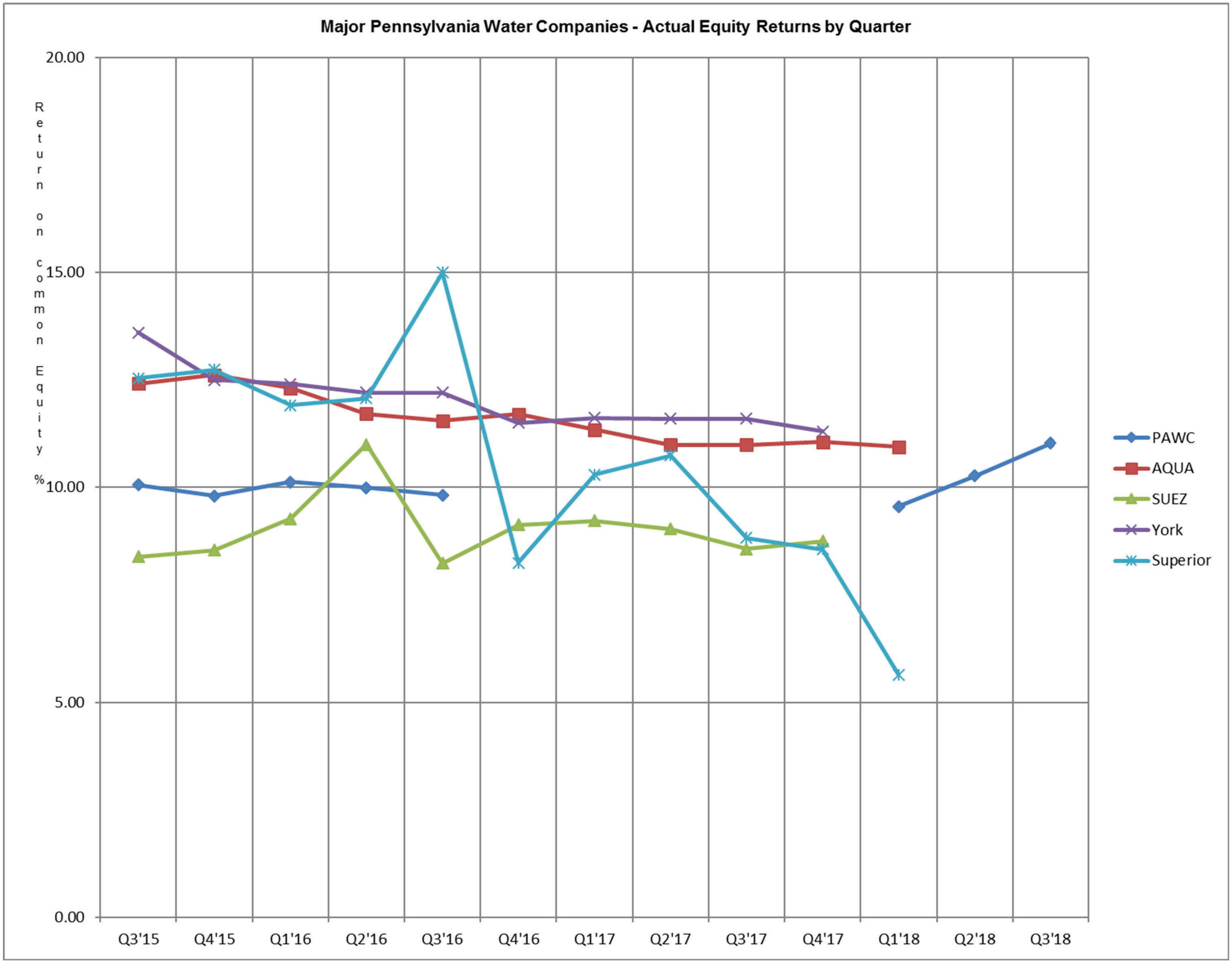
GAS UTILITIES
EQUITY RETURNS BY QUARTER

QTR	Columbia		Peoples Natural		PECO		UGI South		Peoples-Equitable		NFG		UGI North		Peoples Gas	
END	ACT	ADJ	ACT	ADJ	ACT	ADJ	ACT	ADJ	ACT	ADJ	ACT	ADJ	ACT	ADJ	ACT	ADJ
2012 4			11.24	9.57	12.42	15.10	13.68	9.44	7.27	8.05	15.11	10.17	13.31	10.63	5.05	6.94
2013 1			12.49	9.89	14.63	15.13	14.65	10.27	12.42	8.40	19.33	10.25	13.28	10.58		
2	10.85	7.15	16.59	8.35	14.43	14.40	13.02	10.21	10.40	8.92	20.18	10.25	10.98	10.27		
3	9.36	9.86	17.39	8.72	14.14	14.01	12.60	9.38	9.84	9.48	19.61	10.72	10.59	10.76		
4	10.60	10.78	16.33	10.02	14.35	13.97	16.08	9.20	10.52	9.76	20.51	10.07	13.41	10.49	7.21	12.23
2014 1			14.68	9.94	15.23	13.52	16.81	8.35	12.00	8.73	23.11	9.78	16.67	10.06	12.19	11.87
2			13.05	9.78	15.32	13.24	16.71	8.39	13.54	8.49	22.97	12.00	15.30	10.90	14.06	12.32
3			13.43	9.16	15.45	13.21	16.63	8.64	14.41	9.15	21.36	11.03	13.77	10.15	15.07	12.62
4	9.71	9.97	11.85	7.89	13.86	12.59	15.00	7.93	14.52	12.46	20.40	10.79	15.64	9.82	16.91	11.83
2015 1			14.22	7.90	14.60	13.01	15.76	7.87	15.36	12.14	20.17	10.31	15.57	9.52	16.36	11.23
2			14.37	8.88	13.89	12.32	14.07	7.62	14.08	11.26	18.82	10.39	13.76	8.90	16.15	12.90
3			13.55	8.14	13.29	11.77	15.67	6.51	11.30	10.87	16.41	10.27	13.16	8.32	15.69	12.58
4	9.75	9.73	8.80	9.83	12.50	12.70			10.60	10.00	15.01	10.59	9.17	7.25	12.71	12.14
2016 1			7.01	10.02	10.73	13.58			8.98	10.20	12.60	10.97	7.85	8.85	8.54	10.48
2			6.24	9.99	11.55	13.85			8.29	10.40	12.31	11.08	9.41	8.37	9.20	10.43
3			6.93	9.34	12.09	14.40			13.05	10.82	13.00	10.34	6.47	8.81	9.07	12.02
4	8.90	9.26	10.11	11.03	11.39	12.37			16.42	11.07	14.18	9.58			12.47	11.87
2017 1	10.52	10.17	9.96	9.27	11.45	12.55	21.08	10.09	15.85	10.58	12.84	9.26			11.82	12.34
2	9.15	9.81	9.41	9.71	10.87	12.17	19.16	9.44	15.66	10.30	13.33	10.53			11.89	13.47
3	8.15	8.77	6.69	6.40	11.26	10.92	13.34	9.03	12.59	9.85	10.92	10.00			12.04	13.36
4	7.76	8.48	9.66	7.27	11.48	9.83	11.06	8.62	11.28	9.23	11.58	10.56			12.65	11.79
2018 1			11.42	7.00	12.65	9.77	12.82	7.90	12.68	8.22	14.40	10.20	16.95	7.83	14.02	10.17
2			11.03	6.80	12.66	9.05	16.75	6.80	11.81	9.57	12.06	9.89	17.68	8.02	12.78	10.15
3			10.21	7.43	12.54	8.36	18.69	8.04	10.99	9.44	12.52	10.12	20.60	9.16	13.03	10.20


Major Pennsylvania Gas Utilities - Actual Equity Returns by Quarter
Return on Common Equity %
25.00
20.00
15.00
10.00
5.00
0.00
Q3'15
Q4'15
Q1'16
Q2'16
Q3'16
Q4'16
Q1'17
Q2'17
Q3'17
Q4'17
Q1'18
Q2'18
Q3'18
Columbia
Peoples Natural
PECO
UGI South
Peoples-Equitable
NFG
UGI North
Peoples Gas

WATER UTILITIES
EQUITY RETURNS BY QUARTER

QTR END		PAWC ACT	PAWC ADJ	AQUA ACT	AQUA ADJ	SUEZ ACT	SUEZ ADJ	York ACT	York ADJ	Superior ACT	Superior ADJ
2012	4	9.54	9.04	12.41	12.56	8.33	8.49	10.4	9.1		
2013	1			13.24	11.96	8.53	8.71				
	2			14.26	12.52	8.99	9.15			8.57	7.85
	3			15.49	12.21	8.83	9.01			7.46	6.85
	4			13.77	11.97	8.43	9.05	10.2	10.8	10.71	10.01
2014	1	10.52	9.98	13.29	11.56	8.45	9.02	10.2	10.2	13.12	9.97
	2	10.51	10.02	13.01	11.42	8.81	9.32	10.7	10.7	17.09	9.61
	3	11.11	10.57	12.82	11.29	8.57	9.06	10.9	10.9	34.68	9.88
	4	10.49	9.38	12.62	11.49	8.90	9.44	12.3	11.6	16.74	7.96
2015	1	10.33	9.14	12.46	11.11	9.11	9.83	12.7	12.7	15.92	8.37
	2	10.51	9.31	12.66	11.62	8.36	9.25	12.7	12.7	14.65	8.93
	3	10.06	8.81	12.41	11.95	8.39	9.37	13.6	13.6	12.54	9.37
	4	9.80	8.48	12.61	12.16	8.54	8.77	12.50	11.10	12.73	9.50
2016	1	10.12	8.68	12.31	11.71	9.27	10.19	12.40	10.90	11.91	8.17
	2	9.99	8.47	11.71	11.21	11.00	12.37	12.20	10.80	12.07	7.90
	3	9.82	8.47	11.55	10.32	8.23	9.99	12.20	11.00	14.99	7.25
	4	9.37	8.51	11.70	10.57	9.13	9.90	11.50	10.40	8.24	5.04
2017	1			11.34	10.04	9.22	9.60	11.61	9.50	10.29	9.13
	2			10.99	9.22	9.03	9.07	11.60	9.10	10.74	8.61
	3			10.99	9.23	8.57	8.57	11.60	8.70	8.82	8.25
	4			11.05	8.63	8.75	8.73	11.30	8.40	8.56	8.69
2018	1	9.55	8.97	10.94	8.41					5.64	7.39
	2	10.27	9.65								
	3	11.03	9.48								


Major Pennsylvania Water Companies - Actual Equity Returns by Quarter
Return on common Equity %
20.00
15.00
10.00
5.00
0.00
Q3'15
Q4'15
Q1'16
Q2'16
Q3'16
Q4'16
Q1'17
Q2'17
Q3'17
Q4'17
Q1'18
Q2'18
Q3'18
PAWC
AQUA
SUEZ
York
Superior

Attachment B includes:

A. Overall Returns on rate base
1. Actual
2. Company proposed pro forma and ratemaking adjustments

and

B. Equity Returns
1. Actual
2. Company proposed pro forma and ratemaking adjustments

Summary of Returns
For the Year Ended September 30, 2018

COMPANY NAME	OVERALL RETURN ACTUAL	OVERALL RETURN ADJ	EQUITY RETURN ACTUAL	EQUITY RETURN ADJ	ROE AUTH	YEAR AUTH
ELECTRIC						
$10,000,000 Revenues						
PECO Energy - Electric Operations*					Settled	2015
PPL Electric Utilities Corp.	8.18	7.44	11.19	9.83	Settled	2015
Duquesne Light Company*					Settled	2014
West Penn Power Company	8.05	5.48	11.41	6.74	Settled	2017
Pennsylvania Power Company	8.38	5.71	10.30	5.80	Settled	2017
UGI Utilities, Inc. - Electric Division*					9.85	2018
Pennsylvania Electric Company	9.89	6.83	13.97	8.44	Settled	2017
Metropolitan Edison Company	10.30	7.59	14.46	9.62	Settled	2017
GAS						
$10,000,000 Revenues						
Columbia Gas of PA, Inc.*					Settled	2016
Peoples Natural Gas Company LLC	7.48	5.93	10.21	7.43	Settled	2012
PECO Energy - Gas Operations	8.49	6.15	12.54	8.36	Settled	2010
UGI Utilities, Inc. - South	9.45	6.51	18.69	8.04	Settled	2016
Peoples Nat'l - Equitable Division	7.91	6.97	10.99	9.44	Settled	2008
National Fuel Gas Distribution Co.	8.54	7.21	12.52	10.12	Settled	2006
UGI Utilities, Inc. - North	11.65	7.08	20.60	9.16	Settled	2017
Peoples Gas Company, LLC	8.78	7.27	13.03	10.20	Settled	2013
UGI Utilities, Inc. - Central	11.42	5.86	20.69	6.93	Settled	2009
WATER						
$10,000,000 Revenues						
PA American Water Company	8.26	7.37	11.03	9.48	Settled	2018
Aqua Pennsylvania*					Settled	2012
York Water Company*					Settled	2014
SUEZ Water Pennsylvania, Inc.*					Settled	2015

* UGI Utilities, Inc. – Electric Division, Duquesne Light Company, PECO Energy - Electric, Columbia Gas, York Water, SUEZ water, and Aqua Pennsylvania have pending rate filings at Docket Nos. R-2017-2640058, R-2018-3000124, R-2018-3000164, R-2018-2647577, R-2018-3000019, R-2018-3000834, and R-2018-3003068 respectively, and filed a letter with the Secretary in place of a report in accordance with 52 Pa. Code § 71.4.

ALLOWED RATES OF RETURN ON COMMON EQUITY

This is a historical chart that shows the most recent fully litigated rate cases for select companies in electric, gas, and water. A docket number followed by their final return on equity and year is also given.

ELECTRIC	Docket Number	ROE (%)	Year
Recent PA PUC Allowed			
PPL Electric Utilities Corp.	R-2015-2469275	Settled	2015
PECO Energy Company	R-2015-2468981	Settled	2015
UGI - Electric	R-2017-2640058	9.85	2018
Pennsylvania Electric Company	R-2016-2537352	Settled	2017
Metropolitan Edison Company	R-2016-2537349	Settled	2017
Pennsylvania Power Company	R-2016-2537359	Settled	2017
West Penn Power Company	R-2016-2537355	Settled	2017
Current Market Indicated ROE as calculated by the Bureau of Technical Utility Services.			**8.51-9.51**

GAS	Docket Number	ROE (%)	Year
Recent PA PUC Allowed			
Columbia Gas of Pa.	R-2016-2529660	Settled	2016
UGI Utilities, Inc. - South	R-2015-2518438	Settled	2016
Peoples Natural Gas	R-2012-2285985	Settled	2012
UGI Utilities, Inc. - North	R-2016-2580030	Settled	2017
UGI Utilities, Inc. - Central	R-2008-2079675	Settled	2009
PECO Energy	R-2010-2161592	Settled	2010
Peoples TWP	R-2013-2355886	Settled	2013
Current Market Indicated ROE as calculated by the Bureau of Technical Utility Services.			**7.17-12.75**

WATER	Docket Number	ROE (%)	Year
Recent PA PUC Allowed			
Aqua Pennsylvania	R-2011-2267958	Settled	2012
PA American Water	R-2017-2595853	Settled	2017
Columbia Water	R-2017-2598203	Settled	2015
York Water	R-2012-2336379	Settled	2014
Current Market Indicated ROE as calculated by the Bureau of Technical Utility Services.			**8.57-10.76**

Distribution System Improvement Charge (DSIC) Eligible Utilities
Return on Equity (ROE) Summary

	Utility Adjusted ROE[2] (%)	Commission Approved ROE[3] (%)
ELECTRIC		
PECO Energy – Electric Operations*		9.65
PPL Electric Utilities Corp.	9.83	9.65
Duquesne Light Company*		9.65
West Penn Power Company	6.74	9.65
Pennsylvania Power Company	5.80	9.65
Pennsylvania Electric Company	8.44	9.65
Metropolitan Edison Company	9.62	9.65
GAS		
Columbia Gas of PA, Inc.*		10.15
Peoples Natural Gas Company LLC	7.43	10.15
PECO Energy – Gas Operations	8.36	10.15
UGI Utilities, Inc. – South	8.04	10.15
Peoples-Equitable Division	9.44	10.15
UGI Utilities, Inc. – North	9.16	10.15
Peoples Gas Company, LLC	10.20	10.15
UGI Utilities, Inc. – Central	6.93	10.15
WATER		
PA American Water Company	9.48	9.95
PA American – Wastewater	9.48	9.95
AQUA Pennsylvania*		9.95
AQUA Pennsylvania – Wastewater*		9.95
York Water Company*		9.95
SUEZ Water Pennsylvania Inc.*		9.95
Columbia Water Company	5.17	9.95
Newtown Artesian Water	3.97	9.95
Superior Water*		9.95

* UGI Utilities, Inc. – Electric Division, Duquesne Light Company, PECO Energy - Electric, Columbia Gas, York Water, SUEZ Water, and Aqua Pennsylvania, Aqua Pennsylvania-Wastewater and Superior Water have pending rate filings at Docket Nos. R-2017-2640058, R-2018-3000124, R-2018-3000164, R-2018-2647577, R-2018-3000019, R-2018-3000834, and R-2018-3003068 respectively, and filed a letter with the Secretary in place of a report in accordance with 52 Pa. Code § 71.4.

2 Each utility lists adjustments on Schedule B of their quarterly financial report.
3 The ROE is approved in a utility's most recent fully litigated base rate proceeding for which a final order was entered not more than two years prior to the effective date of the DSIC. If more than two years have elapsed between the entry of a final order and the DSIC effective date, the ROE is from this report. If the base rate proceeding is settled, without a stipulated ROE, the ROE is from this report.

Explanation of Discounted Cash Flow (DCF) and Capital Asset Pricing Model (CAPM)

Barometer Group Criteria

The criteria used for determining the industry barometer groups used to calculate ROEs in this report are as follows:

- 50% or more of the company's assets must be related to the jurisdictional utility industry;
- The company's stock must be publicly traded;
- Companies involved in merger & acquisition activity will be excluded;
- Investment information for the company must be available to the Commission from more than one source; and
- Geographic Regions:
  EDCs: *Value Line* East, Central, and West Group Electric Utility companies;
  NGDCs: *Value Line* Investment Survey's Natural Gas Utility industry group companies;
  Water/Waste water: *Value Line* Investment Survey's Water Utility industry group companies.

The barometer group companies are reviewed by staff on a quarterly basis and make any changes to these companies based upon the criteria above.

ROE Calculations

The Commission consistently uses the DCF model to determine the appropriate cost of equity for utilities. In this report, the DSIC ROE is calculated using two DCF models.

TUS uses the following formula to calculate the current dividend DCF: $K = D_1/P_0 + G$

TUS uses the following formula to calculate the 52-week average dividend DCF: $K = D_0/P_a + G$

Definitions:

K	=	Cost of equity
D_1	=	Dividend expected during the year
	=	$D_0 + ½g$
D_0	=	Latest indicated dividend, obtained from Yahoo! Finance
g	=	Expected 5-year dividend growth rate of barometer group obtained from Value Line Investment Survey.
P_0	=	Current price of the stock, obtained from Yahoo! Finance
P_a	=	Average of high and low stock price over the latest 52-week period, obtained from Yahoo! Finance
G	=	Average of 5-year expected earnings growth rate forecasts obtained from Value Line Investment Survey, Zacks Investment Survey, Yahoo! Finance, Morningstar and/or Reuters.

The CAPM uses the yield of a risk-free interest bearing obligation plus a rate of return premium that is proportional to the systematic risk of an investment.

TUS uses the following formula to calculate CAPM: $K = \beta(R_m - R_f)$

Three components are necessary to calculate the CAPM cost of equity:

β	=	Beta, a measure of systematic risk for each stock
R_f	=	The risk-free rate of return, 10-year U.S. Treasury yields are used for R_f. Yields are taken from the previous two quarters and forecasted next four quarters.
R_m	=	Total return of the equity market as determined by the SBBI Yearbook

The Commission determines the ROE used for DSIC purposes based on the range of reasonableness from the DCF barometer group data, CAPM data, recent ROEs adjudicated by the Commission, and informed judgment.

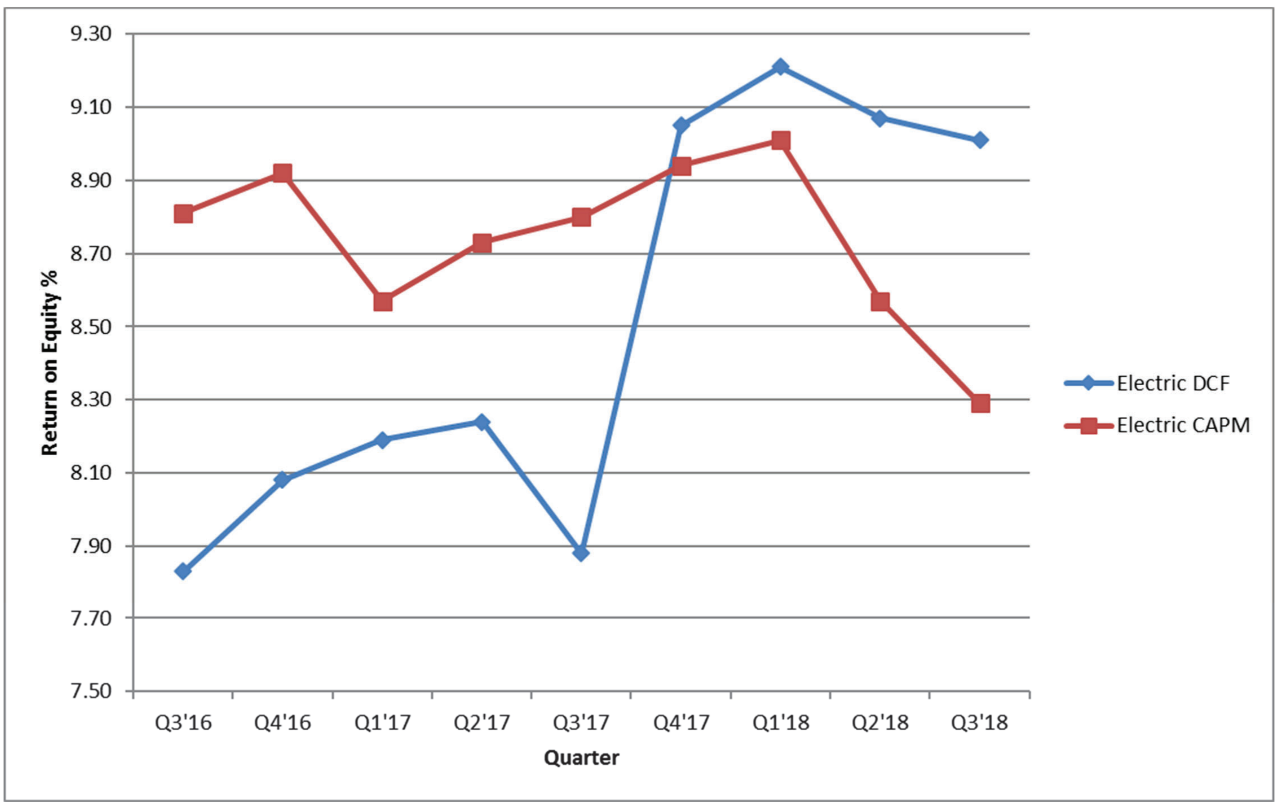
The market indicated common equity cost rate range consists of data used from the barometer groups and is based on a series of calculations to average the DCF methods.

Market Based Returns on Common Equity[1]	
December 17, 2018	
Electric Company Barometer Group	
	Cost Rates
	%
(1) Current DCF:	8.90
(2) 52-Week Average DCF:	9.12
(3) Overall DCF ((1) + (2)) / 2 :	9.01
(4) Market Indicated Common Equity Cost Rate Range:	8.51-9.51
@ 1 standard deviation around the mean.[2]	
(5) CAPM Check of DCF Reasonableness:	8.29
(6) Recent Commission Approved ROEs[3]:	9.80*
*UGI Utilities, Inc. - Electric, R-2017-2640058, does not include 0.05% management effectiveness adjustment	
(7) Distribution System Improvement Charge (DSIC) Return[4]:	**9.65%**
Barometer Group Companies	
Consolidated Edison	
Exelon Corp.	
PPL Corporation	
Public Service Enterprise Group	
American Electric Power	
Eversource Energy	
[1] As calculated by the Bureau of Technical Utility Services	
[2] Standard Deviation of 12 DCF observations	
[3] Base rate case ROEs within last two years, fully litigated or stipulated for DSIC purposes	
[4] Commission authorized Return on Equity (ROE) for DSIC purposes	
Any questions concerning DSIC should be directed to Andrew Herster of the Bureau of Technical Utility Services at (717) 783-5392.	

Historic Electric Industry Barometer Group DCF and CAPM Average ROEs

	Electric	
	DCF	CAPM
Q3'16	7.83	8.81
Q4'16	8.08	8.92
Q1'17	8.19	8.57
Q2'17	8.24	8.73
Q3'17	7.88	8.80
Q4'17	9.05	8.94
Q1'18	9.21	9.01
Q2'18	9.07	8.57
Q3'18	9.01	8.29

Chart of Historic Electric Industry DCF and CAPM Average ROEs



Barometer electric companies are used to calculate a current DCF in the first chart. The second chart demonstrates the companies 52 week average DCF. A final average of the two calculations is also shown at the bottom.

Electric Company Barometer Group						
Calculation of a Current Dividend Yield						
	Closing Market Price (Po) 12/14/2018	Latest Indicated Dividend Do	Ind. Div. Plus 1/2 Div. Growth Rate (D1)	Current Dividend Yield(D1/Po)	DCF	
	($)	($)	($)	(%)	(%)	
Consolidated Edison	83.93	2.86	2.91	3.47	8.32	
Exelon Corp.	46.95	1.38	1.41	3.01	7.93	
PPL Corporation	30.83	1.64	1.66	5.39	10.04	
Public Service Enterprise Group	55.80	1.80	1.85	3.31	9.29	
American Electric Power	80.36	2.68	2.76	3.44	8.77	
Eversource Energy	70.23	2.02	2.08	2.96	8.70	
Group Average D1/Po				3.60		
Group Average G				5.30		
DCF				**8.90**		

Electric Company Barometer Group						
52-week Average Dividend Yield Calculation						
	High	Low	Average (Pa)	Latest Indicated Dividend (Do)	Average Dividend Yield (Do/Pa)	DCF
	($)	($)	($)	($)	(%)	(%)
Consolidated Edison	88.27	71.12	79.70	2.86	3.59	8.44
Exelon Corp.	47.40	35.57	41.49	1.38	3.33	8.24
PPL Corporation	34.15	25.30	29.73	1.64	5.52	10.17
Public Service Enterprise Group	56.68	46.19	51.44	1.80	3.50	9.49
American Electric Power	81.05	62.71	71.88	2.68	3.73	9.06
Eversource Energy	70.53	52.76	61.65	2.02	3.28	9.01
Group Average Do / Pa					3.82	
Group Average G					5.30	
DCF					**9.12**	
		Average of Current and 52-Week			**9.01**	

Multiple sources of the Barometer companies projected 5 year Earnings Per Share are used to calculate the Group Average Dividend Growth Estimate.

Development of a Representative Dividend Growth Rate
for the Barometer Group of Six Electric Companies

		5 Year Forecast				Avgerage	
	Value Line	Value Line	Zack's	Yahoo	Morningstar	Earnings	Growth
	DPS	EPS	EPS	EPS	EPS	Growth	Estimate
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Consolidated Edison	3.50	3.00	4.00	2.87	5.70	3.89	4.85
Exelon Corp.	5.00	8.00	4.60	5.23	8.30	6.53	4.92
PPL Corporation	2.50	2.00	5.00	4.31	11.20	5.63	4.66
Public Service Enterprise Group	5.00	4.00	6.70	7.26	10.00	6.99	5.99
American Electric Power	6.00	4.50	5.70	5.83	5.30	5.33	5.33
Eversource Energy	6.00	5.00	5.90	5.83	6.20	5.73	5.73
Group Average	4.67	4.42	5.32	5.22	7.78	5.68	5.25
USE							5.30

Sources: Morningstar, December 17, 2018 (http://financials.morningstar.com)
Value Line Investment Survey, December 17, 2018
Zacks, December 17, 2018 (www.zacks.com)
Yahoo!, December 17, 2018 (http://finance.yahoo.com/)

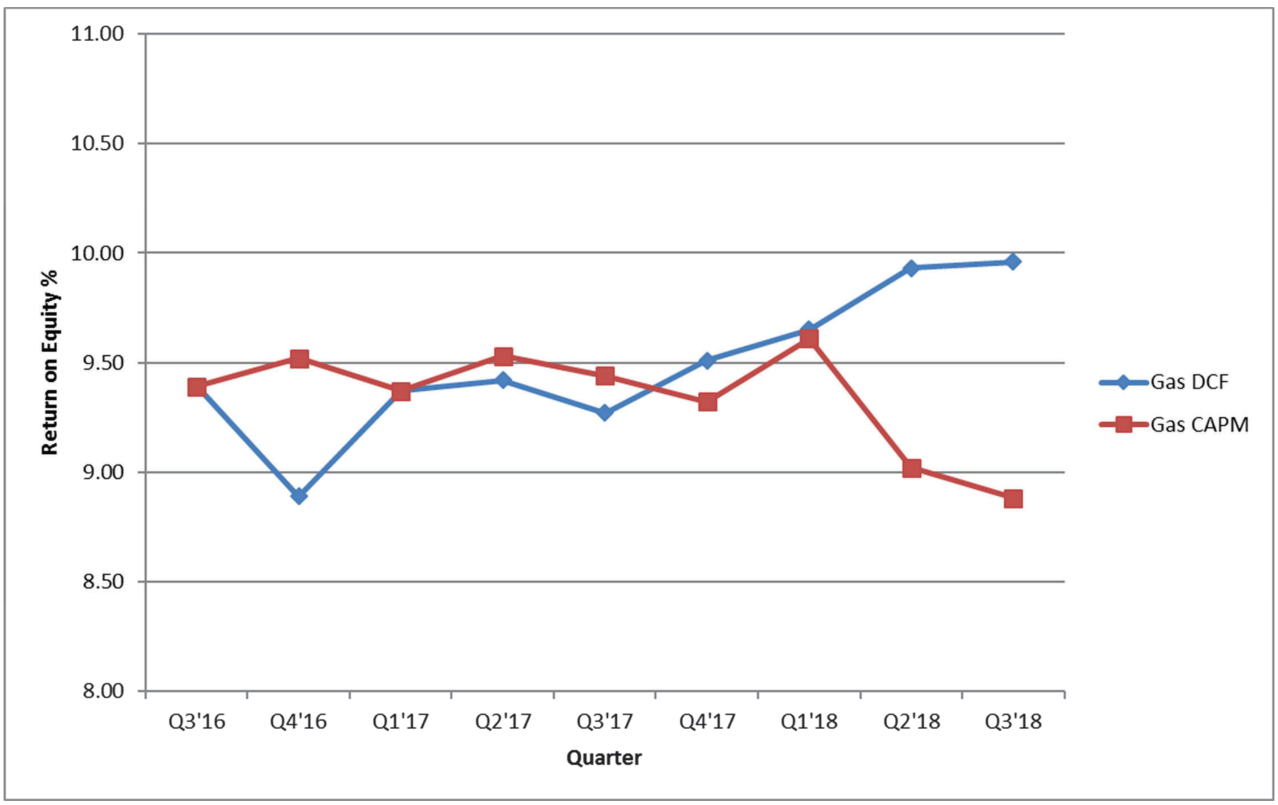
The market indicated common equity cost rate range consists of data used from the barometer groups and is based on a series of calculations to average the DCF methods.

Market Based Returns on Common Equity[1]	
December 17, 2018	
Gas Distribution Company Barometer Group	
	Cost Rates
	%
(1) Current DCF:	9.85
(2) 52-Week Average DCF:	10.07
(3) Overall DCF ((1) + (2)) / 2 :	9.96
(4) Market Indicated Common Equity Cost Rate Range:	7.17-12.75
@ 1 standard deviation around the mean.[2]	
(5) CAPM Check of DCF Reasonableness:	8.88
(6) Recent Commission Approved ROEs[3]:	*
*None within last two years	
(7) Distribution System Improvement Charge (DSIC) Return[4]:	**10.15%**
Barometer Group Companies	
Atmos Energy	
New Jersey Resources	
Northwest Natural Gas Company	
Chesapeake Utilities Corporation	
South Jersey Industries	
NiSource Inc.	
[1] As calculated by the Bureau of Technical Utility Services	
[2] Standard Deviation of 12 DCF observations	
[3] Base rate case ROEs within last two years, fully litigated or stipulated for DSIC	
[4] Commission authorized Return on Equity (ROE) for DSIC purposes	
Any questions concerning DSIC should be directed to Andrew Herster	
of the Bureau of Technical Utility Services at (717) 783-5392.	

Historic Gas Industry DCF and CAPM Average ROEs

	Gas	
	DCF	CAPM
Q3'16	9.39	9.39
Q4'16	8.89	9.52
Q1'17	9.37	9.37
Q2'17	9.42	9.53
Q3'17	9.27	9.44
Q4'17	9.51	9.32
Q1'18	9.65	9.61
Q2'18	9.93	9.02
Q3'18	9.96	8.88

Graph of Historic Gas Industry DCF and CAPM Average ROEs



Barometer gas companies are used to calculate a current DCF in the first chart. The second chart demonstrates the companies 52 week average DCF. A final average of the two calculations is also shown at the bottom.

Gas Company Barometer Group						
Calculation of a Current Dividend Yield						
	Closing Market Price (Po) 12/14/2018	Latest Indicated Dividend Do	Ind. Div. Plus 1/2 Div. Growth Rate (D1)	Current Dividend Yield(D1/Po)	DCF	
	($)	($)	($)	(%)	(%)	
Atmos Energy	99.50	2.10	2.17	2.18	9.62	
New Jersey Resources	50.21	1.17	1.19	2.38	9.70	
Northwest Natural Gas	67.56	1.90	1.92	2.85	7.00	
Chesapeake Utilities Corporation	93.12	1.48	1.55	1.66	8.81	
South Jersey Industries	30.23	1.15	1.17	3.88	15.66	
NiSource Inc.	27.49	0.78	0.82	2.97	8.44	
Group Average D1 / Po				2.65		
Group Average G				7.20		
DCF				**9.85**		

Gas Company Barometer Group						
52-week Average Dividend Yield Calculation						
	High	Low	Average (Pa)	Latest Indicated Dividend (Do)	Average Dividend Yield (Do/Pa)	DCF
	($)	($)	($)	($)	(%)	(%)
Atmos Energy	100.76	76.46	88.61	2.17	2.45	9.89
New Jersey Resources	51.83	35.55	43.69	1.19	2.73	10.06
Northwest Natural Gas	71.81	51.50	61.66	1.92	3.12	7.27
Chesapeake Utilities Corporation	93.40	66.35	79.88	1.55	1.94	9.09
South Jersey Industries	36.72	25.96	31.34	1.17	3.74	15.52
NiSource Inc.	28.11	22.44	25.28	0.82	3.22	8.70
Group Average Do / Pa					2.87	
Group Average G					7.20	
DCF					**10.07**	
		Average of Current and 52-Week			**9.96**	

Multiple sources of the Barometer companies projected 5 year Earnings Per Share are used to calculate the Group Average Dividend Growth Estimate.

Development of a Representative Dividend Growth Rate for the Barometer Group of Gas Companies							
	5 Yr Forecast						
						Avgerage	
	Value Line	Value Line	Zack's	Yahoo	Morningstar	Earnings	Growth
	DPS	EPS	EPS	EPS	EPS	Growth	Estimate
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Atmos Energy	7.00	7.50	8.80	6.45	7.00	7.44	7.44
New Jersey Resources	4.00	9.50	7.00	6.00	6.80	7.33	7.33
Northwest Natural Gas	2.50	30.50	4.30	4.00		12.93	4.15
Chesapeake Utilities Corporation	9.00	8.50	6.00	6.00	8.10	7.15	7.15
South Jersey Industries	4.00	9.50	12.50	12.70	12.40	11.78	11.78
NiSource Inc.	9.00	18.00	5.50	5.92	5.00	8.61	5.47
Group Average	5.92	13.92	7.35	6.85	7.86	9.20	7.22
USE							7.20
Sources:	Morningstar, December 17, 2018 (http://financials.morningstar.com)						
	Value Line Investment Survey, December 17, 2018						
	Zacks, December 17, 2018 (www.zacks.com)						
	Yahoo!, December 17, 2018 (http://finance.yahoo.com/)						

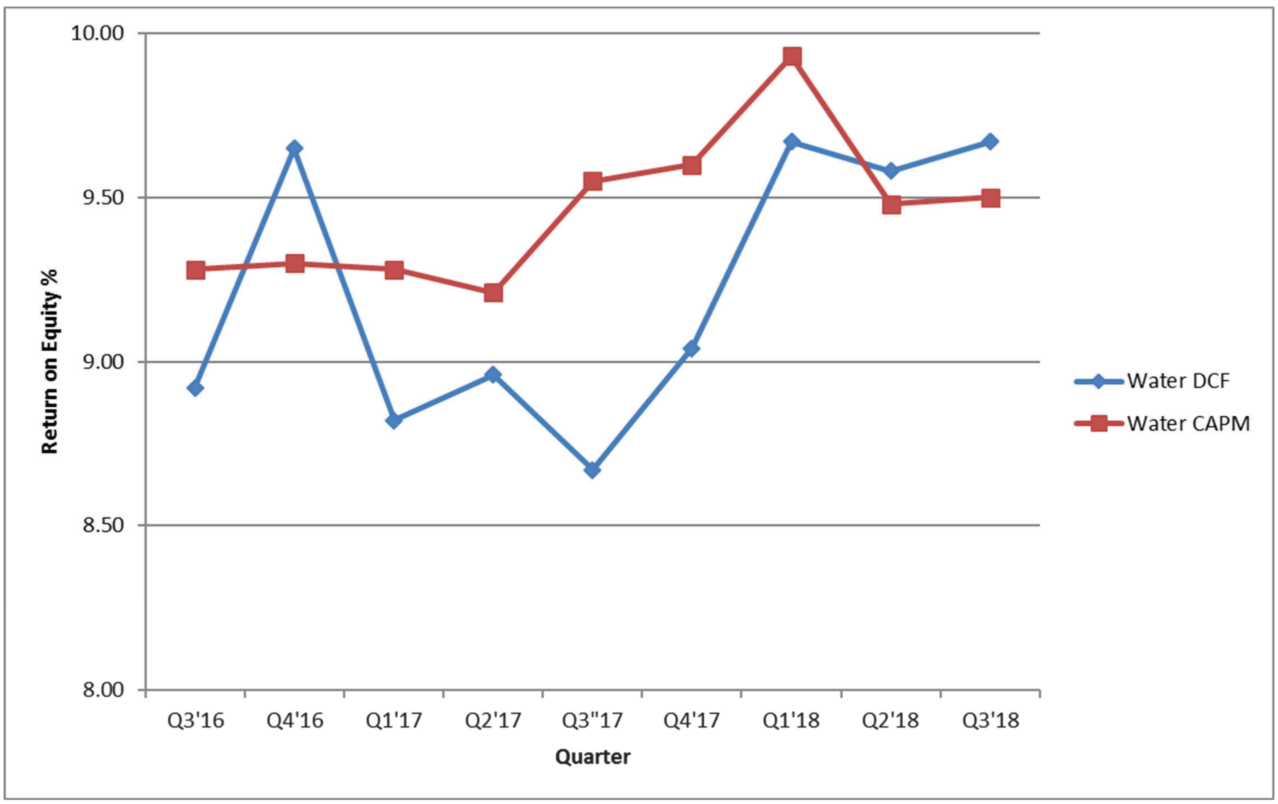
The market indicated common equity cost rate range consists of data used from the barometer groups and is based on a series of calculations to average the DCF methods.

Market Based Returns on Common Equity [1]	
December 17, 2018	
Water Company Barometer Group	
	Cost Rates
	%
(1) Current DCF	9.59
(2) 52-Week Average DCF	9.74
(3) Average DCF	9.67
(4) Market Indicated Common Equity Cost Rate Range	8.57-10.76
@ 1 standard deviation around the mean.[2]	
(5) CAPM Check of DCF Reasonableness	9.50
(6) Recent Commission Approved ROEs[3]:	*
*None within last two years	
(7) Distribution System Improvement Charge (DSIC) Return[4]:	**9.95%**
Barometer Group Companies	
American States Water Company	
Middlesex Water Company	
California Water Service Group	
Aqua America , Inc.	
American Water Works Co., Inc.	
[1] As calculated by the Bureau of Technical Utility Services	
[2] Standard Deviation of 14 DCF observations	
[3] ROEs from base rate cases within last two years, fully litigated or stipulated for DSIC purposes	
[4] Commission authorized Return on Equity (ROE) for DSIC purposes	
Any questions concerning DSIC should be directed to Andrew Herster	
of the Bureau of Technical Utility Services at (717) 783-5392.	

Historic Water Industry DCF and CAPM Average ROEs

	Water	
	DCF	CAPM
Q3'16	8.92	9.28
Q4'16	9.65	9.30
Q1'17	8.82	9.28
Q2'17	8.96	9.21
Q3"17	8.67	9.55
Q4'17	9.04	9.60
Q1'18	9.67	9.93
Q2'18	9.58	9.48
Q3'18	9.67	9.50

Chart of Historic Water Industry DCF and CAPM Average ROEs



Barometer water companies are used to calculate a current DCF in the first chart. The second chart demonstrates the companies 52 week average DCF. A final average of the two calculations is also shown at the bottom.

Water Company Barometer Group							
Calculation of a Current Dividend Yield							
	Closing	Latest	Ind. Div.				
	Market	Indicated	Plus 1/2	Current			
	Price (Po)	Dividend	Div. Growth	Dividend			
	12/14/2018	Do	Rate (D1)	Yield(D1/Po)	Growth	DCF	
	($)	($)	($)	(%)	(%)	(%)	
American States Water Company	69.19	1.10	1.14	1.65	6.00	7.65	
Middlesex Water Company	58.56	0.96	0.99	1.68	9.00	10.68	
California Water Service Group	48.77	0.75	0.77	1.59	8.25	9.84	
Aqua America, Inc.	35.78	0.88	0.92	2.57	7.27	9.84	
American Water Works Co., Inc.	97.14	1.82	1.91	1.97	8.00	9.97	
Group Average D1/Po				1.89			
Group Average G				7.70			
DCF				**9.59**			
52-week High-Low Dividend Yield Calculation							
				Latest	Average		
				Indicated	Dividend		
	High	Low	Average (Pa)	Dividend (Do)	Yield (Do/Pa)	Growth	DCF
	($)	($)	($)	($)	(%)	(%)	(%)
American States Water Company	69.61	50.16	59.89	1.10	1.84	6.00	7.84
Middlesex Water Company	60.31	33.96	47.14	0.96	2.04	9.00	11.04
California Water Service Group	49.07	35.25	42.16	0.75	1.78	8.25	10.03
Aqua America , Inc.	39.55	32.09	35.82	0.88	2.46	7.27	9.72
American Water Works Co., Inc.	98.18	76.04	87.11	1.82	2.09	8.00	10.09
Average							
Group Average Do / Pa					2.04		
Group Average G					7.70		
DCF					**9.74**		
		Average of Current and 52-Week			**9.67**		

Multiple sources of the Barometer companies projected 5 year Earnings Per Share are used to calculate the Group Average Dividend Growth Estimate.

Development of a Representative Dividend Growth Rate for the Barometer Group of Water Companies							
	5 Yr Forecast						
						Avgerage	
	Value Line	Value Line	Zacks	Yahoo	Reuters	Earnings	Growth
	DPS	EPS	EPS	EPS	EPS	Growth	Estimate
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
American States Water Company	8.00	6.00	6.00	6.00	6.00	6.00	6.00
Middlesex Water Company	5.50	9.00		2.70		5.85	9.00
California Water Service Group	6.50	9.50	7.00	9.80		8.77	8.25
Aqua America, Inc.	9.00	7.50	5.30	5.00	9.00	6.70	7.27
American Water Works Co., Inc.	10.00	10.00	7.80	8.20	10.60	9.15	8.00
Group Average	7.80	8.40	6.53	6.34	8.53	7.29	7.70
USE							7.70

Sources: Reuters, December 17, 2018 (www.reuters.com/finance/stocks)
Value Line Investment Survey, December 17, 2018
Zacks, December 17, 2018 (www.zacks.com)
Yahoo!, December 17, 2018 (http://finance.yahoo.com/)

Risk and Return for Regulated Industries

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constant growth DCF formula can be used once the constant growth rate assumption is satisfied at some point in the future (e.g., at the end of 5 or 10 years). A standard "multistage" DCF approach solves the following equation for r_S:[6]

$$P_0 = \frac{D_1}{(1+r_S)} + \frac{D_2}{(1+r_S)^2} + \ldots + \frac{D_T + P_{TERM}}{(1+r_S)^T} \tag{5.5}$$

The terminal price, P_{TERM}, is just the discounted value of all of the future dividends after constant dividend growth is reached:

$$P_{TERM} = \frac{D_T(1+g_{LR})}{(r_S - g_{LR})} \tag{5.6}$$

where T is the last of the periods in which a near-term dividend forecast is made, and g_{LR} is the assumed long-run steady growth rate. Eq. (5.5) defers adoption of the very strong perpetual constant growth assumption that underlies Eq. (5.2)—and hence the simple DCF formula, Eq. (5.4)—for as long as possible and instead relies on near term knowledge to improve the estimate of r_S.

DISCOUNTED CASH FLOW IMPLEMENTATION ISSUES

Growth Rates

In most cases, the choice of growth rate is the most controversial part of the implementation of the DCF model. Since the DCF model uses dividends as the cash distributed to shareholders, we would like to have a forecast of dividend growth rates for as long a period into the future as possible. Unfortunately, forecasts of dividend growth rates are not generally available.[7] Security analysts' forecasts of earnings per share (EPS) are available, but even then, the longest period of publicly available forecasts is usually about 5 years. Nonetheless, forecasts of EPS from security analysts are the best available information on forecast growth rates for the DCF model.

In the constant growth version of the DCF model, the growth rates of dividends, earnings, and the stock price are all expected to be equal and constant. If the 5-year growth rate forecasts are not constant for these parameters, it is an indication that use of the multistage model should be considered. In any case, EPS growth is the fundamental parameter because dividends are ultimately paid from earnings, so dividends cannot grow in the long term at a rate that exceeds EPS growth. Dividends can grow at a slower rate if the company is reinvesting a larger portion of its earnings, but this sets the stage for an increased rate of dividend growth in the future.[8]

A related issue is that a company cannot grow forever at a rate that exceeds the growth rate of the economy, although it might do so for a long enough period that the issue is immaterial to the resulting DCF estimate. To illustrate

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Dividend Payout and Future Earnings Growth

Ping Zhou, CFA, and William Ruland

Because dividends reduce the funds available for investment, many market observers and investors associate high dividend payout with weak future earnings growth. Tests using aggregate market data, however, provided evidence that contradicts that view. Because aggregate results may not apply at the company level, we conducted a company-by-company analysis of the relationship between payout and future earnings growth. Our tests also show that high-dividend-payout companies tend to experience strong, not weak, future earnings growth. These results are robust to alternative measures of payout and earnings, sample composition, mean reversion in earnings, the effects of particular industries, time periods, and share repurchases.

Market observers often view low dividend payout as a signal for high future earnings growth. The rationale is that companies pay fewer dividends or retain more earnings when growth opportunities are ample, so low payout indicates strong future earnings growth. For example, the Gordon (1962) constant dividend growth model shows that with constant expected return, high dividend payout should be offset by either a high P/E or low expected earnings growth. The intertemporal extension of the Miller and Modigliani (1961) dividend irrelevance theorem predicts that with unaltered investments and constant expected return, higher dividend payout will be followed by lower growth (Ibbotson and Chen 2003).[1] Moreover, from the perspective of capital structure, "pecking order theory" (Myers 1984) hypothesizes that companies with great growth opportunities will prefer internally generated cash flows to external sources of funds. This hypothesis suggests that companies with plentiful growth opportunities will have low dividend payouts (or high earnings-retention rates). Empirical studies on the determinants of dividend payout generally support the idea that dividend payout is inversely correlated with investment opportunities (Fama and French 2002; Rozeff 1982).

In an intriguing approach, Arnott and Asness (2003) investigated the relationship between payout and future earnings growth by focusing on the market portfolio, proxied by the S&P 500 Index. The results of that study, which incorporated 130 years of data and a variety of tests, are in sharp contrast with conventional wisdom. Arnott and Asness found that future earnings growth is associated with high rather than low dividend payout. This finding proved robust to various subperiods, to extensive controls for the mean reversion of earnings growth, and to a host of micro and macro variables. The authors noted that their findings "offer a challenge to market observers who see the low dividend payouts . . . as a sign of strong future earnings to come" (p. 70).

The Arnott–Asness analysis has direct and important implications for the valuation of the overall equity market. Does the high dividend–high growth relationship also exist at the company level? Although this question is of utmost importance for valuing individual stocks, the answer is not obvious because aggregate results may not apply at the company level.

One reason for differences between aggregate and company-level results is that the S&P 500 composite is capitalization weighted, so the dividend policies and performance of a few large companies in the index may dominate the aggregate results. Company-level analyses, however, treat all companies equally, thereby reducing the possibility that a handful of giant companies dominate results. Two recent studies illustrate this idea clearly. Fama and French (2001) reported that the percentage of U.S. public companies that pay dividends has decreased sharply since 1978. Thus, on the company level, companies are paying fewer dividends than before. In a more recent study, however, DeAngelo, DeAngelo, and Skinner (2004) showed that aggregate dividends have increased since 1978 because dividends are now more concentrated in a few very large corporations.

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A second reason for caution in extending the Arnott–Asness aggregate result to individual companies is that companies in the S&P 500 tend to be large, well-established businesses. Whether the findings apply to a more diverse sample of companies is an empirical question. This issue has become particularly important in recent years because newly listed companies tend to be smaller, less profitable, and more growth oriented than before (Fama and French 2001). As a result, the differences in characteristics between S&P 500 companies and other public companies have become more important in recent years.

Study Design

Following Arnott and Asness, we measured earnings growth as the compounded annual growth rate. We tested for the relationship between payout and future earnings growth by using the following multivariate regression:

$$EG_{0,t} = \alpha_0 + \beta_1 Payout + \beta_2 Size + \beta_3 ROA + \beta_4 E/P + \beta_5 LEV + \beta_6 PEG_{-t,0} + \beta_7 AG_{0,t} + e, \tag{1}$$

where

- $EG_{0,t}$ = earnings growth, measured as compounded annual earnings for common shareholders (Compustat #237) growth from Year 0 to year t; growth was calculated over one-, three-, and five-year periods—that is, $t = 1, 3,$ or 5
- *Payout* = dividend payout, measured as Year 0 dividends (Compustat #21) divided by Year 0 earnings (Compustat #237)
- *Size* = natural logarithm of market value of equity (Compustat #25 × Compustat #199) at the end of Year 0
- *ROA* = return on assets, measured as earnings (Compustat #237) for Year 0 divided by total assets (Compustat #6) at the end of Year 0
- *LEV* = leverage, measured as the book value of debt (Compustat #6 – Compustat #60) to total assets (Compustat #6),[2] with all measurements at the end of Year 0
- *E/P* = earnings yield, measured as earnings (Compustat #237) for Year 0 divided by the end-of-year market value of equity (Compustat #25 × Compustat #199)
- $PEG_{-t,0}$ = past earnings growth, measured as compounded annual earnings (Compustat #237) growth from year $-t$ to Year 0, with t = 1, 3, or 5 (the basic procedure was the same as for the *EG* variable)
- $AG_{0,t}$ = compounded annual growth in total assets (Compustat #6) from Year 0 to year t with t = 1, 3, or 5 with period t designations as for *EG*

A notable difference between our study and that of Arnott and Asness relates to the time horizon. Whereas Arnott and Asness focused on 5-year-ahead and 10-year-ahead long-term earnings growth, we studied earnings growth over short (1-year-ahead), intermediate (3-year-ahead), and long (5-year-ahead) horizons. We examined relatively short horizons for two reasons. One is that, although investors and analysts are clearly interested in long-term earnings growth, they are also interested in short- and intermediate-horizon growth. Second, long-term growth measures require a large number of observations, a requirement that increases survivor bias as the observation period increases.

Our key independent variable is *Payout*. A negative coefficient on *Payout* would support the conventional wisdom that low earnings growth follows high payout. A positive coefficient on *Payout* would be consistent with the results presented in Arnott and Asness.

We controlled for size because large companies are more established and mature than small companies and thus less likely to exhibit stronger growth. Consequently, we expected to observe an inverse relationship between company size and future earnings growth. We controlled for return on assets because when profitability is already high (other factors being equal), companies should find it difficult to demonstrate strong earnings growth. Thus, we expected *ROA* also to be negatively associated with earnings growth.

The leverage control was based on the expectation that companies with high leverage will tend to have large investments, as suggested by Fama and French (2002), and thus higher earnings growth. Hence, we predicted a positive relationship between leverage and earnings growth.

Following Arnott and Asness, we also controlled for earnings yield and past earnings growth. Under the assumption that the market is reasonably efficient, we expected investors to pay more for a dollar of current earnings if future earnings growth is high (i.e., higher P/E). Thus, we predicted that *E/P* (the inverse of P/E) would be negatively related to future earnings growth.[3]

We considered the possibility of mean reversion in earnings growth by including past earnings growth in our regression. Our tests used the same observation period for past and future earnings growth. For example, we controlled for five-year past growth when examining five-year future growth rates. We expected a negative relationship between past earnings growth and future earnings growth. However, because these controls may not have adequately addressed the possibility of mean reversion, we report later on additional controls for the mean reversion effect.

Finally, we controlled for future asset growth. Other factors being equal, we expected large companies to report higher earnings than small companies. Also, we expected that when companies grew, we would observe growth in earnings. We expected to observe a positive coefficient for the asset growth variable.

Data

We obtained our data from the 2004 Compustat annual files. The sample includes both "active" and "inactive" companies. The sample period is 1950 through 2003. Because our tests required data for past and future earnings growth, the sample size was a decreasing function of the growth horizon.[4] We began with all domestic companies listed on the NYSE, Amex, and NASDAQ that paid dividends on common shares for Year 0. In addition, we required companies with

- positive earnings for Year 0,[5]
- book value of equity greater than $250,000 or total assets greater than $500,000, and
- membership in industries other than financial services (SIC codes 6000–6999) and utilities (SIC codes 4000–4949).

To control for the effects of outliers, for all variables except *Size* and *Payout* (as defined in the previous section), we removed the top and bottom 1 percent of observations. Following the literature, we removed small companies on the basis of the study's requirement for minimum book value of equity or total assets (as in Fama and French 2002). With respect to *Payout*, we removed only the top 1 percent of the observations rather than truncate observations at both the top and bottom ends of the distribution.[6] We used this procedure because the minimum payout would be 0 and about 44 percent of Compustat companies do not pay dividends.

The sample necessarily includes only companies that paid dividends and reported positive earnings in the year under examination. In the interest of maximizing the sample size and generality of results, we did include companies that missed dividends or reported losses in particular years when the dividend and earnings criteria were met in Year 0. Therefore, the study covers the population of Compustat companies insofar as possible. The sample used to test Equation 1 is quite large—40,968 company-years for Year 0 in the case of the one-year growth. Although the number of company-years used in tests of the five-year growth measure decreases to 27,925, our sample continues to be large and comprehensive.

Table 1 reports descriptive statistics for the sample. Note that the medians of earnings growth observations, *EG*, range from 12.6 percent (one-year growth measure) to 9.7 percent (five-year growth measure). Table 1 also shows that the median dividend payout of 33.2 percent is subject to considerable variation among companies. *Payout* at the 75th percentile is more than twice *Payout* for the 25th percentile. With respect to the other variables, the characteristics of the sample companies are similar to those of dividend-paying companies as reported by Fama and French (2001).

Table 1. Descriptive Statistics

Variable	Mean	Standard Deviation	25th Percentile	Median	75th Percentile
A. Dependent variables					
EG(0,1)	0.215	0.732	–0.074	0.126	0.324
EG(0,3)	0.113	0.256	–0.022	0.102	0.224
EG(0,5)	0.099	0.170	0.006	0.097	0.187
B. Independent variables					
Payout	0.398	0.314	0.197	0.332	0.506
Size	5.058	2.026	3.558	4.906	6.413
ROA	0.074	0.042	0.044	0.067	0.096
Leverage	0.465	0.174	0.340	0.468	0.588
E/P	0.105	0.068	0.059	0.087	0.132
PEG(–1,0)	0.260	0.851	–0.059	0.134	0.341
PEG(–3,0)	0.142	0.276	–0.006	0.115	0.244
PEG(–5,0)	0.123	0.179	0.021	0.110	0.206

Results

We first examine the univariate association between current payout and past and future earnings growth. Then, we analyze the relationship between payout and future earnings growth by using multivariate regressions.

Univariate Analysis. For the univariate association between current payout and past and future earnings growth, the cross-correlation matrix in **Table 2** shows Pearson product-moment correlation coefficients between current payout and past and future earnings growth over one-, three-, and five-year observation periods.

Table 2 shows a negative correlation between past and future earnings growth, indicating mean reversion in the growth of earnings. Note also the strong, positive association between current payout and one-, three-, and five-year-ahead earnings growth. The data reveal an even stronger negative correlation, however, between payout and past earnings growth.

Overall, the data suggest that companies with high current dividend payouts tend to have high future earnings growth but relatively low past earnings growth. Because earnings growth tends to revert to the mean, the positive relationship between payout and future earnings growth may be explained by the low past earnings growth of high-payout companies. We controlled for this possibility in our multivariate analysis.

Multivariate Analysis. Regression results for the multivariate analysis for each of the three earnings-growth observation periods are in **Table 3**. Using the Fama and MacBeth (1973) procedure, we estimated regression coefficients for each year to control for cross-sectional dependence. Thus, all reported coefficients are averages of yearly regressions. Note that the coefficients on *Payout* are all positive and highly significant for all three measurement periods.

In Table 3, the control variables are generally highly significant and exhibit the expected relationships with future earnings growth. On the one

Table 2. Correlations between Dividend Payout, Past Earnings Growth, and Future Earnings Growth

	Payout	*PEG*(–5,0)	*PEG*(–3,0)	*PEG*(–1,0)	*EG*(0,1)	*EG*(0,3)	*EG*(0,5)
Payout	1.000	–0.495	–0.457	–0.209	0.248	0.214	0.162
PEG(–5,0)		1.000	0.554	0.144	–0.218	–0.190	–0.164
PEG(–3,0)			1.000	0.228	–0.199	–0.190	–0.155
PEG(–1,0)				1.000	–0.052	–0.072	–0.061
EG(0,1)					1.000	0.509	0.383
EG(0,3)						1.000	0.646
EG(0,5)							1.000

Note: All correlation coefficients are significant at the 1 percent level.

Table 3. Future Earnings Growth as a Function of Dividend Payout

	One-Year *EG*		Three-Year *EG*		Five-Year *EG*	
Variable	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
Intercept	0.283	6.79***	0.103	6.63***	0.061	7.15***
Payout	0.537	12.45***	0.167	12.96***	0.083	10.31***
Size	–0.029	–7.48***	–0.012	–9.92***	–0.007	–7.90***
ROA	–2.388	–10.54***	–0.974	–11.71***	–0.646	–11.30***
E/P	–1.537	–9.41***	–0.695	–11.97***	–0.468	–11.16***
Leverage	0.077	2.22**	0.065	5.35***	0.058	9.12***
PEG	0.012	0.089	–0.083	–5.90***	–0.118	–10.12***
AG	0.873	14.13***	0.996	29.67***	1.011	39.61***
Adjusted R^2		19.96%		31.59%		36.41%

Note: The reported *t*-statistics and adjusted R^2s are based on the Fama–MacBeth procedure.

*Significant at the 10 percent level in a two-tailed test.
**Significant at the 5 percent level in a two-tailed test.
***Significant at the 1 percent level in a two-tailed test.

hand, large companies, companies with higher current profitability, and companies with higher earnings yields tend to have lower future earnings growth. On the other hand, leverage and asset growth are positively associated with future earnings growth. The past earnings growth variable is negative and highly significant for the three- and five-year growth measures. To the extent that our control variables capture the determinants of earnings growth, Table 3 shows that, after consideration of possible mean reversion and other factors, companies with high current payouts tend to realize high future earnings growth.

Earlier, we noted that because the results of time-series studies that use long observation periods can be influenced by the effects of survivorship, these results may not apply to Compustat companies in general. Although our examination of five-year growth with provision for past earnings growth required 11 annual observations, the data show that the tenor of results is essentially the same as for the one-year growth measure. Therefore, the results do not appear to be materially influenced by survivorship considerations.

We provided for the effects of mean reversion by including a past earnings growth variable, as Arnott and Asness did. Our basic procedure used the same observation period for past and future earnings growth. For example, in the examination of five-year future growth rates, the variable for past earnings growth also represented five years. But growth cycles need not be symmetrical. For example, earnings may decrease for one year or three years, then increase for five years. To examine the effects of nonuniform earnings cycles, we repeated the tests and controlled for all three *PEG* measures. For example, for the three-year-ahead growth regression, in addition to the three-year *PEG* measure, we included *PEG* measures for one and five years. The results of our tests (not reported) were essentially the same as those reported here.

The Fama–MacBeth approach we used entails estimating the regression separately for each year and reporting the average of the annual coefficients. The statistical significance of the average coefficient is based on the assumption that the annual coefficients are normally distributed. If the normality assumption is violated, the validity of the statistical significance reported is subject to question. Therefore, we used the Shapiro–Wilk test to determine whether the annual coefficients on *Payout*, the key independent variable, were normally distributed. We found that we could not reject the null hypothesis that the annual coefficients on *Payout* were normally distributed in any of the three (one-year, three-year, and five-year) regressions.[7]

We tested for potential nonlinearity in the relationship between dividend payout and future earnings growth by conducting a rank regression (nonparametric) test of Equation 1. For each year, we first sorted all dependent and independent variables into deciles. Then, we fitted the annual regressions by using decile ranks rather than numerical values of the continuous variables.

We found the coefficients (not reported) on *Payout* in our three rank regressions to be positive and statistically significant at the 1 percent level.[8] Thus, our rank regressions support our basic finding that payout is positively associated with future earnings growth.

The positive association between current dividend payout and future earnings growth is consistent with the aggregate results reported by Arnott and Asness. The data clearly show that on an individual-company level and after controlling for other influences, future earnings growth increases with payout.

Sensitivity Tests

Given the importance of these findings, we conducted a variety of sensitivity tests of the results. We considered alternative measures of earnings, small companies, regulated industries, an additional control for mean reversion in earnings, specific time periods, industry membership, and share repurchases.

Alternative Measures of Earnings. Because our payout measure included only common dividends, we also measured earnings as net income before extraordinary items and available to common shareholders (Compustat #237). Other common earnings measures that we considered are operating income before depreciation (Compustat #13) and income excluding extraordinary items (Compustat #18). We tested whether our results were sensitive to these alternative measures of earnings and found the results (not reported) to be essentially the same with all three measures.

Small Companies and Regulated Industries. Following Fama and French (2002), we originally omitted company-years from the sample in which the book value of equity was less than $250,000 or total assets were less than $500,000. We also omitted financial firms and utilities, which may have payout-to-earnings relationships different from those of other companies. When we relaxed these filters, we found almost no difference in results (not reported).

Additional Control for Mean Reversion in Earnings. Previously, we discussed the possibility that mean reversion in earnings growth could be contributing to our results. Although we controlled for mean reversion in earnings growth in Equation 1, we carried out additional tests for the role of mean reversion.

The first test focused on the subsample of companies for which mean reversion in earnings growth was not likely to explain our results. We sorted companies into four groups on the basis of past earnings growth and payout. With respect to earnings growth, we sorted observations according to low and high past earnings growth based on median values in Year 0. For *Payout*, we sorted observations into low and high current payout groups based on the Year 0 median payout. All sorts were done annually. The four groups are shown in **Exhibit 1**.

Exhibit 1. The Four Groups

1. Low Payout. Low Past Earnings Growth.	2. High Payout. Low Past Earnings Growth.
3. Low Payout. High Past Earnings Growth.	4. High Payout. High Past Earnings Growth.

If mean reversion is responsible for the results reported in Table 3, the association between payout and future earnings growth should be *negative* rather than positive for observations in Groups 1 and 4. For example, for Group 1, mean reversion in earnings growth would suggest that low-payout companies have high future earnings growth because past earnings growth is low. By the same reasoning, mean reversion in earnings growth would suggest that high-payout companies (Group 4) would have low future earnings growth. We fitted Equation 1 for companies in Groups 1 and 4 and found that the regression results (not reported) remained qualitatively unchanged.

We then conducted a second test that addressed the joint effects of past earnings growth/current payout on the payout–future growth relationship. For this test, we created two dummy variables to capture the effects of high or low past earnings growth and high or low current payout. The variable D^{PEG} was set to 1 if the company's past earnings growth (one-year, three-year, five-year) in year t was above the median past earnings growth of the same horizon in year t. Otherwise, the value was 0. Similarly, we set a variable D^{Payout} to 1 if the company's payout in year t was above the median payout in year t and set it to 0 otherwise. We then had the two dummy variables interact with all the independent variables in our main model. The expanded model is

$$EG_{0,t} = \alpha_0 + \sum \beta_i \mathbf{X} + \phi_0 D^{PEG} + \sum \phi_i D^{PEG}\mathbf{X} + \gamma_0 D^{Payout} + \sum \gamma_i D^{Payout}\mathbf{X} + e, \qquad (2)$$

where **X** is the vector of the independent variables in Equation 1 (that is, *Payout*, *Size*, *ROA*, *LEV*, *E/P*, *PEG*, and *AG*) and β_1, ϕ_1, and γ_1 are the coefficients for, respectively, *Payout*, $D^{PEG} \times$ *Payout*, and $D^{Payout} \times$ *Payout*.

The relationship between payout and future earnings growth is captured by $\beta_1 + \phi_1 D^{PEG} + \gamma_1 D^{Payout}$. This expression permitted us to examine the joint relationship between payout and future earnings growth for each of the four classifications of companies. For example, for companies with low past earnings growth and low payout, Group 1 in Exhibit 1, the relationship is captured by β_1 because both D^{PEG} and D^{Payout} equal 0. Similarly, for companies with high past earnings growth and low payout, Group 3 in Exhibit 1, the relationship is captured by $\beta_1 + \phi_1$ because $D^{PEG} = 1$ and $D^{Payout} = 0$.

Table 4 shows a positive relationship between payout and future earnings growth for nearly all groups and for all of the three growth measures. With the exception of observations in the low past earnings growth and low payout group (Group 1), these relationships tend to be highly significant.

Table 4. Extended Analysis of the Impact of Mean Reversion in Earnings Growth on the Relationship between Future Earnings Growth and Dividend Payout

	One-Year *EG*		Three-Year *EG*		Five-Year *EG*	
Classification	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
Group 1: Low payout and low *PEG* (β_1)	0.056	0.82	0.037	1.12	0.036	1.43
Group 2: High payout and low *PEG* ($\beta_1 + \gamma_1$)	0.551	8.78***	0.140	8.08***	0.071	6.33***
Group 3: Low payout and high *PEG* ($\beta_1 + \phi_1$)	–0.058	–1.01	0.072	2.61**	0.050	2.38**
Group 4: High payout and high *PEG* ($\beta_1 + \phi_1 + \gamma_1$)	0.437	7.79***	0.175	8.30***	0.086	6.78***

Notes: The regression is Equation 2. The coefficients and *t*-statistics reported are based on the Fama and MacBeth procedure.

*Significant at the 10 percent level in a two-tailed test.
**Significant at the 5 percent level in a two-tailed test.
***Significant at the 1 percent level in a two-tailed test.

Note also that, given past earnings growth (low or high), the relationship between payout and future earnings growth is generally more positive for high-payout companies. In addition, these results suggest that mean reversion in earnings growth is not the driving force behind our finding. Mean reversion in earnings growth would suggest that the coefficients for Group 3 would be generally smaller than those for Group 1. Similarly, the coefficients for Group 2 should be higher than those for Group 4, but Table 4 shows that, with the exception of one regression, the relationships are the opposite.

Specific Time Periods. We considered to what extent a single time period might be responsible for the results and whether the relationship between payout and future growth has changed over time. To address these issues, we used two approaches. First, we fitted Equation 1 for each of the five 10-year time periods in our sample beginning with the 1950s. Year 0 determined the classification by decade. The requirement of data for past earnings growth reduced the number of years included for the 1950s, and with respect to more recent years, we included data from 2000 to 2003 in the 1990s category.

Panel A of **Table 5** shows coefficients and *t*-statistics for *Payout* for each 10-year subperiod. Note that the relationships between earnings growth and payout are positive and generally significant. Thus, we have no reason to suspect that the results are attributable to any particular time period.

A second way to examine the temporal change in the relationship between payout and future earnings growth is to incorporate dummy variables for decades in Equation 1. Specifically, we created four

Table 5. Future Earnings Growth as a Function of Dividend Payout: Analysis by Decade

	One-Year *EG*		Three-Year *EG*		Five-Year *EG*	
Variable	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
A. Regressions for each decade						
Before 1960	0.287	1.87*	0.082	4.90***	0.058	1.85
1960–69	0.444	7.93***	0.109	3.68***	0.047	3.46***
1970–79	0.639	9.30***	0.231	10.10***	0.095	10.86***
1980–89	0.706	9.42***	0.219	9.27***	0.122	5.77***
After 1990	0.576	7.30***	0.166	9.63***	0.081	8.18***
B. Pooled regressions with time dummy variables						
Intercept	0.253	10.59***	0.111	12.78***	0.063	0.79***
Payout	0.727	28.87***	0.214	23.15***	0.116	18.62***
Size	–0.026	–12.99***	–0.013	–17.07***	–0.007	–14.29***
ROA	–2.370	–21.98***	–1.090	–26.69***	–0.761	–27.23***
E/P	–0.626	–9.91***	–0.358	–15.70***	–0.302	–19.98***
Leverage	–0.029	–1.09	0.025	2.55**	0.033	5.01***
PEG	0.023	4.40***	–0.089	–13.98***	–0.096	–14.85***
AG	0.798	41.78***	1.011	84.57***	0.984	98.82***
D50	–0.095	–2.14**	–0.042	–2.62***	–0.012	–1.11
D60	–0.054	–2.46**	–0.039	–4.95***	–0.021	–3.95***
D70	0.073	4.22***	0.015	2.45**	0.036	8.61***
D80	–0.025	–1.41	–0.008	–1.22	–0.004	–0.94
D50 × *Payout*	–0.280	–3.52***	–0.087	–3.02***	–0.035	–1.84*
D60 × *Payout*	–0.353	–8.36***	–0.079	–5.20***	–0.013	–1.28
D70 × *Payout*	–0.217	–6.14***	0.027	2.12**	–0.021	–2.43**
D80 × *Payout*	–0.006	–0.18	–0.016	–1.27	–0.005	–0.62
Adjusted R^2		17.05%		32.00%		35.62%

Notes: The regression for Panel A is Equation 1. All coefficients, *t*-statistics, and adjusted R^2s reported in Panel A are based on the Fama–MacBeth procedure. The regression for Panel B is Equation 3. All coefficients, *t*-statistics, and adjusted R^2s reported in Panel B are based on pooled ordinary least-squares estimations.

*Significant at the 10 percent level in a two-tailed test.
**Significant at the 5 percent level in a two-tailed test.
***Significant at the 1 percent level in a two-tailed test.

decade dummy variables: *D50*, *D60*, *D70*, and *D80*. The decade variable was coded 1 if the observation was in that decade and was coded 0 otherwise. We then had the four decade dummies interact with *Payout*. The expanded regression was

$$\begin{aligned} EG_{0,t} = {} & \alpha_0 + \beta_1 Payout + \beta_2 Size + \beta_3 ROA + \beta_4\, E/P + \beta_5 LEV \\ & + \beta_6 PEG_{-t,0} + \beta_7 AG_{0,t} + \beta_8 D50 + \beta_9 D60 + \beta_{10} D70 \\ & + \beta_{11} D80 + \beta_{12} D50 \times Payout + \beta_{13} D60 \times Payout \\ & + \beta_{14} D70 \times Payout + \beta_{15} D80 \times Payout + e. \end{aligned} \tag{3}$$

Panel B of Table 5 summarizes the results, two of which are particularly interesting. First, we found that earnings growth, on average, was weaker in the 1950s and 1960s than in the 1990s (including 2000–2003) but was stronger in the 1970s, as evidenced by the significantly negative coefficients on *D50* and *D60* and positive coefficient on *D70*. Second, and more importantly, we found generally negative interaction terms between decade dummies and *Payout* (except for the 1980s). Consistent with the results reported in Panel A of Table 5, these data reveal that the positive relationship between payout and future earnings growth has strengthened in recent years.

Industry Effects. Our results may be merely reflecting industry effects. If so, then after controlling for industry membership, if companies with high dividend payouts tend to concentrate in industries that experience higher earnings growth, we should not find a positive relationship between payout and high earnings growth. To examine this possibility, we applied two tests.

For the first test, we substituted industry-adjusted dividend payout for dividend payout in Equation 1. We calculated industry-adjusted payout as Adjusted payout = Payout – Median industry payout, where median industry payout is the median payout of dividend-paying companies with the same two-digit SIC code in a particular year.

Panel A in **Table 6** shows results of this analysis that are similar to those in Table 3. In fact,

Table 6. Future Earnings Growth as a Function of Dividend Payout with Control for Industry Effects

	One-Year *EG*		Three-Year *EG*		Five-Year *EG*	
Variable	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
A. Industry-adjusted payout						
Intercept	0.488	11.00***	0.165	11.16***	0.093	11.21***
Adjusted *Payout*	0.544	13.10***	0.158	13.44***	0.077	10.82***
Size	–0.026	–6.95***	–0.011	–9.22***	–0.006	–7.29***
ROA	–2.531	–11.11***	–1.018	–11.78***	–0.664	–11.35***
E/P	–1.592	–9.65***	–0.706	–12.43***	–0.473	–11.04***
Leverage	0.050	1.40	0.057	4.75***	0.054	8.49***
PEG	0.011	0.89	–0.092	–6.51***	–0.127	–11.12***
AG	0.859	13.95***	0.987	29.47***	1.006	38.90***
Adjusted R^2		19.91%		31.31%		36.24%
B. Industry dummy variables						
Intercept	0.248	4.92***	0.087	4.78***	0.045	3.51***
Payout	0.543	12.05***	0.165	13.25***	0.084	10.29***
Size	–0.030	–8.91***	–0.012	–10.45***	–0.007	–8.95***
ROA	–2.312	–10.90***	–0.925	–11.92***	–0.611	–11.05***
E/P	–1.711	–11.14***	–0.750	–13.83***	–0.500	–12.26***
Leverage	0.104	3.14***	0.076	6.42***	0.064	11.24***
PEG	0.010	0.79	–0.079	–5.71***	–0.114	–9.64***
AG	0.817	14.24***	0.960	30.07***	0.983	42.81***
Adjusted R^2		24.39%		36.30%		41.10%

Notes: The regression for Panel A is Equation 1, where *Payout* is "adjusted payout" (that is, Payout – Median industry payout). The regression for Panel B is Equation 4. Industry indicators have been omitted because with one for each industry, they are too numerous to show here and the specific industry relationships are not central to our analysis. All coefficients, *t*-statistics, and adjusted R^2s reported are based on the Fama–MacBeth procedure.

*Significant at the 10 percent level in a two-tailed test.
**Significant at the 5 percent level in a two-tailed test.
***Significant at the 1 percent level in a two-tailed test.

the Panel A significance levels for *Payout* are somewhat higher with the industry-adjusted payout variable included.

The second test of industry effects was to include dummy variables for industry membership in the regression. To avoid singularity, we created dummy variables for all but one industry. The expanded regression was

$$EG_{0,t} = \alpha_0 + \beta_1 Payout + \beta_2 Size + \beta_3 ROA + \beta_4\, E/P + \beta_5 LEV + \beta_6 PEG_{-t,0} + \beta_7 AG_{0,t} + \sum \phi_i IND_i + e, \quad (4)$$

where IND_i is a dummy variable that equaled 1 if the company belonged to industry i (defined by a two-digit SIC code) and equaled 0 otherwise.

The results, given in Panel B of Table 6, are similar to those reported in Panel A. Specifically, the coefficients on *Payout* remain strong and significant for all three growth measures. Therefore, our primary results do not seem to be driven by industry effects.

Share Repurchases. Share repurchases have become a popular and important way to distribute cash since the 1980s. For example, Allen and Michaely (2003) reported that in 1979, the aggregate payout through share repurchases was only about 4 percent of earnings but the percentage increased to more than 48 percent in 1998. Because of the dramatic increases in both the magnitude and frequency of share repurchases in recent years, Allen and Michaely, among others, emphasized the desirability of considering repurchases in tests that relate to corporate dividend payouts. We considered the sensitivity of our results to repurchases by examining the relationships between earnings growth and three measures of payout—dividend payout (as previously defined), repurchase payout, and total payout.

Repurchase payout is defined as the ratio of common stock repurchases to earnings. Total payout is the sum of dividend payout and repurchase payout. Following Grullon and Michaely (2002), we measured the dollar amount of a company's common stock repurchases as the dollar amount of its total stock repurchases (Compustat #115) minus the change in redemption value of the preferred shares outstanding (Compustat #56). Because share repurchases were not common until the 1980s, our tests incorporated observations beginning in 1980. To separate the effects of dividend payouts and share repurchases, the sample of dividend-paying companies in this test included only companies that paid dividends and did *not* repurchase shares in Year 0. Similarly, only companies that repurchased shares and did *not* pay regular dividends in Year 0 were included in the repurchase sample.

The results of this analysis are presented in **Table 7**. We found that the payout–future growth relationship continues to be strong after explicit consideration of share repurchases. Specifically, total payout is positively related to future earnings growth in all three regressions. For the companies that paid dividends and did not repurchase shares, dividend payout is strongly and positively associated with future earnings growth for all three growth measurement periods. Repurchase payout is also positively related to future earnings growth, but the significance levels, although high, are somewhat lower than for the other payout measures. Collectively, Table 7 indicates that (1) total current payout is positively related to future earnings growth and (2) the relationship is stronger for dividends than for share repurchases.

Table 7. Future Earnings Growth as a Function of Dividend Payout: Alternative Measures of Payout

	One-Year *EG*		Three-Year *EG*		Five-Year *EG*	
Variable	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
Total payout	0.246	9.35***	0.060	8.96***	0.035	6.06***
Dividend payout	0.600	8.75***	0.183	10.43***	0.090	5.60***
Repurchase payout	0.149	6.22***	0.030	4.58***	0.009	1.96*

Notes: The regression is Equation 1 with *Payout* measured as total payout, dividend payout, and repurchase payment. Only the coefficients for the alternative measures of *Payout* are shown. All coefficients, *t*-statistics, and adjusted R^2s reported are based on the Fama–MacBeth procedure.

*Significant at the 10 percent level in a two-tailed test.
**Significant at the 5 percent level in a two-tailed test.
***Significant at the 1 percent level in a two-tailed test.

Potential Explanation: Free Cash Flow Theory

What explains the positive relationship between current payout and future earnings growth? Arnott and Asness suggested that the positive current payout–future growth relationship is consistent with free cash flow theory. As described by Jensen (1986) and others, free cash flow theory suggests that the managers of companies with abundant free cash flows have incentives to overinvest. Thus, the low dividend–low growth relationship may be a result of overinvestment on the part of low-payout companies.

In one test of the free cash flow theory, Lang and Litzenberger (1989) examined stock returns associated with announcements of dividend changes. They found, after they held the magnitudes of dividend increases constant, that companies with limited growth opportunities experience larger share price increases. Lang and Litzenberger interpreted these results as consistent with free cash flow theory; that is, the stronger market reactions for the low-growth companies indicate that the reduction in agency costs through dividend increases is larger for companies with limited growth opportunities.

To test for the operation of free cash flow theory in this context, we followed Fama and French (2002) and adopted as a proxy for growth opportunities the ratio of the company's market value of equity and book value of debt to the book value of its assets, *V/A*. The variable *V/A* is a rough proxy for Tobin's *q* that has been used in numerous studies, including Lang and Litzenberger. Higher *V/A* indicates greater growth opportunities and hence fewer free cash flow problems. If the positive relationship between dividend payout and future earnings growth is a result, at least in part, of the reduction of agency costs through dividend payout, this relationship should be stronger for companies with limited growth opportunities because those companies have higher agency costs associated with abundant free cash flows.

Our main interest was with the interaction between *V/A* and *Payout*—that is, *V/A* × *Payout*. If free cash flow theory is operative, we would expect the coefficient on *V/A* × *Payout* to be negative. A negative coefficient on the interaction term would suggest that when growth opportunities are limited, the positive relationship between payout and future earnings growth is more prominent than when growth opportunities are plentiful. The revised model is

$$\begin{aligned} EG_{0,t} = {} & \alpha_0 + \beta_1 Payout + \beta_2 Size + \beta_3 ROA + \beta_4\, E/P \\ & + \beta_5 LEV + \beta_6 PEG_{-t,0} + \beta_7 AG \\ & + \beta_8\, V/A \times Payout + e, \end{aligned} \tag{5}$$

where V is the market value of equity (Compustat #25 × Compustat #199) plus the book value of debt (Compustat #181 – Compustat #35) plus preferred stock (Compustat #10) and A represents book value of total assets (Compustat #6).

Table 8 reports the results of this analysis. The relationship between payout and future earnings growth continues to be strong despite the introduction of the *V/A* and *V/A* × *Payout* variables. As expected, *V/A*, the proxy for growth opportunities, is positively associated with future earnings growth. More importantly, *V/A* × *Payout* has the predicted negative coefficient for the one- and three-year growth measures. These results indicate that when growth potential is low, the association between payout and earnings growth is strong, a relationship that is consistent with free cash flow theory.

Conclusion

We reported on the relationship between current dividend payout and future growth in earnings at the individual-company level. Our study was motivated by the Arnott–Asness analysis of the market-wide relationship between current dividend payout and future growth in earnings. Arnott and Asness found that high aggregate current payout is associated with high, rather than low, aggregate future earnings growth.[9]

We examined a large sample of companies over a 50-year time period. Our tests included controls for mean reversion in earnings and other variables that have been posited to explain earnings growth. We found a strong, positive association between current dividend payout and future earnings growth. These results are robust to (1) alternative measures of earnings, (2) additional controls for mean reversion in earnings, (3) various subperiods, (4) consideration of industry effects, and (5) the influence of share repurchases. We also found that, consistent with free cash flow theory, the positive relationship between dividend payout and future earnings growth is more prominent for companies with limited growth opportunities or a tendency toward overinvestment.

Our company-level analysis complements the aggregate-level analysis of Arnott and Asness. Both studies found that high payout is related to high future earnings growth and thereby challenge conventional wisdom. The Arnott–Asness results bear on the valuation of the overall market, and our results shed light on the valuation of individual stocks.

Table 8. Future Earnings Growth as a Function of Dividend Payout with Control for the Influence of Growth Opportunities

	One-Year *EG*		Three-Year *EG*		Five-Year *EG*	
Variable	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
Intercept	0.117	2.33**	0.068	4.06***	0.050	5.14***
Payout	0.791	10.28***	0.220	10.72***	0.089	6.84***
Size	–0.034	–9.46***	–0.014	–11.79***	–0.008	–9.23***
ROA	–4.474	–13.83***	–1.650	–14.80***	–1.121	–14.76***
E/P	–0.368	–2.79***	–0.328	–5.03***	–0.219	–4.67***
Leverage	–0.035	–1.07	0.028	2.22**	0.033	4.52***
PEG	–0.002	–0.15	–0.093	–6.53***	–0.126	–9.99***
AG	0.802	12.93***	0.949	28.74***	0.972	39.83***
V/A	0.211	11.30***	0.059	11.45***	0.0.29	7.37***
V/A × *Payout*	–0.188	–5.39***	–0.042	–4.92***	–0.005	–0.88
Adjusted R^2		22.10%		32.90%		37.49%

Notes: The regression is Equation 5. All coefficients, *t*-statistics, and adjusted R^2s reported are based on the Fama–MacBeth procedure.

*Significant at the 10 percent level in a two-tailed test.
**Significant at the 5 percent level in a two-tailed test.
***Significant at the 1 percent level in a two-tailed test.

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This article qualifies for 1 PD credit.

Notes

1. Arnott and Asness (2003) provided a numerical example for this argument (pp. 70–71). They also pointed out that the intertemporal argument is, in fact, an extrapolation of Miller and Modigliani's theorem.
2. Compustat does not provide book value of equity (Compustat #60) for most companies before 1960. For those companies, we measured leverage as total liability (Compustat #181) divided by total assets (Compustat #6).
3. Interestingly, Arnott and Asness showed that after controlling for dividend payout, aggregate earnings yield was at best weakly negatively related to aggregate future earnings growth. Nevertheless, we included *E/P* in our regression because the negative association between *E/P* and future earnings growth is strongly motivated by theory.
4. For example, when we examined five-year-ahead earnings growth, the first year we examined was 1955 and the last year we examined was 1998 because we needed data to calculate earnings growth for the past and future five years surrounding the event year. In contrast, when we examined one-year-ahead earnings growth, the first year we examined was 1951 and the last year was 2002 because we needed data only for the years immediately before and after the event year.
5. Negative dividend payout has no clear economic meaning. This requirement only slightly reduced the number of sample companies because only about 1 percent of companies that pay dividends in a particular year also report losses.
6. Removing companies in the top 2 percent or top 0.5 percent of the dividend-payout distribution did not qualitatively alter our results. Also, our results held when we removed companies with the lowest 1 percent of positive dividend payout.
7. The Shapiro–Wilk *W* statistic equaled 0.992, 0.980, and 0.988, respectively, for the one-year, three-year, and five-year regressions, with respective *p*-values of 0.97, 0.57, and 0.91.
8. The coefficients on *Payout*, which are all significant at the 1 percent level, are 0.073, 0.064, and 0.041 for, respectively, the one-, three-, and five-year growth periods.
9. We also considered whether high payout is associated with high future growth in sales. Rozeff found that companies with strong *expected* sales growth tend to have lower dividend payouts. We are not aware of any empirical evidence on the relationship between dividend payout and *actual* sales growth. To examine this issue, we substituted sales growth (both past and future) for earnings growth in Equation 1 and found no significant association between payout and future sales growth. Thus, the results suggest that companies pay lower dividends in expectation of higher sales growth but do not necessarily enjoy higher actual sales growth.

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International Evidence on the Payout Ratio, Earnings, Dividends, and Returns

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International Evidence on the Payout Ratio, Earnings, Dividends, and Returns

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Recent evidence for the U.S. market has shown that, contrary to popular wisdom, the greater the proportion of earnings paid out as dividends, the greater the subsequent real earnings growth. This study extends previous work by examining whether a similar relationship exists in 11 international markets and by considering the role the payout ratio plays in explaining future real dividend growth and returns. Higher payout ratios do indeed lead to higher real earnings growth—but not to higher real dividend growth. This information has limited use, however, for predicting future returns.

Arnott and Asness (2003; hereafter A&A) established the somewhat surprising finding that higher aggregate dividend-payout ratios in the United States are associated with higher future earnings growth. This finding supports theories that view dividends as signals for earnings expectations. We have extended the work of A&A and others in two main ways:

- We investigated whether similar findings are evident in 11 major international markets.
- We extended the analysis to the relationship between the payout ratio and returns, which we believe to be important because returns are the ultimate focus of portfolio managers and investment strategists.

Although the payout ratio has long been of importance to corporate finance researchers (e.g., Lintner 1956), it has been relatively neglected in the asset-pricing and prediction literature (see McManus, ap Gwilym, and Thomas 2004; ap Gwilym, Seaton, and Thomas, forthcoming 2005)—despite market fascination with investment strategies based on dividends and earnings (e.g., the "Dow 10" strategy).[1] A&A redressed this omission in the literature by examining the aggregate payout ratio for U.S. stocks since 1871 and its relationship to subsequent 10-year real earnings growth. They found a positive coefficient on the payout ratio in a simple linear regression for a variety of subperiods and suggested that the low payout ratio of 2001 would lead to low earnings growth in the following decade. In their analysis of 5-year earnings growth and a rolling 30-year period, they found that these results are robust.

Because dividends are "stickier" (more stable over time) than earnings, A&A also examined whether the phenomenon is actually reflecting mean reversion in earnings; a transient drop in earnings would raise the payout ratio and signal a future rebound in earnings, implying that dividend policy is not really useful as a predictor. They tested this question empirically by including past real earnings growth in the regression, but the hypothesis that the payout ratio is reflecting mean reversion in earnings was comprehensively rejected. Other possible predictor market variables (such as the yield-curve slope and earnings yield) were included, but the inference remained the same: A high payout ratio is associated with high subsequent earnings growth.

Market strategists are also paying more attention to dividends and payout ratios as the markets enter an era that many believe may be unexciting for equities (see Perkins and Gavrina 2004). With the global dividend yield declining from more than 5 percent in the 1980s to less than 2 percent by the late 1990s and with the payout ratio peaking in the early 1990s but currently low, investors are being reminded of the importance of dividends to long-run total returns. Low payout ratios at least

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allow the possibility, other things being equal, of payment hikes.

A primary focus of this article is whether the U.S. findings extend to other countries. A&A suggested that their findings

> conform to a world in which managers possess private information that causes them to pay out a large share of earnings when they are optimistic . . . and to pay out a small share when they are pessimistic. . . . Alternatively, the facts also fit a world in which low payout ratios lead to . . . inefficient empire building. (p. 84)

Given the different managerial cultures, financial market histories, and corporate and individual tax regimes of countries, we believed, before our study, that to discover the U.S. findings repeated in other countries would be quite remarkable.[2]

In assessing the historical evidence that expected future earnings growth is fastest when the current payout ratio is high and slowest when the payout ratio is low, A&A applied the Miller and Modigliani (1961) "dividend irrelevance" theorem, which states that the value of a firm is completely independent of the proportion of earnings retained by that firm. Miller and Modigliani's work established that in a frictionless world, when the investment policy of a firm is held constant, its dividend-payout policy has no consequences for shareholder wealth. Nevertheless, Lintner found that companies follow deliberate dividend-payout strategies.

Several explanations of this dividend puzzle have been suggested. One popular theory is that companies can signal future profitability by paying dividends (Bhattacharya 1979). Recent evidence on this proposition is mixed; DeAngelo, DeAngelo, and Skinner (1996) and Bernartzi, Michaely, and Thaler (1997) showed that current dividend changes do not help predict companies' future earnings growth. Another viewpoint is that dividend policies address agency problems between corporate insiders and outside shareholders. La Porta, Lopez-de-Silanes, Shleifer, and Vishny (2000) analyzed two models designed to address this issue. In the "outcome" model, the hypothesis was that dividends are paid because minority shareholders pressure corporate insiders to pay out cash; hence, strong minority rights should be associated with higher payouts. In the "substitute" model, insiders interested in issuing equity in the future pay dividends to establish a reputation for decent treatment of minority shareholders; hence, strong shareholder protection may mean high payouts are not required to establish credibility. In other words, the quality of shareholder protection is seen as a proxy for agency costs. La Porta et al. found that dividend policies vary across countries in a way consistent with the outcome agency model. They devised a shareholder rights table (see La Porta et al. 1998) in which the "common law" countries of the United States and the United Kingdom scored high on shareholder protection. Among the "civil law" countries, Italy and Germany scored at the bottom; Greece, Switzerland, and the Netherlands scored somewhat better, followed by Portugal and France, and then, Spain and Japan.

Data and Methodology

We studied 11 countries: France, Germany, Greece, Italy, Japan, the Netherlands, Portugal, Spain, Switzerland, the United Kingdom, and the United States. They were chosen on the basis of availability of data from the 30 countries in the Organization for Economic Cooperation and Development to represent the industrialized world.

The data required for each country were monthly values of dividend yield, earnings yield, a retail price index or consumer price index (as appropriate), and the stock market index level. The source was Datastream.

For each country, we chose an index to represent the country's aggregate equity market. To facilitate comparisons with the A&A findings, we used the S&P 500 Index for the United States. For Germany, we used the DAX 30 because the total market index lacked some earnings yield data. We encountered the same problem for Spain, so we used the MADRIDZ. For the rest of the countries, we used a total market index. For the United Kingdom and the United States, we had observations from January 1965 through December 2004, whereas for France, Germany, Japan, the Netherlands, and Switzerland, observations begin with January 1973. Italy's first month of data is January 1986, and Spain's is January 1987. Observations for both Greece and Portugal start in 1990. All observations end in December 2004.

Following the procedure of A&A, we used the earnings yield series to estimate a history of 12-month trailing earnings in index points for each country. First, the earnings yield series was multiplied by the price series. To obtain a real earnings series, the earnings series was divided through by the retail price index. The same process was applied to the dividend yield to create a real dividend series. The payout ratio was defined as the ratio of one-year trailing dividends to one-year trailing earnings. An important issue with these indices is that their composition will vary over time. A&A pointed out that the aggregate EPS series is not the same as the earnings growth on a static portfolio. Higher-performing stocks will replace lower-performing stocks in the index, and each time rebalancing occurs to account for new listings, the divisor of the index will increase. This process causes the total earnings of the index as well as EPS to decrease; the end result is that EPS cannot keep pace with the growth experienced by the economy as a whole (GDP growth).

We also constructed, in accord with the method used by Fama and French (1998), a return series for each country's index. We assumed that dividends were reinvested at the end of 12-month periods for all return periods in excess of one year. The formula for calculating the return on the index was

$$R_n = \left[\frac{P_2\left(1+d_2\right)}{P_1}\right] - 1,$$

where R_n is the nominal 12-month return, P_1 and P_2 are the price levels at, respectively, the beginning and end of the 12-month period, and d_2 is the dividend yield at the end of the period expressed as a decimal. We then calculated the real return series by subtracting the change in inflation over the period from the nominal return. Return horizons of 1, 5, and 10 years were used.

Because of the differing periods for which data were available by country, the study focused on three periods of matched data. The United Kingdom and the United States, which had the most observations available, are in three time periods: 1965–2004 (Period 1), 1973–2004 (Period 2), and 1990–2004 (Period 3). France, Germany, Japan, the Netherlands, and Switzerland are in the last two time periods. The remaining countries—Greece, Italy, Portugal, and Spain—are only in the last period. For the longest time period, we estimated rolling 10- and 5-year regressions. Thus, for example, those regressions on the U.K. Total Market Index are of the 10-year and 5-year real earnings growth (REG) or real dividend growth (RDG) regressed on the payout ratio (PR) for the period 1965–2004. For the second time period, 1973–2004, 5-year REG, RDG, or real returns were used. For example, for France, we regressed 5-year real returns on the payout ratio to investigate the relationship between those two variables over the 1973–2004 period. (Both the 10-year and 5-year periods are consistent with the approach of A&A.) For the last time period, 1990–2004, we used 1-year real returns, REG, or RDG as the dependent variable.

We investigated the explanatory power of the following variables: the payout ratio, the dividend yield, the earnings yield, lagged dividend growth, and lagged earnings growth. For the lagged variables, in the first time period, we lagged real earnings or dividend growth by 10 years and 5 years, whereas for the second time period, we used 5-year lags.

We ran these regression models for all the countries. As additional tests, for 1973–2004 and 1990–2004, we also created "World" indices—both equally weighted and value weighted—that included all of the countries in our sample for a particular period. The value-weighted series were created by assigning a set of weights based on each country's market value expressed in U.S. dollars.[3] All returns for these indices were calculated from the perspective of a U.S. dollar investor.

The summary statistics computed for the payout ratio for all countries for the three time periods are displayed in **Table 1**. Panel A reveals that for the longest period, the United Kingdom had higher maximum, minimum, mean, and median payout ratios than the United States. Although the differences are not substantial, this finding confirms that a culture of paying dividends is more evident in the United Kingdom than in the United States. The compound annual real growth in earnings and dividends in the United States and the United Kingdom is similar.

Panel B presents the same statistics and growth rates for the 1973–2004 period and includes the equal-weighted World index (EW) and value-weighted World index (VW) for the seven countries. The mean payout ratio ranges from 0.27 for Switzerland to 0.53 for the United Kingdom. The highest maximum payout ratio is, again, for the United Kingdom, and the lowest minimum value for the ratio is for Switzerland. The median payout ratios range from 0.27 to 0.54, with Switzerland's noticeably lower than the others. Japan has the lowest compound annual real growth in dividends and earnings. France has the highest annual real growth rate in earnings and dividends in this sample. The equal-weighted World index has higher growth rates than the value-weighted index, reflecting outperformance of the smaller markets.

Panel C details the findings for the 1990–2004 period—with four new countries added to those of Panel B. As in Panels A and B, the United Kingdom has the highest mean and maximum payout ratios. Portugal has the lowest minimum payout ratio. The mean and median payout ratios have similar ranges. The data indicate that all the countries except Japan had positive earnings growth over the 1990–2004 period. The positive growth rates range from 1.00 percent (Portugal) to 8.95 percent (Greece). Dividend growth was also positive—except for the United Kingdom. Dividend growth rates for the remaining markets varied from 0.21

Table 1. Summary Statistics

	Payout Ratio				Compound Annual Real Growth	
Country	Max.	Min.	Mean	Median	Earnings	Dividend
A. 1965–2004						
United Kingdom	0.83	0.33	0.56	0.58	2.26%	1.17%
United States	0.77	0.29	0.50	0.49	2.22	1.14
B. 1973–2004						
France	0.69	0.29	0.45	0.45	5.75%	4.85%
Germany	0.69	0.21	0.38	0.37	4.40	0.90
Japan	0.52	0.26	0.38	0.38	0.43	–0.68
Netherlands	0.61	0.29	0.48	0.48	4.01	2.94
Switzerland	0.44	0.20	0.27	0.27	2.80	3.18
United Kingdom	0.83	0.33	0.53	0.54	2.25	1.46
United States	0.77	0.29	0.49	0.46	2.69	1.53
EW7	0.52	0.35	0.43	0.42	3.94	2.28
VW7	0.60	0.34	0.45	0.44	2.72	1.30
C. 1990–2004						
France	0.57	0.32	0.44	0.44	3.66%	7.03%
Germany	0.48	0.21	0.32	0.31	2.87	1.29
Greece	0.61	0.12	0.39	0.43	8.95	12.78
Italy	0.69	0.25	0.46	0.49	1.87	4.11
Japan	0.52	0.26	0.39	0.38	–0.35	0.21
Netherlands	0.61	0.40	0.50	0.50	4.48	3.99
Portugal	0.68	0.02	0.45	0.47	1.00	3.72
Spain	0.55	0.31	0.42	0.42	2.23	2.91
Switzerland	0.44	0.21	0.28	0.27	5.45	6.83
United Kingdom	0.83	0.45	0.61	0.60	1.02	–0.02
United States	0.77	0.29	0.49	0.44	4.00	1.92
EW11	0.50	0.35	0.43	0.43	5.28	4.45
VW11	0.59	0.34	0.46	0.44	2.87	2.06

percent (Japan) to 12.78 percent (Greece). Consistent with the findings in Panel B, the EW11 had higher growth rates than the VW11.

Although the average payout ratios do not rank the country markets precisely according to the rankings by agency problems reported by La Porta et al. (2000), and indeed agency issues were not the main focus of the present study, the general consistency between payout ratios and lack of agency problems cannot be ignored. The United Kingdom and the United States have high payouts, whereas Greece, Switzerland, and Germany have low shareholder protection and low payouts. The patterns for the remaining countries are less clear.[4]

Regression Results

In this section, we report our findings on the relationships between the dividend-payout ratio and earnings growth, dividend growth, and equity market returns.

Payout Ratio and Earnings Growth. Table 2 demonstrates the extent to which PR can explain subsequent REG, in each of the three data periods, for 10-year, 5-year, or 1-year subsequent earnings growth. In Panel A, coefficients on the PR variable are positive with some statistical significance. This result is consistent with A&A but inconsistent with the "traditional" view that higher retention of earnings leads to higher subsequent growth. The explanatory power of the U.S. regressions, with adjusted R^2 values of 28.3 percent and 40.4 percent, is reasonable; the R^2 values for the United Kingdom are markedly lower.

In Panel B, as in Panel A, all the PR coefficients are positive; all but the coefficient for Germany are significant. The explanatory power of the regressions, however, differs considerably. France, Japan, the United States, and the value-weighted World index have reasonably high adjusted R^2 values, but the remaining countries (particularly Germany, the Netherlands, and Switzerland) do not.

Table 2. Subsequent Real Earnings Growth as a Function of Payout Ratio (t-statistics in parentheses)

Country	Constant	PR	Adjusted R^2
A. 1965–2004			
10-year subsequent real earnings growth			
United Kingdom	0.00	0.03	7.8%
	(0.33)	(2.31)	
United States	–0.08	0.19	28.3
	(–3.61)	(4.07)	
5-year subsequent real earnings growth			
United Kingdom	–0.05	0.13	17.4%
	(–2.59)	(3.70)	
United States	–0.21	0.45	40.4
	(–5.70)	(6.22)	
B. 1973–2004: 5-year subsequent real earnings growth			
France	–0.13	0.42	25.9%
	(–4.02)	(5.95)	
Germany	0.02	0.06	0.3
	(0.68)	(0.88)	
Japan	–0.20	0.52	31.7
	(–4.80)	(5.18)	
Netherlands	–0.03	0.16	5.4
	(–0.93)	(2.01)	
Switzerland	–0.12	0.57	8.6
	(–2.95)	(3.80)	
United Kingdom	–0.06	0.15	17.8
	(–2.68)	(3.49)	
United States	–0.23	0.51	49.3
	(–7.30)	(8.25)	
EW7	–0.18	0.49	18.6
	(–3.17)	(3.76)	
VW7	–0.29	0.67	55.9
	(–9.66)	(10.28)	
C. 1990–2004: 1-year subsequent real earnings growth			
France	–0.89	2.15	42.0%
	(–7.61)	(7.96)	
Germany	–0.07	0.36	0.6
	(–0.33)	(0.57)	
Greece	0.05	0.08	–0.5
	(0.33)	(0.23)	
Italy	0.08	–0.09	–0.3
	(0.80)	(–0.38)	
Japan	–0.40	1.01	14.6
	(–3.85)	(4.02)	
Netherlands	–0.63	1.34	15.6
	(–2.71)	(2.81)	
Portugal	–0.63	1.46	25.1
	(–4.75)	(4.63)	
Spain	–0.18	0.48	4.6
	(–1.29)	(1.36)	
Switzerland	–0.36	1.49	9.4
	(–1.46)	(1.65)	
United Kingdom	–0.26	0.45	8.2%
	(–2.44)	(2.59)	
United States	–0.36	0.88	13.3
	(–2.40)	(2.84)	
EW11	–0.35	0.90	6.7
	(–1.76)	(1.96)	
VW11	–0.55	1.28	17.3
	(–2.72)	(2.77)	

The results shown in Panel C of Table 2 are consistent with those of the previous panels: All of the markets except Italy display positive PR coefficients. Again, the explanatory power varies from country to country, with Germany, Greece, Italy, and Spain having particularly low values. Overall, across various earnings growth horizons and for a number of countries, the evidence clearly points to the existence of a positive relationship between payout ratios and real earnings growth.

As an additional test of the relationship between the two, we considered whether countries with higher payout ratios deliver higher subsequent real earnings growth. **Table 3** shows the REG experienced by an investor who at the beginning of each year ranked the seven individual markets available between 1973 and 2004 according to PR and invested in the same ranking each year. For example, rank #1 captures the REG of an investment in the lowest-PR country at the beginning of each annual period and rank #7 represents an investment in the highest-PR country each year. The results show that investing in a country with a high PR leads to higher REG than does investing in low-PR markets, but the relationship is not monotonic. The final column of Table 3 shows that the average annual difference between investing in the highest-PR and the lowest-PR markets was 5.3 percentage points (pps), although this difference was significant only at the 90 percent level. If an investor had taken a 50 percent long position in each of #6 and #7 and a 50 percent short position in each of #1 and #2, however, the REG difference would have been 5.6 pps, which, with a t-statistic of 2.28, would be significant at the 95 percent level.

The ability to explain future earnings growth may be improved by introducing the overall valuation of the aggregate stock market into the model. For example, at the individual stock level, Barth, Elliott, and Finn (1999) found that companies with track records of consistent earnings growth achieve higher P/E multiples than companies with patchy earnings records. The presumption is that

Table 3. Average Arithmetic Annual Real Earnings Growth for Markets Ranked Annually by Payout Ratio, 1973–2004

#1 (low PR)	#2	#3	#4	#5	#6	#7 (high PR)	#7 – #1
1.4%	0.7%	3.4%	5.9%	6.9%	6.7%	6.7%	5.3 pps (t-statistic = 1.84)

the market anticipates that the consistent performers will continue to deliver stellar earnings growth. Given that the aggregate market discounts future prospects, one would expect earnings yield to be negatively related to subsequent real earnings growth.

Table 4 presents results of regressions containing earnings yield (EY) and payout ratio at the beginning of each period as the explanatory variables for real earnings growth. Panel A indicates that the inclusion of EY generally produced a modest improvement over Table 2 in the explanatory power of the regressions for the United Kingdom and the United States. The predominance of negative coefficients for EY is consistent with the hypothesis. Despite the inclusion of EY, PR retains its positive coefficient, albeit with reduced statistical significance.

For the countries and period reflected in Panel B, the use of EY also raised adjusted R^2 values. The coefficients on EY are negative in five of the markets and are significant for France, Germany, and Switzerland. Again, PR retains a positive relationship with REG in all cases, with generally high levels of significance.

The impact of EY is most noticeable in the regressions reported in Panel C for all 11 markets. Compared with Table 2, a significant improvement in the explanatory power is notable. EY demonstrates strongly negative coefficients for most countries. PR has a positive coefficient for all markets except Greece and Italy and is statistically significant in seven country markets plus both World indices, although generally the results appear less conclusive than they are for the five-year regressions.

The implication of Table 4 is that the inclusion of EY does not detract in any meaningful way from the positive relationship previously observed between dividend-payout ratio and real earnings growth. This finding is consistent with the findings of A&A for the U.S. market. Regressions that contained earnings yield improved in explanatory power over those using PR alone, but the effect is most noticeable in the short (one-year) regressions.

A final possibility we considered is that the payout ratio may merely be proxying for depressed or inflated earnings (see A&A, p. 76). Dividends are generally considered to be a much smoother time series than earnings. Therefore, in recessionary periods, earnings may be low relative to dividends, resulting in a high PR, whereas in a period of high growth, the converse may be true. If mean reversion in earnings occurs, it would be consistent with our previous observation that a high payout ratio (i.e., low earnings) results in high subsequent earnings growth whereas a low payout ratio (i.e., high earnings) leads to low subsequent earnings growth. To attempt to test the idea that the payout ratio serves as a proxy for high/low earnings, we ran regressions in which the independent variable was PR and the dependent variable was lagged earnings growth (LEG).[5]

Table 5 presents the results of these regressions. The coefficients on both 10-year lagged earnings growth (LEG_{10} in Panel A for 1975–2004) and 5-year lagged earnings growth (LEG_5 in Panel B for 1970–2004) are negative, which is consistent with the hypothesis of depressed earnings reverting to a mean, although only the U.K. LEG_5 coefficient is significant. The introduction of the lagged growth variables improves the explanatory power somewhat compared with Table 2, but the PR coefficients remain positive and significant. In Panel C for 1978–2004, the coefficients on LEG_5 are statistically significant except those for the United States and Switzerland and all are negative except the coefficient for Japan. Despite this result, the PR coefficients retain positive signs in all but two markets, and many are still significant. Lagged earnings growth seems to have some role to play in explaining subsequent earnings growth, particularly for the five-year horizon. The 10-year results appear to be more consistent with the findings of A&A, who noted that although lagged earnings growth had the anticipated negative sign in their results, the predictive ability of the variable was poor and it failed to materially diminish the role of the payout ratio, particularly in 1946–2001.

Payout Ratio and Dividend Growth. The positive relationship we reported in the previous section between the dividend-payout ratio and real earnings growth failed to conform to conventional wisdom but was consistent with the U.S. evidence presented by A&A. In this section, we report an extension of our analysis that considered whether a similarly unexpected relationship exists

Table 4. Subsequent Real Earnings Growth as a Function of Payout Ratio and Earnings Yield
(t-statistics in parentheses)

Country	Constant	PR	EY	Adjusted R^2
A. 1965–2004				
10-year subsequent real earnings growth				
United Kingdom	0.01	0.02	–0.05	8.3%
	(0.77)	(0.98)	(–0.66)	
United States	–0.01	0.10	–0.30	41.2
	(–0.30)	(1.42)	(–1.76)	
5-year subsequent real earnings growth				
United Kingdom	–0.08	0.16	0.09	17.7%
	(–1.57)	(2.75)	(0.43)	
United States	–0.18	0.42	–0.21	31.7
	(–2.97)	(4.49)	(–1.76)	
B. 1973–2004: 5-year subsequent real earnings growth				
France	–0.04	0.38	–0.82	36.0%
	(–1.21)	(4.64)	(–3.47)	
Germany	0.09	0.10	–1.21	8.5
	(2.31)	(1.48)	(–2.50)	
Japan	–0.21	0.52	0.27	31.9
	(–5.02)	(5.23)	(0.62)	
Netherlands	0.06	0.02	–0.33	10.4
	(0.95)	(0.21)	(–1.80)	
Switzerland	0.01	0.48	–1.15	27.4
	(0.11)	(3.11)	(–3.35)	
United Kingdom	–0.12	0.22	0.23	20.3
	(–1.97)	(3.01)	(0.86)	
United States	–0.19	0.46	–0.32	51.4
	(–3.33)	(5.69)	(–1.45)	
EW7	–0.15	0.46	–0.23	19.8
	(–2.31)	(3.31)	(–1.31)	
VW7	–0.30	0.67	0.37	56.6
	(–9.48)	(11.26)	(1.14)	
C. 1990–2004: 1-year subsequent real earnings growth				
France	–0.42	1.54	–2.96	50.1%
	(–1.93)	(4.11)	(–2.53)	
Germany	0.04	0.29	–1.39	1.2
	(0.16)	(0.47)	(–0.60)	
Greece	0.58	–0.03	–6.74	38.8
	(3.54)	(–0.14)	(–6.46)	
Italy	0.40	–0.10	–5.77	14.6
	(2.43)	(–0.40)	(–3.09)	
Japan	–0.35	0.95	–1.35	14.2
	(–1.35)	(2.99)	(–0.17)	
Netherlands	–0.40	1.33	–3.47	29.0
	(–1.99)	(3.55)	(–3.32)	
Portugal	–0.51	1.25	–0.29	26.0
	(–2.79)	(3.11)	(–1.13)	
Spain	–0.05	0.66	–2.88	36.5
	(–0.36)	(2.15)	(–5.64)	
Switzerland	0.25	0.46	–5.54	22.8
	(0.89)	(0.51)	(–4.58)	

(continued)

Table 4. Subsequent Real Earnings Growth as a Function of Payout Ratio and Earnings Yield (continued)
(t-statistics in parentheses)

Country	Constant	PR	EY	Adjusted R^2
United Kingdom	–0.13	0.49	–2.59	16.2%
	(–0.96)	(2.90)	(–2.21)	
United States	–0.04	0.89	–7.49	22.3
	(–0.20)	(2.79)	(–2.27)	
EW11	–0.12	0.91	–4.65	21.5
	(–0.56)	(2.25)	(–3.60)	
VW11	–0.49	1.78	–14.52	22.3
	(–2.41)	(3.82)	(–2.55)	

between the payout ratio and subsequent real dividend growth. A commonly accepted implication of Miller and Modigliani is that a high payout ratio leads to low subsequent real dividend growth unless the company's funds are replenished by stock issuance, and vice versa. For example, a 100 percent PR would almost certainly result in underinvestment in the company's ongoing business

Table 5. Subsequent Real Earnings Growth as a Function of Payout Ratio and Lagged Earnings Growth
(t-statistics in parentheses)

Country	Constant	PR	Lagged Earnings Growth (LEG)	Adjusted R^2
A. 1975–2004: 10-year subsequent real earnings growth				
United Kingdom	0.01	0.03	–0.09	11.0%
	(1.00)	(3.01)	(–0.72)	
United States	–0.07	0.17	–0.18	29.1
	(–2.03)	(2.51)	(–0.59)	
B. 1970–2004: 5-year subsequent real earnings growth				
United Kingdom	–0.02	0.09	–0.64	56.8%
	(–0.89)	(3.03)	(–8.67)	
United States	–0.18	0.41	–0.18	48.4
	(–4.58)	(5.19)	(–1.36)	
C. 1978–2004: 5-year subsequent real earnings growth				
France	0.16	–0.15	–0.98	76.0%
	(4.37)	(–1.89)	(–12.38)	
Germany	0.16	–0.22	–0.87	63.2
	(4.01)	(–1.95)	(–10.35)	
Japan	–0.47	1.28	0.86	50.5
	(–6.32)	(6.42)	(4.82)	
Netherlands	–0.02	0.17	–0.37	27.1
	(–0.55)	(2.54)	(–3.93)	
Switzerland	0.01	0.18	–0.25	10.1
	(0.21)	(0.76)	(–1.41)	
United Kingdom	–0.02	0.10	–0.64	57.1
	(–0.98)	(2.89)	(–9.11)	
United States	–0.22	0.48	–0.15	53.2
	(–5.96)	(6.93)	(–1.25)	
EW7	–0.09	0.33	–0.58	55.5
	(–1.71)	(2.94)	(–5.17)	
VW7	–0.18	0.44	–0.44	65.6
	(–5.51)	(6.26)	(–3.49)	

and produce no RDG in the long run, whereas a low PR might allow the company to undertake many projects with positive net present values and thus raise subsequent RDG.

Table 6 reports the results of regressions akin to those reported in Table 2 but with RDG as the dependent variable. Panel A reveals a negative and statistically significant relationship between PR and 10-year subsequent RDG; the adjusted R^2 value is particularly high for the United Kingdom. Results for the five-year RDG in Panel A and the results shown in Panel B are similar. All the country markets except the United States have negative PR coefficients; the World indices also have positive coefficients. In Panel B, PR has some explanatory power related to RDG for the United States, France, and Germany but not for the other markets. Panel C indicates that, as found for the longer growth horizons, a high proportion of these markets show a negative relationship between PR and RDG. The explanatory power varies considerably from country to country. Overall, the evidence presented in Table 6 points to PR and subsequent RDG being negatively related. Unlike our findings for PR as related to REG, the relationship we found between PR and RDG concurs with conventional wisdom.

Table 6. Subsequent Real Dividend Growth as a Function of Payout Ratio (t-statistics in parentheses)

Country	Constant	PR	Adjusted R^2
A. 1965–2004			
10-year subsequent real dividend growth			
United Kingdom	0.14	–0.21	58.4%
	(8.23)	(–7.33)	
United States	0.03	–0.04	4.5
	(3.38)	(–2.50)	
5-year subsequent real dividend growth			
United Kingdom	0.10	–0.15	0.1%
	(3.93)	(–3.38)	
United States	–0.01	0.03	0.8
	(–0.72)	(1.05)	
B. 1973–2004: 5-year subsequent real dividend growth			
France	0.12	–0.15	7.6%
	(4.25)	(–2.76)	
Germany	0.10	–0.22	11.3
	(3.57)	(–3.28)	
Japan	0.02	–0.06	2.5
	(0.98)	(–1.49)	
Netherlands	0.13	–0.18	5.7
	(2.55)	(–1.84)	
Switzerland	0.10	–0.22	1.3
	(2.74)	(–1.56)	
United Kingdom	0.07	–0.07	4.1%
	(2.97)	(–1.85)	
United States	–0.03	0.09	14.2
	(–2.52)	(3.56)	
EW7	0.01	0.03	–0.2
	(0.32)	(0.28)	
VW7	–0.03	0.10	7.2
	(–2.20)	(2.90)	
C. 1990–2004: 1-year subsequent real dividend growth			
France	–0.21	0.64	6.9%
	(–1.32)	(1.66)	
Germany	0.48	–1.41	34.5
	(4.13)	(–4.09)	
Greece	0.70	–1.42	50.4
	(8.78)	(–7.52)	
Italy	0.51	–0.98	16.6
	(3.43)	(–3.15)	
Japan	0.04	–0.10	0.7
	(1.10)	(–1.49)	
Netherlands	0.35	–0.61	12.9
	(3.60)	(–3.19)	
Portugal	0.54	–1.08	21.2
	(6.35)	(–6.24)	
Spain	0.35	–0.78	10.4
	(2.13)	(–2.16)	
Switzerland	0.52	–1.59	13.9
	(2.56)	(–2.17)	
United Kingdom	0.11	–0.18	5.3
	(2.51)	(–2.63)	
United States	–0.04	0.11	2.3
	(–1.01)	(1.37)	
EW11	0.26	–0.48	4.9
	(2.22)	(–1.88)	
VW11	–0.02	0.08	0.2
	(–0.32)	(0.57)	

The possibility remains, however, that a market's overall valuation plays a part in explaining the relationship between PR and RDG in that market, in the same way market valuation plays a role in the relationship of PR and REG. To explore this possibility, we ran regressions for the three periods in which we used dividend yield (DY) at the beginning of the period as an additional variable to proxy for overall market valuation. **Table 7** reports the results. Panel A offers mixed evidence: PR has negative coefficients for the U.K. market but positive coefficients for the U.S. market. The U.S. market also exhibits a positive coefficient in the five-year regression results shown in Panel B. Five of the markets, however, show a negative relationship between

Table 7. Subsequent Real Dividend Growth as a Function of Payout Ratio and Dividend Yield
(*t*-statistics in parentheses)

Country	Constant	PR	DY	Adjusted R^2
A. 1965–2004				
10-year subsequent real dividend growth				
United Kingdom	0.14	–0.21	0.00	58.4%
	(5.52)	(–7.66)	(–0.29)	
United States	–0.03	0.01	0.01	16.8
	(–1.65)	(0.70)	(3.69)	
5-year subsequent real dividend growth				
United Kingdom	0.04	–0.11	0.01	19.8%
	(1.09)	(–2.73)	(1.65)	
United States	–0.01	0.03	0.00	0.7
	(–0.77)	(1.07)	(0.42)	
B. 1973–2004: 5-year subsequent real dividend growth				
France	0.14	–0.04	–0.02	32.0%
	(4.87)	(–0.50)	(–4.78)	
Germany	0.10	–0.05	–0.02	15.9
	(3.45)	(–0.67)	(–2.37)	
Japan	0.02	–0.04	–0.01	5.0
	(0.96)	(–0.86)	(–1.20)	
Netherlands	0.25	–0.20	–0.02	24.0
	(5.15)	(–3.67)	(–3.34)	
Switzerland	0.13	0.11	–0.05	34.9
	(3.67)	(0.62)	(–4.40)	
United Kingdom	–0.01	–0.02	0.01	10.0
	(–0.16)	(–0.44)	(1.50)	
United States	–0.03	0.09	0.00	14.0
	(–1.83)	(3.44)	(–0.13)	
EW7	0.06	0.00	–0.98	11.0
	(1.26)	(0.05)	(–2.90)	
VW7	–0.04	0.10	0.04	7.0
	(–2.12)	(2.92)	(0.26)	
C. 1990–2004: 1-year subsequent real dividend growth				
France	–0.14	0.63	–0.02	7.7%
	(–0.69)	(1.53)	(–0.88)	
Germany	0.55	–0.96	–0.11	47.6
	(5.44)	(–3.16)	(–4.03)	
Greece	0.70	–1.23	–0.03	51.3
	(8.73)	(–4.70)	(–1.08)	
Italy	0.50	–0.48	–0.09	20.2
	(3.44)	(–1.23)	(–1.33)	
Japan	–0.04	–0.11	0.10	6.0
	(–0.89)	(–1.56)	(1.28)	
Netherlands	0.36	–0.45	–0.03	21.2
	(4.72)	(–3.03)	(–3.91)	
Portugal	0.68	–0.72	–0.11	46.8
	(7.10)	(–5.52)	(–5.15)	
Spain	0.34	–0.62	–0.02	11.6
	(2.04)	(–1.69)	(–1.40)	
Switzerland	0.92	–1.37	–0.29	44.7
	(3.98)	(–2.08)	(–4.68)	

(continued)

Table 7. Subsequent Real Dividend Growth as a Function of Payout Ratio and Dividend Yield (continued)
(t-statistics in parentheses)

Country	Constant	PR	DY	Adjusted R^2
United Kingdom	0.12	–0.34	0.02	15.9%
	(2.57)	(–3.43)	(2.82)	
United States	–0.03	0.02	–0.03	8.0
	(–0.82)	(1.76)	(–1.58)	
EW11	0.25	–0.34	–2.15	6.8
	(2.24)	(–1.55)	(–1.34)	
VW11	–0.14	0.11	3.01	5.1
	(–1.09)	(0.68)	(1.55)	

RDG and PR, although both World indices have positive coefficients. The DY coefficients are generally negative throughout Table 7. The addition of DY improves the explanatory power of the regressions compared with those in which PR was the only independent variable (Table 6). Panel C confirms the positive relationship between PR and RDG for the United States, but PR has negative coefficients for the remaining countries except France. DY is negative for all the markets (for some, strongly negative) except Japan and the United Kingdom, which confirms the hypothesis that higher market valuations are consistent with greater future growth of both earnings and dividends.

As a further comparison of the payout ratio's relationships to real earnings growth and real dividend growth, **Table 8** reports the results of regressions of subsequent RDG on PR and *lagged* real dividend growth (LDG) as the explanatory variables. In Panel A, the PR coefficients are negative for both the United Kingdom and, surprisingly, the United States. Ten-year lagged dividend growth (LDG_{10}) also has a negative coefficient in both cases, which is consistent with the evidence for LEG_{10} in Panel A of Table 5 and suggests some tendency for mean reversion. Panel C shows similar findings in the five-year regression results for the seven countries and the Word indices. The PR variable is negative in all cases except the United States and the World indices; LDG_5 is negative in all cases except the United Kingdom and Switzerland. The inclusion of the lagged variable adds considerably to the explanatory power of the model compared with the regressions reported in Table 6.

The observations of a positive relationship between PR and REG and a negative relationship between PR and RDG are consistent with traditional theory only in the case of the PR–RDG relationship. Therefore, either the findings in this study are peculiar to the time periods used or there is a flaw in conventional thinking about payout policy. Because A&A demonstrated that PR and REG have been positively linked throughout the 20th century in the United States, we conclude that the observations we made for the 1965–2004 period are not atypical. Some of the negative relationship between PR and REG can no doubt be explained by the mean reversion of earnings, as revealed in Table 5, but this finding alone does not describe the entire relationship. Therefore, an additional explanation is probably warranted.

Consider an environment that managers, in aggregate, deem to be offering high returns on capital investments. To fund these investments, companies retain more and more of their earnings, and the payout ratio falls. But because many companies are chasing the perceived opportunities in the marketplace (in accordance with the initial optimism among corporate decision makers), future returns fail to match the optimistic estimates made when earnings were retained. This scenario is consistent with a low payout ratio leading to lower subsequent real earnings growth. The reverse situation would occur if managers saw only limited possibilities and underestimated the profitability of potential projects. They would be prepared to return large portions of earnings to shareholders (unless they were building personal empires) and make few investments. These few investments would not suffer from the competition that exists during periods of high optimism and thus would earn higher rates of return than were initially estimated. In this scenario, a high payout ratio is consistent with higher subsequent earnings growth.

Another potential explanation for the findings reported in this study is that mean reversion exists in the payout ratio itself. If so, when the payout ratio is high, the predictions are that future real earnings growth will rise but also that dividends will not be increased at an equally high rate. Because managers seek to avoid dividend cuts wherever possible, a period of high earnings growth gives managers the opportunity to raise dividends but to do so at a slower pace than that at which earnings are increasing, thus bringing PR

Table 8. Subsequent Real Dividend Growth as a Function of Payout Ratio and Lagged Dividend Growth
(t-statistics in parentheses)

Country	Constant	PR	LDG	Adjusted R^2
A. 1975–2004: 10-year subsequent real dividend growth				
United Kingdom	0.09	–0.08	–0.26	70.6%
	(8.60)	(–4.23)	(–4.17)	
United States	0.03	–0.03	–0.01	4.9
	(2.71)	(–1.26)	(–0.09)	
B. 1970–2004: 5-year subsequent real dividend growth				
United Kingdom	0.11	–0.15	–0.16	16.6%
	(4.31)	(–2.98)	(1.95)	
United States	–0.02	0.05	–0.24	9.3
	(–1.32)	(1.91)	(–2.65)	
C. 1978–2004: 5-year subsequent real dividend growth				
France	0.15	–0.17	–0.50	25.1%
	(5.23)	(–2.79)	(–4.91)	
Germany	0.18	–0.40	–0.86	46.4
	(4.50)	(–3.42)	(–6.99)	
Japan	0.01	–0.04	–0.16	2.4
	(0.76)	(–0.86)	(–1.29)	
Netherlands	0.12	–0.13	–0.19	12.3
	(2.40)	(–1.17)	(–1.41)	
Switzerland	0.14	–0.36	0.26	9.7
	(3.32)	(–2.40)	(1.35)	
United Kingdom	0.12	–0.16	0.13	18.7
	(4.81)	(–3.32)	(1.24)	
United States	–0.03	0.10	–0.56	40.0
	(–2.54)	(4.49)	(–6.29)	
EW7	–0.04	0.18	–0.21	11.3
	(–1.10)	(2.43)	(–1.45)	
VW7	–0.02	0.08	–0.28	16.8
	(–1.18)	(2.43)	(–2.28)	

down to a lower level.[6] In this way, should earnings stall or decline in future periods, the managers might feel less pressure to cut dividends because earnings would still adequately cover the distribution. When the payout ratio is very high, earnings presumably have less room to decrease before a dividend reduction is called for.

To investigate whether mean reversion in the payout ratio is causing the difference in sign between the PR–REG relationship and the PR–RDG relationship, we carried out a regression of both PR and the change in PR (PRC) *over the same period* against RDG. (Although PRC cannot be observed before an event, it can serve as a useful explanatory variable for our purposes here.) When the payout ratio is high, subsequent real earnings growth is also high; the logical extension would be that this effect is correlated with rising dividends. Therefore, the negative relationship between PR and RDG is surprising. By controlling for mean reversion in PR through the use of PRC, we hoped to achieve a more direct observation than was possible in previous regressions of the effect of PR on RDG.

Panel A of **Table 9** shows that the addition of the change in payout ratio for this long period leads to positive coefficients for both PR and PRC for the United Kingdom; for the United States, one coefficient on PR has become less negative than it was in Table 6; the coefficients on PRC are positive. These findings support the notion that real dividend growth is positively related to PR when mean reversion in PR is accounted for. In Panel B, however, many of the markets have retained the negative, statistically significant coefficients on PR. Only the coefficients for the United Kingdom and the Netherlands have flipped to positive. The introduction of PRC has had little impact on the one-year results reported in Panel C. Therefore, mean reversion in PR may explain some of the negative relationship observed between RDG and PR, but it fails to give a full explanation of this conundrum.

Table 9. Subsequent Real Dividend Growth as a Function of Payout Ratio and Subsequent Change in Payout Ratio
(t-statistics in parentheses)

Country	Constant	PR	PRC	Adjusted R^2
A. 1965–2004				
10-year subsequent real dividend growth				
United Kingdom	0.00	0.03	0.19	83.5%
	(0.21)	(0.92)	(8.54)	
United States	0.01	–0.01	0.03	7.5
	(1.17)	(–0.41)	(1.81)	
5-year subsequent real dividend growth				
United Kingdom	0.00	0.03	0.23	43.8%
	(0.14)	(0.64)	(6.55)	
United States	–0.01	0.03	0.01	0.6
	(–0.63)	(0.85)	(0.21)	
B. 1973–2004: 5-year subsequent real dividend growth				
France	0.16	–0.26	–0.09	9.2%
	(3.95)	(–2.97)	(–1.65)	
Germany	0.13	–0.29	–0.12	12.3
	(3.42)	(–2.95)	(–0.96)	
Japan	0.11	–0.32	–0.23	35.4
	(5.16)	(–5.28)	(–6.00)	
Netherlands	0.00	0.07	0.07	24.3
	(0.11)	(0.81)	(5.39)	
Switzerland	0.08	–0.15	0.06	1.1
	(1.43)	(–0.69)	(0.36)	
United Kingdom	0.01	0.03	0.17	18.7
	(0.30)	(0.60)	(3.68)	
United States	–0.03	0.09	0.00	13.8
	(–2.07)	(2.89)	(0.00)	
EW7	0.05	–0.07	–0.09	0.7
	(0.75)	(–0.40)	(–0.89)	
VW7	0.03	–0.04	–0.09	15.6
	(0.77)	(–0.49)	(–1.99)	
C. 1990–2004: 1-year subsequent real dividend growth				
France	–0.39	1.04	0.65	12.2%
	(–1.85)	(2.12)	(1.57)	
Germany	0.44	–1.28	0.23	35.1
	(3.87)	(–3.83)	(0.92)	
Greece	0.65	–1.31	0.25	51.0
	(7.42)	(–6.20)	(1.11)	
Italy	0.29	–0.53	1.36	37.0
	(2.48)	(–1.93)	(3.66)	
Japan	0.14	–0.35	–0.59	26.2
	(2.75)	(–3.14)	(–3.46)	
Netherlands	0.57	–1.05	–0.48	20.6
	(5.72)	(–5.38)	(–3.16)	
Portugal	–0.14	0.40	1.60	55.8
	(–1.18)	(1.44)	(4.97)	
Spain	0.12	–0.23	1.17	27.8
	(0.85)	(–0.70)	(2.96)	
Switzerland	0.37	–1.06	0.60	15.0
	(1.50)	(–1.18)	(0.76)	

(continued)

Table 9. Subsequent Real Dividend Growth as a Function of Payout Ratio and Subsequent Change in Payout Ratio (continued)
(t-statistics in parentheses)

Country	Constant	PR	PRC	Adjusted R^2
United Kingdom	0.06	–0.09	0.22	12.9%
	(1.11)	(–1.14)	(2.55)	
United States	0.02	0.00	–0.27	13.6
	(0.34)	(0.02)	(–2.11)	
EW11	0.37	–0.73	–0.39	6.7
	(2.97)	(–2.66)	(–1.39)	
VW11	0.11	–0.20	–0.44	20.2
	(1.62)	(–1.39)	(–2.61)	

The Payout Ratio and Returns. We have been considering the ability of the payout ratio to explain growth in earnings and growth in dividends. The information that practitioners want, however, is whether this evidence can be used to generate returns. Do higher earnings and/or dividend growth lead to higher returns? To find an answer, we ranked five-year periods of REG and RDG on an annual basis for the markets where data were available for the 1973–2004 period. We formed quartiles in which Quartile 1 contains the lowest six five-year periods of REG (or RDG) and so on up to Quartile 4, which contains the highest six five-year periods of REG (RDG). The concurrent average annually compounded percentage real return of each quartile is reported in **Table 10**.

Panel A demonstrates that periods of high REG (Quartile 4) were clearly accompanied by higher returns than periods of low REG (Quartile 1), but the results provide no evidence of a linear increase in returns across quartiles. Panel B reveals that periods of high RDG were also accompanied by higher returns than were low-RDG periods. As for REG, however, no linear relationship is shown.

The conclusion of this simple analysis is that high REG and RDG *tend* to exist in parallel with relatively higher returns. The implication of this conclusion for practitioners is that a high payout

Table 10. Average Five-Year Real Returns for Quartiles Ranked by Concurrent Real Earnings Growth and Quartiles Ranked by Real Dividend Growth, 1973–2004

Country	Quartile 1 (low REG or RDG)	Quartile 2	Quartile 3	Quartile 4 (high REG or RDG)
A. Ranking by concurrent five-year real earnings growth				
France	6.17%	8.70%	9.66%	20.11%
Germany	3.45	–0.60	9.34	17.07
Japan	–6.48	3.14	7.43	12.27
Netherlands	3.76	9.03	15.25	21.31
Switzerland	0.66	2.17	14.47	17.01
United Kingdom	5.76	11.38	8.64	12.97
United States	7.66	6.11	3.30	16.80
EW7	5.21	4.46	13.87	15.96
VW7	6.57	6.15	10.04	13.06
B. Ranking by concurrent five-year real dividend growth				
France	2.88%	18.12%	8.86%	14.79%
Germany	–0.83	6.67	6.09	18.19
Japan	–2.33	–2.61	9.21	12.09
Netherlands	2.53	19.23	14.44	8.90
Switzerland	–0.67	8.24	7.39	19.35
United Kingdom	–1.36	13.63	11.90	14.57
United States	6.63	4.97	10.87	11.40
EW7	5.36	9.37	6.75	18.03
VW7	6.87	2.23	9.46	17.27

ratio may lead to subsequent high real earnings growth but also to low real dividend growth. Thus, PR emits a somewhat contradictory signal in terms of returns. **Table 11** formalizes this idea by presenting results for regressions akin to those of Tables 2 and 6 but with subsequent real returns as the dependent variable and PR as the independent variable. In Panel A, for the 10-year subsequent real return regressions, both PR coefficients are negative but only the U.K. coefficient is significant. The adjusted R^2 value is very low for the United States but fairly substantial for the United Kingdom. For the 5-year subsequent real return regressions, however, the U.S. coefficient is positive whereas the U.K. coefficient remains negative. Panel B, with a fairly even mix of positive and negative coefficients, shows no general relationship between PR and returns. The explanatory power of most of these regressions is negligible. In Panel C, 9 of the 11 countries have positive PR coefficients, as do both World indices. The adjusted R^2 values are typically low, although generally higher than those in the 5-year regressions in Panel B. These results provide little evidence that PR has any ability to predict subsequent aggregate market returns.

Table 11. Subsequent Real Returns as a Function of Payout Ratio
(t-statistics in parentheses)

Country	Constant	PR	Adjusted R^2
A. 1965–2004			
10-year subsequent real returns			
United Kingdom	0.30	–0.39	51.5%
	(10.79)	(–7.28)	
United States	0.14	–0.14	2.5
	(3.37)	(–1.67)	
5-year subsequent real returns			
United Kingdom	0.19	–0.21	5.3%
	(3.70)	(–2.09)	
United States	–0.03	0.19	2.9
	(–0.54)	(1.63)	
B. 1973–2004: 5-year subsequent real returns			
France	0.07	0.09	0.3%
	(0.82)	(0.45)	
Germany	0.07	0.02	0.0
	(1.25)	(0.18)	
Japan	0.00	0.11	0.1
	(0.05)	(0.63)	
Netherlands	0.22	–0.22	1.8
	(2.83)	(–1.26)	
Switzerland	0.05	0.14	0.0
	(0.72)	(0.56)	
United Kingdom	0.14	–0.08	0.7
	(3.21)	(–0.92)	
United States	–0.11	0.40	18.1%
	(–2.48)	(4.93)	
EW7	0.20	–0.24	8.5
	(5.13)	(–2.69)	
VW7	0.24	–0.50	25.2
	(6.81)	(–4.05)	
C. 1990–2004: 1-year subsequent real returns			
France	–0.77	1.81	11.5%
	(–3.11)	(3.51)	
Germany	0.37	–0.88	3.2
	(1.58)	(–1.24)	
Greece	–0.26	1.01	7.7
	(–1.61)	(2.61)	
Italy	0.43	–0.77	6.6
	(1.86)	(–1.59)	
Japan	–0.43	1.06	9.5
	(–2.44)	(2.34)	
Netherlands	–0.31	0.84	2.6
	(–1.02)	(1.46)	
Portugal	–0.09	0.38	0.9
	(–0.57)	(1.08)	
Spain	–0.01	0.29	–0.2
	(–0.01)	(0.41)	
Switzerland	0.08	0.15	–0.5
	(0.26)	(0.14)	
United Kingdom	–0.38	0.75	10.7
	(–2.41)	(3.14)	
United States	0.04	0.13	0.3
	(0.33)	(0.60)	
EW11	–0.25	0.69	13.3
	(–1.91)	(2.73)	
VW11	–0.11	7.65	1.5
	(–0.64)	(0.88)	

PR may in some way, however, be correlated with the valuation of the aggregate market. If so, then the specification in Table 11 fails to remove this effect. To test for this possibility, we included earnings yield as an additional explanatory variable to proxy for overall market valuation (as in Table 4). **Table 12** provides the results. In Panel A, with the inclusion of EY, both PR coefficients for the United States become positive and significant, the 5-year U.K. coefficient is also positive, but the 10-year U.K. coefficient remains significantly negative. In Panel B, six of the seven individual markets have positive PR coefficients (compared with five in Table 11) but only the U.K. and U.S. coefficients are significant. Both of the World indices have negative coefficients in Panel B, but the reason may be that returns were calculated in U.S. dollars. The inclusion of EY appears to have had little effect (when compared with Table 11) on the PR coefficients reported in Panel C.

Table 12. Subsequent Real Returns as a Function of Payout Ratio and Earnings Yield
(t-statistics in parentheses)

Country	Constant	PR	EY	Adjusted R^2
A. 1965–2004				
10-year subsequent real returns				
United Kingdom	0.20	–0.28	0.42	54.0%
	(3.03)	(–3.43)	(1.67)	
United States	–0.28	0.39	1.83	25.4
	(–2.83)	(2.98)	(5.09)	
5-year subsequent real returns				
United Kingdom	–0.22	0.25	1.74	25.0%
	(–1.79)	(1.82)	(2.88)	
United States	–0.19	0.36	1.10	13.2
	(–2.47)	(2.79)	(3.42)	
B. 1973–2004: 5-year subsequent real returns				
France	–0.07	0.14	1.27	12.6%
	(–0.94)	(0.92)	(2.72)	
Germany	–0.04	–0.05	1.91	9.5
	(–0.57)	(–0.41)	(2.59)	
Japan	–0.10	0.04	3.88	28.0
	(–1.73)	(0.34)	(4.62)	
Netherlands	0.02	0.06	0.66	5.7
	(0.14)	(0.23)	(1.53)	
Switzerland	0.07	0.13	–0.21	0.0
	(0.78)	(0.48)	(–0.41)	
United Kingdom	–0.27	0.41	1.58	28.5
	(–2.31)	(3.22)	(2.93)	
United States	–0.22	0.51	0.78	25.5
	(–3.38)	(5.41)	(2.62)	
EW7	0.02	–0.06	1.08	22.5
	(0.32)	(–0.51)	(3.08)	
VW7	0.25	–0.51	–0.05	25.0
	(4.18)	(–3.97)	(–0.16)	
C. 1990–2004: 1-year subsequent real returns				
France	–1.48	2.86	5.08	20.8%
	(–4.71)	(5.63)	(2.73)	
Germany	0.02	–0.67	4.42	8.5
	(0.07)	(–0.87)	(1.84)	
Greece	–0.35	1.03	1.14	7.6
	(–1.30)	(2.61)	(0.54)	
Italy	0.07	–0.75	6.37	13.0
	(0.31)	(–1.65)	(2.22)	
Japan	–2.17	3.10	44.91	60.0
	(–6.61)	(5.46)	(7.68)	
Netherlands	–0.47	0.85	2.47	5.6
	(–1.49)	(1.57)	(1.81)	
Portugal	–0.12	0.42	0.06	0.3
	(–0.53)	(0.93)	(0.38)	
Spain	–0.12	0.13	2.49	4.0
	(–0.41)	(0.21)	(1.72)	
Switzerland	–0.02	0.31	0.86	–0.9
	(–0.04)	(0.25)	(0.39)	

(continued)

Table 12. Subsequent Real Returns as a Function of Payout Ratio and Earnings Yield (continued)
(t-statistics in parentheses)

Country	Constant	PR	EY	Adjusted R^2
United Kingdom	–0.67	0.67	5.63	28.7%
	(–4.09)	(3.02)	(3.93)	
United States	–0.19	0.12	5.46	13.4
	(–1.26)	(0.60)	(2.65)	
EW11	–0.27	0.67	0.53	12.8
	(–1.52)	(2.53)	(0.18)	
VW11	–0.13	7.75	0.24	5.4
	(–0.76)	(0.92)	(1.34)	

Overall, the results of our introduction of a variable to control for market valuation suggest that a positive relationship exists between PR and subsequent returns, but the evidence of a significant relationship is weak except for the United States. Therefore, predicting future returns from the payout ratio is problematic.

Conclusion

We extended the work of Arnott and Asness in the U.S. market to an additional 10 countries, and this international evidence generally supports A&A's findings—despite the very different institutional, tax, and legal environments of our sample. In short, substantial reinvestment of retained earnings does not lead to faster future real earnings growth, although it does lead to faster real dividend growth. Investing in countries with higher payout ratios is also observed to result in higher earnings growth than investing in markets with low payout ratios.

Unfortunately, these findings did not translate to return predictability in a persuasive fashion: The results vary for different countries and time periods. The notable exception appears to be the U.S. market, where the payout ratio is significantly related to subsequent 5-year and 10-year returns. In general, predicting real earnings and dividend growth is the easy part; valuing them is quite another matter!

Currently, the components of the S&P 500 are paying out around one-third of their earnings as dividends, well below the post–World War II average of 50–60 percent. Therefore, our findings suggest that the outlook for earnings growth in the next few years is ominous.

This article qualifies for 1 PD credit.

Notes

1. Recent articles (e.g., Currier 2004; Perkins and Gavrina 2004) have begun to change this trend by placing greater emphasis on aggregate payout ratios.
2. A detailed discussion of the various tax structures is available from the authors on request.
3. For Japan, Switzerland, and the United Kingdom, we used, respectively, a US$/¥, US$/SFr, or US$/£ exchange rate. For the remaining countries, a US$/€ exchange rate was used. Datastream applied a synthetic euro exchange rate to the series prior to the introduction of the euro in 1999. Because the US$/€ exchange rate came into existence only in January 1999, we built a historical US$/€ exchange rate as follows. From January 1978 to December 1998, the European Currency Unit (ECU) was the precursor of the euro; when the euro was established in 1999, it replaced the ECU at a 1:1 ratio. Therefore, for the 1978–98 period, we used a US$/ECU exchange rate. The US$/€ exchange rate we used for 1973–1977 was based on the German mark because of its dominance in the ECU.
4. The United States and the United Kingdom were the only common-law countries in our sample.
5. These regressions were run for only the first two periods because data for Period 3 were insufficient.
6. See Kaplan and Reishus (1990) for the potential consequences of cutting dividends.

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Surprise! Higher Dividends = Higher Earnings Growth

Robert D. Arnott and Clifford S. Asness

We investigate whether dividend policy, as observed in the payout ratio of the U.S. equity market portfolio, forecasts future aggregate earnings growth. The historical evidence strongly suggests that expected future earnings growth is fastest when current payout ratios are high and slowest when payout ratios are low. This relationship is not subsumed by other factors, such as simple mean reversion in earnings. Our evidence thus contradicts the views of many who believe that substantial reinvestment of retained earnings will fuel faster future earnings growth. Rather, it is consistent with anecdotal tales about managers signaling their earnings expectations through dividends or engaging, at times, in inefficient empire building. Our findings offer a challenge to market observers who see the low dividend payouts of recent times as a sign of strong future earnings to come.

Since 1995, and until a recent uptick arising from plunging earnings, marketwide dividend-payout ratios in the United States have been in the lowest historical decile, reaching unprecedented low levels from late 1999 to mid-2001. Alternatively stated, earnings-retention rates have recently been at or near all-time highs. Meanwhile, price-to-earnings ratios and price-to-dividend ratios are high by historical standards, despite the sharp fall in stock prices since early 2000. With recent valuation ratios at such high levels and dividend payouts so low, the only way future long-term equity returns are likely to rival historical norms is if future earnings growth is considerably faster than normal. Some market observers, including some leading Wall Street strategists, do indeed forecast exceptional long-term growth. As a cause for this optimism, they point to, among other things, the recent policies of low dividend-payout ratios.

Consider the well-known constant-growth valuation model of Gordon (1962):

$$R = \frac{D}{P} + G. \tag{1}$$

Expected return, R, equals the dividend yield, D/P, plus an assumed constant expected growth term, G. Now, the dividend yield itself can be thought of as the product of the dividend-payout ratio, D/E (the ratio of dividends to earnings), and the earnings yield, E/P (the inverse of P/E):

$$R = \left(\frac{D}{E}\right)\left(\frac{E}{P}\right) + G. \tag{2}$$

Equation 1 and Equation 2 can be applied to a given company or to the market portfolio itself. We focus on the latter application. Assuming dividend policy does not affect the expected return on the market portfolio (and assuming the payout ratio is constant through time, so earnings and dividend growth are equal), a low payout (D/E) must be offset either by a high E/P (low P/E) or by high expected growth.

As we will show, in the past 130 years, U.S. equity market P/Es have not offset variation in payout ratios. For instance, recent P/Es have been very high, whereas to offset today's low payout, they would have to be quite low. Thus, the task of offsetting the low payout is left to G, growth.

Some interpret this forecasted marketwide inverse relationship of current dividend-payout policy to future growth as an intertemporal extension of the Modigliani and Miller (1961) dividend irrelevance theorem.[1,2] For example, imagine an instantaneous pervasive change in dividend policy

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that permanently alters the market *D/E* from paying out 50 percent of earnings to paying out 25 percent of earnings. Because current earnings do not change (and, according to Miller and Modigliani, price should not change), the task of keeping expected return constant is again left to growth. For instance, suppose the market was selling for a P/E of 15 at the time of this change (about the historical average). Thus, E/P was 6.7 percent (1/15); 25 percent of 6.7 percent is 1.7 percent. In other words, in a market with a P/E of 15, for the market's expected return to be unaltered and current prices and earnings to remain unchanged, a permanent change in payout policy from 50 percent to 25 percent would have to be offset by a permanent increase in expected growth of 1.7 percent.

For a single company, this increase in growth is clearly possible—if the business is easily scalable or if offsetting transactions (e.g., share buybacks) are undertaken—and investment policy is unaffected. By similar reasoning, many observers would accordingly expect a strong and reliably negative relationship between payout ratios and future earnings growth for the market as a whole. Looking at the recent policy of low payouts, this view, if true, would offer grounds for optimism regarding future earnings growth.

Implicit in this view is a world of perfect capital markets. For instance, this reasoning assumes that investment policy is unaltered by the amount of dividends paid, that information is equal and shared (meaning the dividend does not convey managers' private information), that tax treatment is the same for retained or distributed earnings, that managers act in the best interests of the shareholders, that markets are priced efficiently, and so forth. When the assumption of perfection is relaxed, a host of behavioral or information-based hypotheses arise as potential explanations for how the market's payout ratio might relate to expected future earnings growth. Thus, we turned to the historical data to answer the question of how marketwide payout ratios have related to future earnings growth.[3]

Data

We used three sources of dividend yield and stock total-return data—Schwert (1990), Shiller (2000; updated data from aida.econ.yale.edu/~shiller/data.htm), and Ibbotson Associates (2001).[4] In calculating real earnings growth, we began with a calculation of real earnings for an index portfolio. We did so in the following steps:

1. constructing a total return index for stocks,
2. subtracting out the monthly dividend income on stocks, based on the data from Schwert, Shiller, and Ibbotson, which gave us a stock price index from 1871 to date,
3. dividing through by the U.S. Consumer Price Index (CPI) to impute a real stock price series, and
4. multiplying the real price series by the earnings-yield data from Shiller.[5]

This process generated a history of the EPS of the S&P 500 Index.

Because earnings and the forecasting of earnings growth is the crux of our article, more discussion of our definition of EPS is in order. We conduct tests of whether certain variables, notably the payout ratio, can be used to forecast the growth in the aggregate EPS number derived in Step 4. This aggregate EPS series is not the same as the earnings growth on a static portfolio of stocks. The economy at large is dynamic; a "market" portfolio must adjust to acknowledge this fact. By focusing on a portfolio that an investor might choose as a market portfolio, we were tacitly selling the companies that were no longer an important factor in the market or economy to make room for those that had become an important factor. Standard and Poor's does exactly the same by adding "new-economy" stocks (whatever the new economy is at each point in time), dropping "old-economy" stocks, and changing the divisor for the index. Changing the divisor each time the index composition is changed is equivalent to a pro rata sale of existing holdings to rebalance into new holdings. So, when we were examining 10-year real earnings growth (the forecasting horizon we primarily focused on), we were not looking at the growth of earnings on a fixed set of stocks bought at the outset. "Growth" in our approach is analogous to the growth an investor might have seen on the EPS of an index fund portfolio that held the assets selected by Standard and Poor's since 1926 (and by Cowles, retrospectively, from 1871 to 1925). It is the rate of growth in this index fund's EPS that we attempted to forecast in this study (and generally what we refer to as "earnings growth").

Another way to think about what we did is to recognize the distinction between the market and a specific index portfolio. The market, in aggregate, shows earnings and dividend growth wholly consistent with growth in the overall economy (Bernstein 2001a). If that same market portfolio were unitized, however, the unit values would not grow as fast as the total capitalization because of the dilution associated with new assets in the market portfolio (new companies in an index are almost always larger than the companies that they replace). Similarly, the "per share" earnings and dividends of an index fund portfolio (per "share" of the unitized index fund) will not keep pace with the growth in the aggregate dollar earnings and dividends of the companies that constitute the market. Why? Because when one stock is dropped and another added, the added stock is typically larger and more profitable than the deletion, which increases the divisor for constructing the index.

Precisely the same thing happens in the management of an actual index fund. When a stock is replaced, the proceeds from the deleted stock rarely suffice to fund the purchase of the added stock. Accordingly, all stocks are trimmed slightly to fund the new purchase—the implied consequence of the change in the divisor for an index. This mechanism drives a persistent wedge between, on the one hand, the growth of the aggregate dollar earnings and dividends for the market portfolio (which will keep pace with GDP growth over time) and, on the other hand, the per share growth of earnings and dividends for the market index (which will not keep pace with GDP growth—see Arnott and Bernstein 2002).

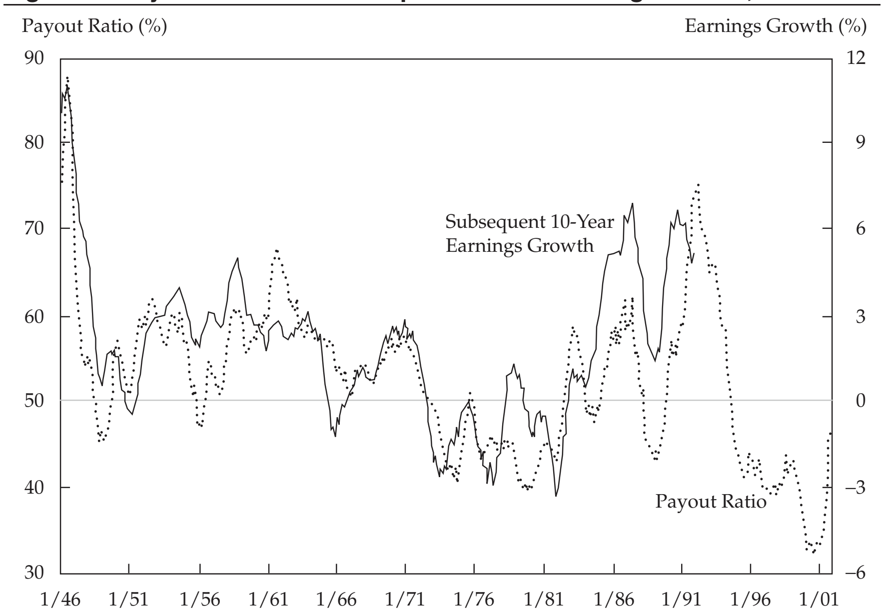
Entrepreneurial capitalism created the companies that we had to add to the market portfolio (or brought down those that had to be removed), thereby changing our divisor. Thus, a persistent difference exists between our measure of EPS and aggregate dollar earnings or GDP, with our EPS growing slower than aggregate dollar earnings or GDP growth over long periods. Differences in levels of growth ended up in the unexamined intercepts of our regressions, however, and only covariance of this differential with our *ex ante* predictive measures affected our tests (the robustness checks to follow provide some comfort that this issue is not important).

For some of our tests, we used both bond yields and the CPI. Our two sources of bond yields were the National Bureau of Economic Research (NBER) and Ibbotson Associates.[6] In cases of differences, we averaged the yield data. We used the same two sources for CPI data.[7] GDP data were drawn from the NBER.[8]

The Payout Ratio for Forecasting Earnings Growth

We defined the payout ratio in this study as last year's trailing dividends divided by last year's trailing earnings. Dividends are "sticky"; they tend not to fall in notional terms, although they can fall during severe earnings downturns and can fall in real terms during periods of high inflation. Because earnings are more volatile than dividends, payout ratios are relatively volatile, although they have been far less volatile since 1946 than before. **Figure 1** shows the payout ratio of the S&P 500 from 1946 through year-end 2001 and subsequent 10-year growth in real earnings. Note that the payout ratio

Figure 1. Payout Ratio and Subsequent 10-Year Earnings Growth, 1946–2001



falls to the lowest levels ever seen near the end of our sample period, before a recovery in late 2001, because of plunging current earnings.

This discussion will focus on 1946–2001 (the post-World War II period) as the "modern period," for which our confidence in data quality and applicability to current times are highest. The period before 1946 was one of two world wars, the Great Depression, unregulated markets, and a host of other differences from the post-1945 era. Where possible, however, we will also show results for earlier and longer periods.

Figure 1 shows empirically that forecasts of a natural inverse relationship between dividend payout and future earnings growth are not correct. **Figure 2**, which plots subsequent 10-year real earnings growth against starting payout ratios as a scatterplot, rejects this elegant thesis even more vividly. Obviously, rather than inverse, the relationship of current payout to future earnings growth is strongly positive. **Table 1** contains the monthly regression corresponding to Figure 1 of the rolling 10-year real earnings growth of the S&P 500 on the starting payout ratio, *PR*, for the past 50–130 years.[9] The link seen in the plots and regressions is compelling, particularly because it has the "wrong" sign.[10]

Examining our main 1946–2001 period another way, we divided all rolling 10-year periods starting in January 1946 and ending in December 1991 into four quartiles by starting payout ratio (Quartile 1 being the low payout ratio and Quartile 4, the high). **Table 2** reports the average 10-year earnings growth and the worst and best 10-year earnings growth achieved when starting in each respective payout-ratio quartile. The average earnings growth obviously increases with a rising starting payout ratio, which corresponds to the regression in Table 1 and scatterplot in Figure 2. We suspect that many readers will be surprised that starting in the bottom quartile of payout ratios, the average subsequent real earnings growth is actually negative. Needless to say, negative real earnings growth for a 10-year span falls far below what most investors would find acceptable, let alone expect *ex ante* one quarter of the time.

The worst and best 10-year spans also show the same monotonic relationship with the starting payout ratio: The higher the payout ratio, the better the average subsequent 10-year earnings growth and the better the best and the worse the worst outcomes. A striking example is that the worst 10-year growth when starting in the highest-payout-ratio quartile is better than the average earnings growth when starting in the lowest-payout-ratio quartile. Conversely, the best 10-year growth starting in the lowest-payout quartile is not as good as the average growth when starting in the highest-payout quartile.

In general, when starting from very low payout ratios, the equity market has delivered dismal

Figure 2. Scattergram of Payout Ratio vs. Subsequent 10-Year Real Earnings Growth, 1946–2001 Data

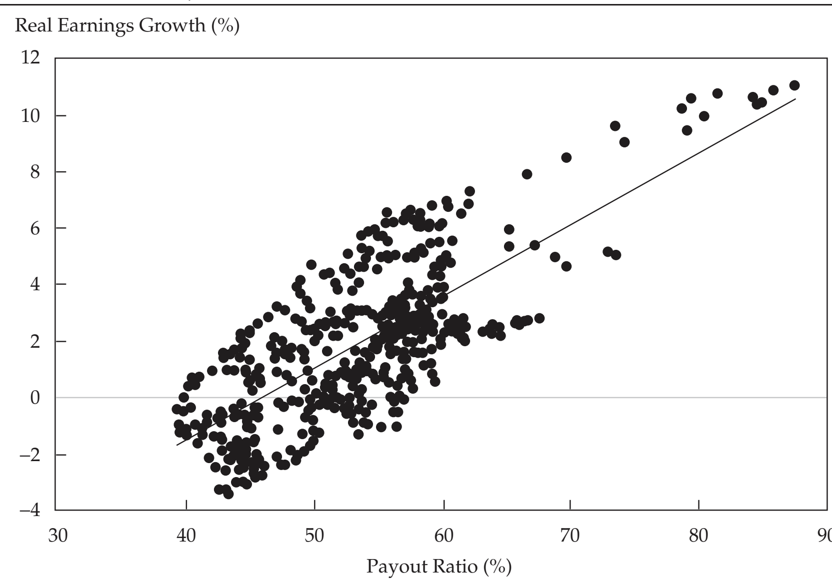


Table 1. Subsequent 10-Year Earnings Growth as a Function of Payout Ratio: Regression Coefficients (*t*-statistics in parentheses)

Regression Span	*a*	*b*	Adjusted R^2
1946–2001	–11.6%	0.25*PR*	54.6%
	(–7.2)	(8.6)	
1871–2001	–3.1	0.07*PR*	14.2
	(–3.1)	(4.5)	
1871–1945	–5.1	0.09*PR*	19.5
	(–4.4)	(7.5)	

Note: The regression equation is

10-Year earnings growth = Constant term + (b) × Preceding payout ratio, or

$$EG_{10} = a + b(PR).$$

Table 2. Payout Ratios and Subsequent 10-Year Earnings Growth: Quartile Comparisons, 1946–1991

Starting Payout Quartile	Average	Worst	Best
1 (low)	–0.4%	–3.4%	+3.2%
2	+1.3	–2.4	+5.7
3	+2.7	–1.1	+6.6
4 (high)	+4.2	+0.6	+11.0

real earnings growth over the next decade; growth has actually fallen 0.4 percent a year on average—ranging from a worst case of truly terrible –3.4 percent compounded annual real earnings for the next 10 years to a best case of only 3.2 percent real growth a year over the next decade. From a starting point of very high payout ratios, the opposite has occurred: strong average real growth (4.2 percent), a worst case of positive 0.6 percent, and a maximum that is a spectacular 11.0 percent real growth a year for 10 years. Indeed, the very early evidence from the last few quarters (late 2001) would suggest that the recent record low payout ratio and earnings growth are falling into the classic pattern. Contrary to the arguments of the "new paradigm" advocates, earnings have been tumbling, not soaring, since earnings retention reached record levels. Of course, the most recent 10-year observations from these payout-ratio lows remain to be seen.

Potential Explanations

Many hypotheses might explain the (perhaps surprising) positive relationship between current payout ratio and future real earnings growth. The following list, although clearly incomplete, represents a beginning effort to explain this phenomenon:

- Corporate managers are loath to cut dividends (Lintner 1956). Perhaps a high payout ratio indicates managerial confidence in the stability and growth of future earnings and a low payout ratio suggests the opposite. This confidence (or lack of it) might be based on public information but also private information (see, for example, Miller and Rock 1985).
- Another hypothesis consistent with the relationship we empirically observed is that companies sometimes retain too much of their earnings as a result of the managers' desires to build empires (Jensen 1986).[11] There need not be anything nefarious in this behavior: An otherwise benign coincidental policy of earnings retention may end up encouraging empire building by creating an irresistible cash hoard burning a hole in the corporate pocket. Conversely, financing through share issuance and paying substantial dividends, although perhaps less tax efficient, may subject management to more scrutiny, reduce conflicts of interest, and thus curtail empire building. (The assumption is, of course, that inefficient empire building lays the foundation for poor earnings growth in the future whereas discipline and a minimization of conflicts has the opposite, salutary effect.)
- Perhaps the positive relationship is driven by sticky dividends (see Lintner) combined with mean reversion in more volatile earnings. Temporary peaks and troughs in earnings, subsequently reversed, could cause the payout ratio to be positively correlated with future earnings growth (i.e., temporarily low earnings today cause a high payout ratio, thus forecasting the earnings snapback tomorrow). The testable difference between this hypothesis and the first two is that dividend policy has no special standing, so any reasonable measure of mean reversion in earnings should work to forecast future earnings growth.
- Perhaps our data or experimental design are in error. For instance, perhaps our results are time-period specific (either as to the years covered by our study or the length of our forecasting period). Or maybe our results merely proxy for other, more fundamental variables that forecast economic activity. Or perhaps our results are just random noise.

Clearly, distinguishing the first two hypotheses from each other, or confirming or rejecting either, is beyond the scope of this article.[12] We simply note that each of these stories fits the data. Next, we carry out some very preliminary investigations but leave more precise tests, or the introduction of new explanations, to future work.

Robustness Tests

Readers might and should be skeptical of a relationship that consists of forecasting overlapping 10-year earnings growth over a 55-year span when strongly serially correlated payout ratios are used. Arguably, we have only slightly more than five truly independent observations. Although statistical tools can adjust regression *t*-statistics for this phenomenon and R^2 measures remain legitimate, relationships of this type may seem statistically significant even when they are not. A diligent mining of the available data without economic intuition or finding results that spuriously proxy for some other more basic relationship could deliver our findings without the causality that we infer. Because this possibility can never be completely dismissed and because we know our results are the opposite of what so many would intuitively expect, we carried out extensive robustness checks. The checks included methodologically motivated tests (e.g., tests in out-of-sample periods, tests for small specification changes that might change results, etc.) and economically motivated tests (tests of whether the power of the payout ratio is coming from the reasons we hypothesized or from other sources).

Methodological Tests. The simplest robustness check is an out-of-sample test. We favored the post-WWII period in the discussion so far because of our confidence in the data quality and its relevance to today's world, but we do have data back to 1871. Accordingly, Table 1 shows in the last row the same regression for the prior, entirely separate, 1871–1945 period. The coefficients and the R^2 value are smaller, which might make sense in light of the more volatile earnings and noisier data before 1946. But the *t*-statistics are still quite strong, and the relationship still explains 19.5 percent of the variance of earnings. Most importantly, the coefficient has the same counterintuitive positive sign.

Also, as is evident in the scatterplot of Figure 2, eliminating the most extreme (highest and lowest 10 percent) of payout ratios from the 1946–2001 data (i.e., dropping those observations) would have little effect on the regressions.

Sensitivity to 10-Year Forecasting Horizon. We focused on 10-year periods because we were ultimately interested in the impact of real growth on fair valuation. Transient short-term peak-and-trough earnings should have little impact on the proper price to pay for stocks; only long-term earnings prospects should matter. We arbitrarily chose 10-year spans to balance two conflicting goals—a span long enough to be of economic significance (the long term) but short enough to have a reasonable number of independent periods and to have some relevance to an investor's career horizon.

For a robustness check, we repeated our tests on 5-year real earnings growth. In so doing, we probably sacrificed some economic relevance; strong statements about 10-year earnings growth are more important to fair value than statements about 5-year growth. But we doubled the number of nonoverlapping periods. The first two rows of **Table 3**, which contain results for 1946–2001 and 1871–2001, demonstrate that the link we identified holds up nicely for shorter earnings-growth periods.

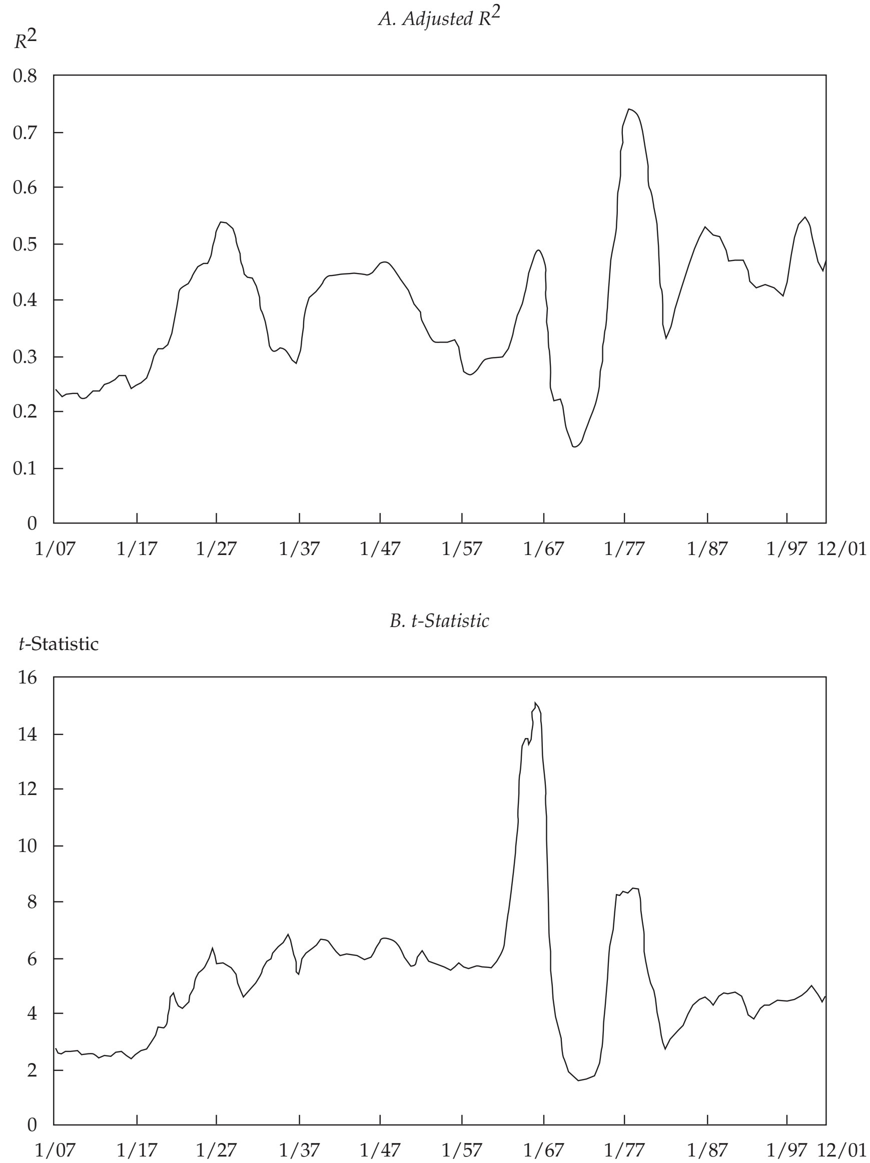
Table 3. Five-Year Earnings Growth as a Function of Payout Ratios: Regression Coefficients
(*t*-statistics in parentheses)

Regression Span	*a*	*b*	Adjusted R^2
1946–2001	–21.3%	0.44*PR*	53.8%
	(–6.0)	(7.3)	
1871–2001	–11.3	0.19*PR*	24.0
	(–5.2)	(6.7)	
1871–1945	–18.0	0.26*PR*	34.1
	(–4.7)	(5.8)	
1946–1979	–22.2	0.45*PR*	61.1
	(–5.6)	(6.8)	
1871–1979	–12.9	0.21*PR*	26.8
	(–5.1)	(6.6)	
1980–2001	–21.1	0.46*PR*	49.6
	(–3.5)	(4.4)	

Note: Regression equation is $EG_5 = a + b(PR)$.

Predictive Consistency. For testing the consistency of our R^2 and *t*-statistic results, we again used five-year results so that we could consider more independent data points. We performed the monthly regression of five-year real S&P 500 earnings growth on the starting payout ratio on a rolling 30-year basis for every 30-year span from 1871 through 2001.[13] Panel A of **Figure 3** traces the R^2 and Panel B traces the *t*-statistics on the coefficient for the payout ratio from each of these rolling regressions. Results indicate substantial variation over time, as one would expect: The statistical noise in the relationship should cause such variability, and the fundamental relationship may strengthen or weaken with changes in the economic, tax, or

Figure 3. Consistency of 30-Year Regressions: $EG_5 = a + b(PR)$, 1871–2001



political environment. Nevertheless, the basic message exhibits considerable stability: When payout ratios are low, future earnings growth tends to be slow, and high payout ratios go hand in hand with rapid subsequent earnings growth. The lowest *t*-statistic is still a respectable (certainly for an order statistic) 1.6; similarly, the R^2, although variable, is always economically meaningful. The lowest R^2 and highest R^2 are, respectively, 13 percent and 74 percent. Most importantly, the sign never changes.

Proxy for Mean Reversion? Mean reversion in earnings might be caused by true mean reversion or by transient errors in reported earnings that would induce apparent mean reversion in the contiguously measured changes. A temporary drop in earnings could raise expected future compound earnings growth from this lower base. The temporary earnings drop would simultaneously raise the current payout ratio, *D/E*, because sticky dividends do not fall as much as earnings. Finding this kind of mean reversion might still be interesting, but dividend policy would have no special standing as a predictor. We tested for this case by adding direct measures of mean reversion in earnings to our regressions and comparing their significance with the remaining significance of the payout ratio.

First, we added prior-10-year real earnings growth to the regression as lagged earnings growth (LEG_{10}). If the mean-reversion hypothesis is true, then adding prior earnings growth as an additional right-hand-side variable could explicitly show the mean reversion we are looking for (through a negative coefficient as poor prior 10-year real growth forecasts superior subsequent growth and vice versa) and might cause the payout ratio to lose much of its importance in bivariate tests. Panel A of **Table 4** shows that simple mean reversion in 10-year earnings growth has the expected negative sign but is a weak predictive variable. Specifically, this measure neither approaches the efficacy of the payout ratio over any time period nor materially crowds out the efficacy of the payout ratio, particularly for the 1946–2001 period.

We constructed a second proxy for mean reversion in earnings by dividing the prior-1-year real earnings (also used to construct our payout-ratio variable) by the average of real earnings over the past 20 years (MA_{20}).[14] We hypothesized that when this variable is high, the temporary component of earnings will be high, and we expected this variable to forecast lower subsequent real earnings growth.[15] Panel B of Table 4 shows the results: For the most recent and most relevant period, 1946–2001, the payout ratio is the clear victor. The ratio MA_{20} has the expected negative sign (meaning that when earnings are below their long-term average, better growth over the next 10 years is forecasted), but the relationship is weak and does not at all ameliorate the power of the payout ratio. Including periods prior to 1946 produces more-competitive results; the two variables enter with similar power and the "right" signs (positive for payout, negative for MA_{20}), although the payout ratio is still the clear victor. Multicolinearity makes the t-statistics and the relative contribution of each variable difficult to determine, particularly for the earlier period (the correlations between payout and MA_{20} are –0.44 for 1946–2001, –0.63 for 1871–2001, and –0.69 for 1871–1945).

The payout ratio's predictive power admirably survives head-to-head competition against two reasonable proxies for simple mean reversion in earnings (although MA_{20}, in particular, shows some competitive forecasting power when a very old sample period is included). Although the payout ratio is (and, intuitively, should be) highly correlated with measures of simple mean reversion in real earnings, the data show important marginal information contained in dividend policy, indeed more information (and much more in the modern time period) than provided by other measures of mean reversion.[16]

Note that, in some sense, these tests should not be viewed as "payout ratio versus mean reversion." Clearly, the payout ratio can be interpreted as one measure of how depressed or how strong earnings are (in this case, dividends are used as a yardstick) and thus how much we might expect them to revert to the mean. In other words, rather than view these

Table 4. Ten-Year Earnings Growth as a Function of Payout Ratios and Direct Measure of Mean Reversion: Regression Coefficients
(t-statistics in parentheses)

Regression Span	a	b_1	b_2	Adjusted R^2
A. Reversion as prior-10-year earnings growth: $EG_{10} = a + b_1(PR) + b_2(LEG_{10})$				
1946–2001	–11.0%	0.25PR	–0.09LEG_{10}	55.3%
	(–5.7)	(7.9)	(–0.6)	
1871–2001	–2.0	0.06PR	–0.09LEG_{10}	15.3
	(–1.9)	(3.9)	(–0.9)	
1871–1945	–4.5	0.08PR	–0.06LEG_{10}	19.4
	(–2.6)	(6.1)	(–0.4)	
B. Reversion as current earnings/20-year average: $EG_{10} = a + b_1(PR) + b_2(MA_{20})$				
1946–2001	–9.0%	0.24PR	–0.02MA_{20}	56.6%
	(–2.8)	(7.0)	(–1.3)	
1871–2001	2.3	0.05PR	–0.03MA_{20}	22.8
	(0.7)	(2.6)	(–1.7)	
1871–1945	2.0	0.05PR	–0.04MA_{20}	26.2
	(0.4)	(2.1)	(–1.4)	

results as a refutation of mean reversion and an affirmation of the payout ratio as a predictor, the finding can be viewed as the discovery that scaling earnings by dividends (the payout ratio) produces an effective and consistent measure of mean reversion in earnings—more effective and consistent than several other reasonable candidates, particularly in the modern era. Earnings do indeed seem to revert to the mean but may revert most strongly in terms of their ratio to dividends.

Stock Repurchases. Share buybacks were a far smaller part of the market prior to 1980 (see, for instance, Bagwell and Shoven 1989 and Fama and French 2002). The increase in share buybacks in recent years is one potential pitfall for our study. If buybacks substitute for regular dividends, then our measure of the payout ratio may be effectively understated when buyback activity is high. Buybacks can also raise EPS growth. If stock buybacks are substituting for dividends, then changes in buyback activity should weaken our results: Falling payout ratios in the 1980–2001 span, if attributable to share buybacks, could correspond to increases in subsequent earnings growth.

We were able to test for the influence of a changing buyback atmosphere only indirectly. If the relationship between payout ratio and future earnings growth is similar in the pre- and post-1980 periods, we could feel comfortable that the relatively new phenomenon of large-scale share buybacks was not unduly influencing our results (in either direction). Therefore, we recomputed the results for the regression of five-year earnings growth as a function of the payout ratio for only the 1946–1979 period and 1871–1979 (we used five-year data because we had even fewer data for this test). The results are shown in the fourth and fifth rows of Table 3. In these earlier periods, which experienced far fewer share buybacks than the 1980–2001 period, the link between payout ratios and real earnings growth worked almost exactly as well as over the longer span.[17] Table 3 also presents, in the last row, evidence for the relatively short period associated with a large amount of buybacks, 1980–2001. Here again, despite the paucity of data, we found strong results of a link.

To be fair, one cannot know the impact of the increase in buybacks, assuming the increase is permanent, until far more data are available than this brief 20-year history. From the initial evidence, however, stock buybacks have apparently not made the importance of the dividend payout ratio "different this time."

The Payout Ratio against the Yield-Curve Slope. Other research (e.g., Harvey 1991) has shown that the slope of the U.S. Treasury yield curve is a strong positive forecaster of economic growth.[18] This finding invites two questions relating to our research. If the yield-curve slope forecasts economic growth, does it also forecast earnings growth? If so, does the yield-curve slope augment or subsume the power of payout ratios for forecasting earnings growth? Either could happen if, for example, the curve is very steep during recessions, precisely when the payout ratio is larger than average (because of depressed earnings and sticky dividends).

To answer these two questions, we began by defining the yield-curve slope as the difference between the 10-year T-bond yield and the 3-month T-bill yield at the start of any period. We tested the forecasting power of the yield-curve slope (*YCS*) for both 10-year and 5-year real earnings growth. **Table 5** presents the results.

This discussion will focus on the 1946–2001 period because interest rates were not always freely floating before this period, but Table 5 also presents results for the earlier 1871–1945 period and the full 1871–2001 period. Panel A shows that the yield-curve slope, when used alone to forecast earnings growth, generally has the anticipated sign. Not only does a steeper yield curve suggest a stronger future economy, as found by other authors, but it also suggests faster real earnings growth, although the yield curve has much more power for forecasting 5-year growth than 10-year growth. This finding conforms with the work of Fama and French (1989), who noted that the yield-curve slope seems to be correlated with relatively high-frequency elements of the business cycle. As Panel B of Table 5 makes clear, however, the yield curve's power does not come close to driving out the much stronger power present in the payout ratio.

The bottom line is that yield-curve slope has the right sign from 1946–2001 (and most other periods) but is a relatively weak predictor of earnings growth. The yield-curve slope does not approach the univariate forecasting power of the payout ratio, nor does it erode the efficacy of the payout ratio when included in bivariate forecasting regressions.

The Payout Ratio against Stock Market Valuation Levels. Should the market's earnings yield, instead of the payout ratio, predict earnings growth? If future real earnings growth is going to be faster than normal, investors should perhaps pay a higher P/E multiple than normal and, hence, accept a lower earnings yield on their investments.[19] Thus,

Table 5. Earnings Growth as a Function of the Yield-Curve Slope and Payout Ratio: Regression Coefficients
(t-statistics in parentheses)

Time Span	a	b_1	b_2	Adjusted R^2
A. Earnings growth as a function of yield-curve slope				
Ten-year earnings growth: $EG_{10} = a + b_1(YCS)$				
1946–2001	1.56%	0.38*YCS*		2.0%
	(2.8)	(1.2)		
1871–2001	1.3	0.44*YCS*		2.2
	(2.0)	(1.4)		
1871–1945	1.2	0.43*YCS*		1.8
	(1.3)	(1.0)		
Five-year earnings growth: $EG_5 = a + b_1(YCS)$				
1946–2001	0.6%	1.70*YCS*		14.0%
	(0.7)	(2.5)		
1871–2001	0.3	2.09*YCS*		11.3
	(0.3)	(3.6)		
1871–1945	0.3	2.20*YCS*		10.5
	(0.2)	(2.9)		
B. Earnings growth as a function of yield-curve slope and payout ratio				
Ten-year earnings growth: $EG_{10} = a + b_1(YCS) + b_2(PR)$				
1946–2001	–11.6%	0.14*YCS*	0.25*PR*	54.8%
	(–7.0)	(0.5)	(7.8)	
1871–2001	–3.0	0.17*YCS*	0.07*PR*	14.5
	(–3.0)	(0.7)	(4.1)	
1871–1945	–5.5	–0.24*YCS*	0.09*PR*	19.9
	(–3.8)	(–0.7)	(6.9)	
Five-year earnings growth: $EG_5 = a + b_1(YCS) + b_2(PR)$				
1946–2001	–20.8%	0.99*YCS*	0.41*PR*	58.2%
	(–6.3)	(2.2)	(6.9)	
1871–2001	–10.8	1.46*YCS*	0.17*PR*	29.2
	(–5.1)	(2.8)	(5.2)	
1871–1945	–17.0	0.53*YCS*	0.24*PR*	34.5
	(–3.9)	(0.7)	(4.4)	

in an efficient market with constant expected equity returns, a low earnings yield may be a good predictor of higher future real earnings growth. **Table 6** shows the results from a regression of 10-year earnings growth on the payout ratio and the earnings yield, *E/P*, for various periods. The relationship is as expected: For the modern period, a low earnings yield (high P/E) signals high future 10-year real earnings growth, with a t-statistic of –2.5. This finding supports the view that the market correctly anticipates faster future earnings growth and pays up for it. Results for the other time periods offer additional support for this finding.

This relationship is far weaker, however, than the link we found between the starting payout ratio and future earnings growth, and the relationship suffers greatly in multiple regression tests, as Panel B shows. In the tests for forecasting 10-year earnings growth using both the starting payout ratio and the earnings yield, the payout ratio completely drives out the earnings yield for the 1946–2001 period. The sign for E/P actually reverses, so conditional on payout ratio, a lower E/P (higher P/E) presages slightly lower earnings growth. The success of E/P is greater when older data are included, as shown especially for the full period. On balance, however, the verdict is clear: The power of market valuation levels to forecast future returns is weaker than the power of the payout ratio—particularly in the modern period. For the post-WWII period, the difference is startling.[20]

We found this result extremely interesting. Suppose real earnings growth is strong and the market expects this trait to continue. Investors might then be willing to pay a premium multiple of these strong earnings, which would result in a

Table 6. Ten-Year Earnings Growth as a Function of Earnings Yield and Payout Ratio, Regression Coefficients
(t-statistics in parentheses)

Regression Span	a	b_1	b_2	Adjusted R^2
A. Ten-year earnings growth as a function of earnings yield: $EG_{10} = a + b_1(E/P)$				
1946–2001	5.1%	–0.38(E/P)		17.5%
	(3.2)	(–2.5)		
1871–2001	5.5	–0.50(E/P)		10.2
	(3.3)	(–3.0)		
1871–1945	6.3	–0.65(E/P)		10.5
	(2.3)	(–2.2)		
B. Ten-year earnings growth as a function of earnings yield and payout ratio: $EG_{10} = a + b_1(E/P) + b_2(PR)$				
1946–2001	–11.8%	0.01(E/P)	0.25PR	54.5%
	(–2.9)	(0.1)	(5.2)	
1871–2001	0.2	–0.28(E/P)	0.05PR	16.6
	(0.1)	(–1.9)	(3.1)	
1871–1945	–2.5	–0.22(E/P)	0.07PR	20.2
	(–0.6)	(–0.7)	(4.5)	

lower-than-normal earnings yield (high P/E). Now suppose that, at this same time, many companies are unwilling to pay out high dividends—possibly in an effort to optimize the tax treatment of their shareholders but perhaps because the managers know the good times will not last or are, conversely, caught up in the "irrational exuberance" of the good times and are spending those retained earnings on inefficient empire building. In this case, the P/E is optimistic about the future but the payout ratio is not. Which should one believe?

The regression results in Table 6 suggest that for forecasting future real earnings growth, look at managers' dividend policies rather than what the market will pay for each dollar of earnings. More often than not, it is the payout ratio, not the valuation level, that gets it right.

Link to the Macro Economy. Recall that the empire-building hypothesis says that when payout ratios are low, the reason may be that companies are retaining cash to invest in unwise, low-return projects, perhaps building up a large organization to benefit the managers rather than shareholders. In addition, perhaps building an empire with retained cash is easier than paying dividends and issuing stock to finance expansion (which would subject the managers to the added scrutiny of the capital markets).

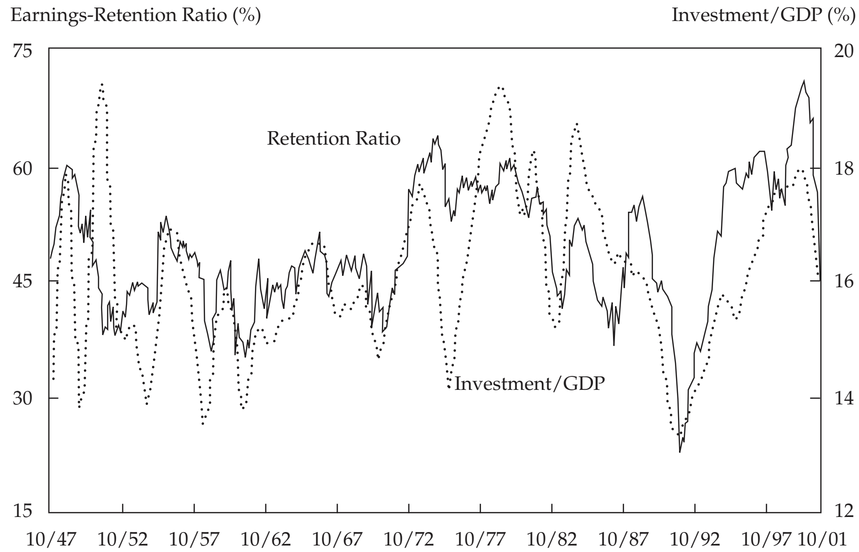
In what must be viewed as preliminary tests of this conjecture, we examined whether the payout ratio is correlated through time with a measure of economy-wide investment. For each quarter since 1947 (when our data source begins), using the St. Louis Federal Reserve Bank's FRED database, we formed the ratio of gross private domestic investment (GPDI) to GDP. We summed the last four quarterly observations to form annual investment and GDP figures, and we now focus on this ratio:

$$\frac{\text{Investment}}{\text{GDP}} = \frac{\text{Last four quarters of GPDI}}{\text{Last four quarters of GDP}}.$$

The idea was to form a simple measure of whether current investment is running high or low. If the empire-building hypothesis is true, we should see a positive correlation between investment/GDP and the retention ratio (1.0 minus the payout ratio). In other words, the more earnings companies are retaining, the more investment we should see. But this is not necessarily true. For instance, if tax optimization is driving recent low payouts, not the desire to invest more than usual, low payouts could simply be being offset by other forms of distribution (e.g., buybacks, less issuance of new shares, etc.).

Figure 4, which is a plot of aggregate investment to GDP and the retention ratio on separate axes, indicates that the correlation between these two variables, at +0.66, is strong. Interestingly, such a correlation with payout largely vanished when we compared investment/GDP with our proxies for mean reversion in S&P 500 earnings. The correlation of investment/GDP with lagged 10-year earnings growth, current earnings divided by their long-term moving average, and current earnings divided by current GDP were all found to be less than half the 0.66 correlation of investment/GDP with the payout ratio. Clearly, times of high cash retention (low dividends) are also times of high investment for the economy at large, but times of

Figure 4. S&P 500 Earnings-Retention Ratio and Aggregate Investment/GDP, 1947–2001



high investment are not necessarily times of depressed earnings. Note, in particular, that in late 1999 and early 2000 (prior to the technology bubble bursting), both series were very high, indicating that the high retention rates at corporations were not simply the result of tax optimization (i.e., substituting capital gains for dividend income) but did, in fact, coincide with higher-than-normal investment. On this measure, dividend policy and investment policy (at least at the macroeconomic level) are not even close to independent.

An interesting aspect is that, as **Table 7** and **Table 8** show, the payout ratio and investment/GDP (*INVEST/GDP*) both forecast 10-year real earnings growth *and* 10-year real GDP growth with signs consistent with our story (that is, more retention is a forecast of lower earnings and more investment is a forecast of lower GDP growth).[21] And, as for the payout ratio, the sign for *INVEST/GDP* is again "wrong"!

As with earnings growth, our findings for GDP are not being driven by simple mean reversion. Forecasts of the next 10 years' real GDP growth based on the previous 10 years' growth shows a modest continuation effect rather than mean reversion; also, errors in GDP that were later reversed would lead to a high *INVEST/GDP*, forecasting positive, not negative, future growth. Instead, as with earnings and dividends, we found the counterintuitive result that when investment is high as a percentage of GDP, future GDP growth is low. Although we are reporting only an initial investigation, we consider it interesting corroborating evidence for the empire-building explanation of the payout ratio's power.

Table 7. Ten-Year Earnings Growth as a Function of Investment/GDP and Payout Ratio: Regression Coefficients, 1947–2001 Data
(*t*-statistics in parentheses)

Earnings Growth	a	b_1	b_2	Adjusted R^2
A. $EG_{10} = a + b_1(INVEST/GDP)$				
EG_{10}	12.9%	–0.70(*INVEST/GDP*)		18.3%
	(6.4)	(–5.3)		
B. $EG_{10} = a + b_1(PR) + b_2(INVEST/GDP)$				
EG_{10}	–9.8%	0.22*PR*	–0.02(*INVEST/GDP*)	41.5%
	(–1.0)	(2.9)	(–0.1)	

Table 8. Ten-Year GDP Growth as a Function of Investment/GDP and Payout Ratio: Regression Coefficients, 1947–2001 Data
(*t*-statistics in parentheses)

Earnings Growth	a	b_1	b_2	Adjusted R^2
A. $GDP_{10} = a + b_1(INVEST/GDP)$				
GDP_{10}	8.9%	–0.36(*INVEST/GDP*)		22.0%
	(5.3)	(–3.9)		
B. $GDP_{10} = a + b_1(PR)$				
GDP_{10}	–0.1% +	0.08*PR*		22.0%
	(–1.2)	(4.3)		
C. $GDP_{10} = a + b_1(PR) + b_2(INVEST/GDP)$				
GDP_{10}	4.4%	0.05*PR*	–0.22(*INVEST/GDP*)	26.2%
	(1.5)	(1.8)	(–2.0)	

This investment/GDP result is also a significant robustness check on our earlier work. Our main results are for forecasting a version of index fund EPS. Regardless of our other robustness checks, EPS changes still could, because of index changes or corporate actions, be contaminating our data. Similarly, although the results are seemingly robust through time, the possibility that tax changes or changing sensitivity to, or awareness of, tax optimization could skew the decision to retain versus pay out earnings. Importantly, although perhaps bringing its own baggage, the ratio of investment to starting GDP as a forecast of real GDP growth suffers from none of these potential problems. The fact that the results indicate a phenomenon occurring that is very similar to the payout-ratio forecasting earnings growth is quite reassuring for fans of the empire-building story. Similarly, the fact that investment/GDP is highly correlated with the payout ratio but not with other measures, such as lagged earnings growth or current earnings versus a moving average, is a blow to those who might otherwise believe that our results for the payout ratio are driven by simple mean reversion in earnings.

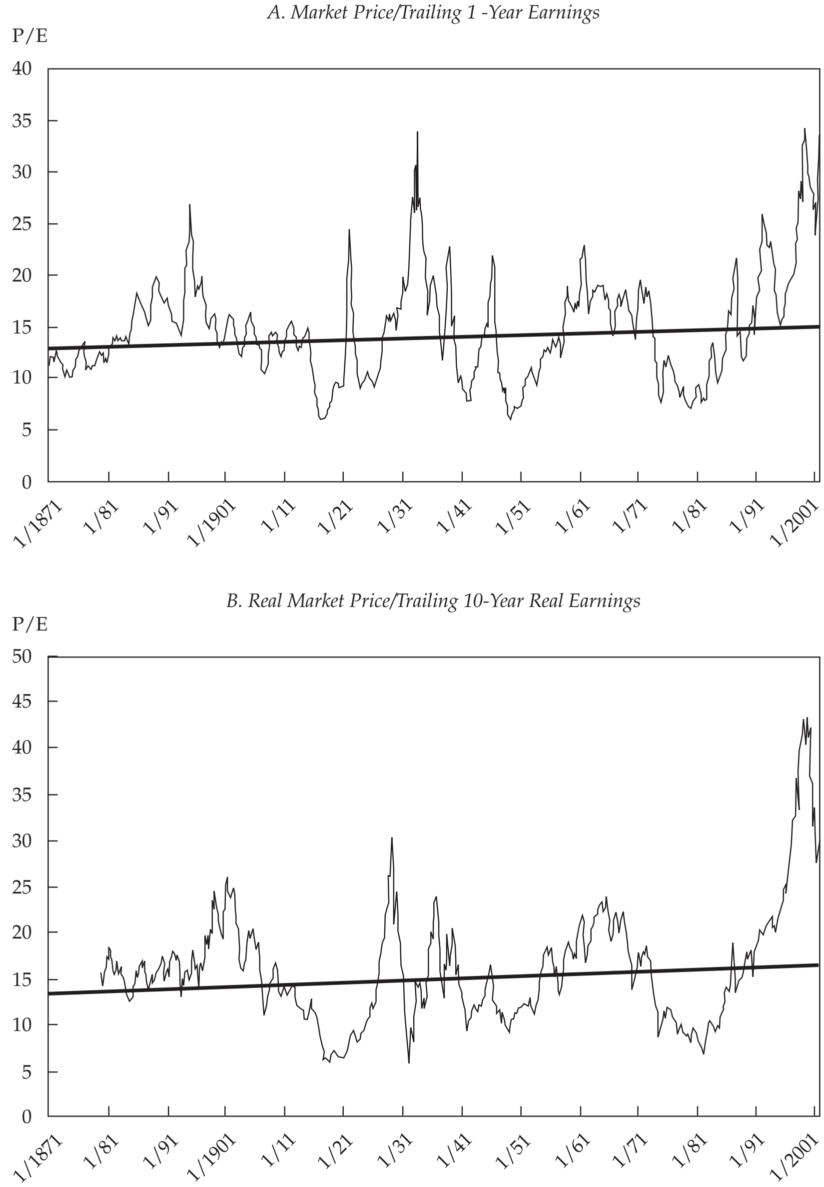
Implications

What are the implications of our findings for investors and for the equity markets? After a painful two-year bear market dating from March 2000, some might now, as of the writing of this article in early 2002, judge equities to be cheap by comparing today's prices with the unprecedented levels of late 1999 and early 2000. Noting the dramatic fall, one might now favor the purchase of equities as a "contrarian" recommendation. Compared with history, however, stocks are anything but cheap, as is evident by the history of P/Es in Panel A of **Figure 5**.

Panel A shows that P/Es based on one-year trailing earnings are at their highest level ever; despite falling prices, the plunge in recent earnings has driven the S&P 500's P/E to an extreme. Some might argue that this picture overstates the case, because recent earnings are perhaps abnormally low (or, if we may be provocative, the 1999/2000 earnings were abnormally high). The P/E based on 10 years of trailing real earnings shown in Panel B, however, shows valuations comparable to right before the crash of 1929 and higher than at all times in history except during the bubble preceding 1929—or the bubble of 1999–2000. Arguing that today's 10-year P/E value is overstated would be hard. Other metrics are similar. Basically, compared with history, stocks remain expensive.[22]

Will the premium price be rewarded? Many authors and observers (e.g., Shiller 2000; Arnott and Ryan 2001; Arnott and Bernstein 2002; Asness 2000a) have noted that the high prices of equities today, coupled with a historically reasonable estimate of future earnings growth, have led to low estimates of future real returns and of the future equity risk premium. Some, taking a stance based on efficient markets (notably, Ibbotson and Chen 2003), disagree. In effect, they combine (1) the assumption of market efficiency, (2) the assumption that the Miller and Modigliani propositions hold intertemporally (that is, that high retention rates imply high future growth rates), and (3) the assumption that expected market returns do not vary through time. Based on these three assumptions, they contend that recent high P/Es do not alter the likely future rates of return. Low payout ratios will lead to faster earnings growth and recent high P/Es also mean that future earnings growth will make up for the low earnings yield. In other words, the omniscient invisible hand of an efficient market will adjust growth to compensate for any

Figure 5. Price to Earnings, 1871–2001



valuation level or payout, thereby providing a constant expected return!

This reasoning, this set of assumptions, and this forecast for high growth, which are sound in theory, are clearly rejected by our empirical work. We find no historical empirical support for the rationale. Ibbotson and Chen, via their intertemporal interpretation of Miller and Modigliani, would forecast higher-than-normal real earnings growth as a direct result of lower-than-normal dividend payouts. Our empirical results show the opposite. Similarly, a high P/E, contrary to the assumptions of Ibbotson and Chen, has almost no power to forecast future earnings growth in the presence of the payout ratio.

Essentially, prior to the plunge in earnings in late 2001, investors faced a situation of very high P/Es and very low payout ratios. History says such a period is a time of poor expected long-term future earnings growth. By the very end of 2001, the situation had changed; one-year earnings had plunged, sending payout ratios somewhat upward but sending P/Es into the stratosphere. In either situation, our results imply that forward-looking forecasts of the equity premium are very low compared with history.

The recent condition of very high P/Es and very low payout ratios combines expensive valuation and a low forecast of earnings growth. History suggests that this combination is clearly a recipe for low expected returns. The current condition, now that earnings have tumbled and payout ratios have returned closer to "normal," suggests more reasonable forecasts of earnings growth but from a now-reduced earnings base. With a historically off-the-charts P/E, this change provides little solace.

Finally, what do our findings mean for the ongoing controversy over executive stock options?[23] One nuance of the issuance of executive stock options is that they may provide an incentive to managers not to pay dividends, because dividends reduce the stock price on which their options are valued. Recall that one leading explanation for the perverse predictive power we found for the payout ratio is that some executives probably engage in unproductive empire building when they do not pay out sufficient dividends. The potential danger of such behavior when combined with the disincentive to pay dividends that might accompany executive stock options is as obvious as it is worrisome.

Conclusion

We did not start out trying to forecast gloom and doom. We started out by looking at the optimists' assertion that today's low payout ratios are a strong positive signal for future growth. Unfortunately, this view is emphatically inconsistent with the historical evidence.

Unlike optimistic new-paradigm advocates, we found that low payout ratios (high retention rates) historically precede low earnings growth. This relationship is statistically strong and robust. We found that the empirical facts conform to a world in which managers possess private information that causes them to pay out a large share of earnings when they are optimistic that dividend cuts will not be necessary and to pay out a small share when they are pessimistic, perhaps so that they can be confident of maintaining the dividend payouts. Alternatively, the facts also fit a world in which low payout ratios lead to, or come with, inefficient empire building and the funding of less-than-ideal projects and investments, leading to poor subsequent growth, whereas high payout ratios lead to more carefully chosen projects. The empire-building story also fits the initial macroeconomic evidence quite well. At this point, these explanations are conjectures; more work on discriminating among competing stories is appropriate.

Sometimes the world really does change. For instance, the recent low market payout ratios may indeed be the result of a new sensitivity to shareholder tax optimization, not a result of more negative forces (e.g., empire building, manager pessimism). In such a case, expected growth from recent low payout ratios might be much better than history would suggest, perhaps even strong enough to offset high prices and/or low payouts and deliver historically normal returns. But those forecasting this optimistic result are running into a headwind of 130 years of history; thus, the burden of proof should fall on them. They must show why high cash retention is no longer a negative for future growth (or even a neutral event for future growth) but is now, rather, a significant positive omen. In effect, they must show that change has created a truly new paradigm. With P/Es still extraordinarily high by any measure, this burden is not a light one.

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Notes

1. Miller and Modigliani posited and proved that in an ideal world, and in the absence of tax arbitrage considerations, dividend policy should not matter. Why? Because capital is fungible: A company has no reason to care whether it garners capital for projects from bond issuance, from stock issuance, or from retained earnings; therefore, the company should go wherever the risk-adjusted cost of capital is lowest. Reciprocally, an investor has no reason to care whether an investment pays a dividend that the investor can reinvest or whether the company reinvests earnings itself to fuel earnings growth equivalent to the forgone dividend yield. Thus, changes in dividend policy should not affect firm value. Similarly, investment policy and dividend policy should be independent.
2. Miller and Modigliani focused neither on intertemporal comparisons nor on dividend policy at an aggregate market level. The oft-cited intertemporal argument we examine is an extrapolation of Miller and Modigliani theory suggested by many analysts and strategists to justify rapid future earnings growth for the broad stock market. Ibbotson and Chen (2003) sum up this viewpoint well when they state that for the market as a whole, "Furthermore, our forecasts

are consistent with Miller and Modigliani (1961) theory, in that dividend-payout ratios do not affect P/Es and high earnings-retention rates (usually associated with low yields) imply higher per share future growth." (p. 00)

3. For more discussion of current approaches to estimating future returns, see the presentations and discussions at www.aimrpubs.org/ap/home.html from AIMR's *Equity Risk Premium Forum*.
4. The Schwert data are for January 1802 through December 1925; the Shiller data are for February 1871 through March 2001; and the Ibbotson data are for January 1926 through December 2000. Each source provides broad capitalization-weighted stock market yields and total returns; Shiller's data also include earnings. With regard to Shiller's data, monthly dividend and earnings data were computed from the S&P 500 Index four-quarter totals for the quarters since 1926, with linear interpolation to monthly figures. Dividend and earnings data before 1926 are from Cowles (1939) and interpolated from annual data.
5. These data came from Standard and Poor's for 1926 to date and from Cowles for periods before 1926.
6. Yields on 10-year government bonds came from the NBER for January 1800 through May 2001. Note: data were annual until 1843; we interpolated the data for monthly estimates. Long-term government bond yields and returns for January 1926 through December 2000 came from Ibbotson Associates.
7. NBER data spanned January 1801 through May 2001. Note: data were annual until 1950; we interpolated the data for monthly estimates. Ibbotson Associates data spanned 1926 through December 2000. We gave Ibbotson data primary (two-thirds) weighting for 1926–1950 because the NBER data are annual through 1950.
8. We used NBER data for January 1800 through March 2001. The NBER data are annual GNP figures through 1920 (which we interpolated July to July for our monthly data) and quarterly GDP figures for 1921–2001.
9. All *t*-statistics in this article have been adjusted for overlapping observations (the Newey–West 1987 correction).
10. Benartzi, Michaely, and Thaler (1997) found a different but related result for the cross-section of companies, namely, that dividend changes across stocks are not strong forecasters of cross-sectional differences in future earnings growth. In contrast and with results more similar to our findings, Nissim and Ziv (2001) found that dividend changes do contain information about future profitability. Although similar in spirit to our approach, these papers differ in two important ways from our tests. First, our tests are on the level of payout ratio policy, not dividend changes. Second, our results are for the aggregate market, not the cross-section of differential company growth.
11. Brealey and Myers (2000) described empire building as follows: "Other things equal, managers prefer to run large businesses rather than small ones. Getting from small to large may not be a positive-NPV undertaking" (p. 321). They went on to quote Jensen with, "The problem is how to motivate managers to disgorge the cash rather than investing it below the cost of capital or wasting it in organizational inefficiencies" (p. 323). In addition to the 1986 Jensen paper, see also Jensen and Meckling (1976).
12. Note, however, that the third and fourth explanations can be tested.
13. The start was 1901 because the 30-year window goes back to our data beginning in 1871. The first sample period is 1871–1901, and the most recent is 1971–2001. Thus, we had 100 years of rolling 30-year spans and at least four completely nonoverlapping periods.
14. Dividing by 10 years of real earnings led to similar inferences.
15. Both the payout ratio and MA_{20} are scaled versions of current earnings. One scales on dividends, and the other scales on past average real earnings. So, our test was whether scaling by average historical earnings or scaling by dividends is the more effective forecaster.
16. We ran three more tests of whether simple mean reversion (unrelated to dividends) is driving the strong 1946–2001 results. First, instead of using last year's earnings as the E to calculate the payout ratio, we used a three-year average of real earnings. If transitory components of E are driving the payout ratio's predictive power, then using a longer, more stable version of E might drive out this power. Second, in a draconian test, we simply lagged the payout ratio by one full year, greatly reducing the chance of highly transitory components of E driving our results. Third, we tried real earnings divided by real GDP as another proxy for whether earnings were high or low and likely to reverse. In each case, the payout ratio's power survived. Of course, averaging in older earnings data or arbitrarily skipping a year reduced the statistical significance of our tests somewhat, but the *t*-statistics on payout defined in these ways were still quite striking (always greater than 3.0). The results for E/GDP were similar to the results reported in the text. The variable had the hypothesized negative sign but did not work nearly as well as the payout ratio and did not significantly reduce the payout ratio's power in bivariate tests.
17. Also recall from Figure 2 that our 10-year results held up well for 1871–1945.
18. Harvey found that the term structure of interest rates can account for more than half of the variation in GNP growth in many G–7 countries. He noted that this explanatory power is a great deal higher than the explanatory power offered by a model based on past GNP growth rates. He also found the term structure forecasts to compare favorably with alternative forecasts.
19. Because the earnings yield, E/P, is the reciprocal of P/E, if the P/E is 25, stocks are delivering $1 of earnings for each $25 of stock valuation, or a 4 percent earnings yield. We prefer using earnings yield to using P/E because it is more directly comparable with bond or cash yields, is more stable over time, and behaves more sensibly during times of deeply depressed earnings. If the earnings of a $100 stock fall from $5 a share to $1 a share, the P/E is a relatively meaningless 100×; if earnings fall farther to a $1 loss per share, the P/E is completely meaningless. In contrast, in these hypothetical cases, the earnings yield falls from 5 percent to 1 percent to –1 percent, all of which have a simple economic meaning: The earnings yield tells how much in earnings an investor can expect on each $100 invested.
20. Campbell and Shiller (1998, 2001) found, similarly, that valuation ratios do a poorer job than fans of efficient markets might have expected of forecasting earnings growth, dividend growth, and productivity growth.
21. These results are also consistent with the company-by-company results of Titman, Wei, and Xie (2001) that companies that invest more tend to produce lower risk-adjusted returns. Like us, these authors also tested for and favored the empire-building story as an explanation for their counterintuitive results.
22. Some market observers have suggested that investors are more tolerant of equity market risk today and, therefore, valuation levels can easily be higher than in the past. Figure 5 also shows an exponential line of best fit (regression line) that may suggest that the "normal" P/E has risen by at least 25 percent over the past 130 years. This rise is a material change in fair value, which we think is entirely plausible, although it could also be a function of end points, notably the 2000 bubble. But in both panels, such a change would still place the "normal" P/E at just over half the recent levels.
23. The controversy covers both the efficacy of such options (do the positive incentives outweigh the negative ones?) and whether such options should be expensed (clearly, they should be).

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APPLICATION OF CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC FOR AUTHORITY TO CHANGE RATES	§ § § §	BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS

DIRECT TESTIMONY AND EXHIBITS

OF

J. RANDALL WOOLRIDGE, PH.D.

ON BEHALF OF

TEXAS COAST UTILITIES COALITION

JUNE 19, 2024

SOAH DOCKET NO. 473-24-13232
PUC DOCKET NO. 56211

APPLICATION OF CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC FOR AUTHORITY TO CHANGE RATES	§ § § §	**BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS**

DIRECT TESTIMONY AND EXHIBITS OF J. RANDALL WOOLRIDGE, PH. D.

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APPLICATION OF CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC FOR AUTHORITY TO CHANGE RATES	§ § § §	**BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS**

DIRECT TESTIMONY AND EXHIBITS OF J. RANDALL WOOLRIDGE, PH. D.

I. INTRODUCTION

Q. PLEASE STATE YOUR FULL NAME, ADDRESS, AND OCCUPATION.

A. My name is J. Randall Woolridge, and my business address is 120 Haymaker Circle, State College, PA 16801. I am a Professor of Finance and the Goldman, Sachs & Co. and Frank P. Smeal Endowed University Fellow in Business Administration at the University Park Campus of the Pennsylvania State University. I am also the Director of the Smeal College Trading Room and President of the Nittany Lion Fund, LLC. I provide a summary of my educational background, research, and related business experience in Appendix A.

Q. ON WHOSE BEHALF ARE YOU TESTIFYING?

A. I have been asked by the Texas Coast Utilities Coalition ("TCUC") to provide an opinion as to the overall fair rate of return or cost of capital for the regulated electric services of the CenterPoint Energy Houston Electric LLC ("CEHE," "CenterPoint Houston," or the "Company") and to evaluate the Company's rate of return testimony in this proceeding.[1]

Q. HOW IS YOUR TESTIMONY ORGANIZED?

A. The following outlines my testimony:

- First, I summarize my cost of capital recommendation for the Company and review the primary areas of contention on the Company's position.
- Second, I provide an assessment of capital costs in today's capital markets.

[1] In my testimony, I use the terms 'rate of return' and 'cost of capital' interchangeably. This is because the required rate of return of investors on a company's capital is the cost of capital.

- Third, I discuss the selection of proxy groups for estimating the cost of equity capital for the Company.
- Fourth, I discuss the Company's recommended capital structure and debt cost rates.
- Fifth, I provide an overview of the concept of the cost of equity capital, and then estimate the equity cost rate for the Company.
- Finally, I critique the Company's rate of return analysis and testimony.

II. SUMMARY OF RECOMMENDATIONS

A. OVERVIEW

Q. WHAT COMPRISES A UTILITY'S "RATE OF RETURN"?

A. A company's overall rate of return has three main components:

(1) capital structure (*i.e.*, ratios of short-term debt, long-term debt, preferred stock and common equity);

(2) cost rates for short-term debt, long-term debt, and preferred stock; and

(3) common equity cost, otherwise known as Return on Equity (ROE).

Q. WHAT IS A UTILITY'S ROE INTENDED TO REFLECT?

A. ROE is described most simply as the allowed rate of profit for a regulated company. In a competitive market, a variety of factors determine a company's profit level, including the state of the economy, the degree of competition a company faces, the ease of entry into its markets, the existence of substitute or complementary products/services, the company's cost structure, the impact of technological changes, and the supply and demand for its services and/or products. For a regulated monopoly, the regulator determines the level of profit available to the public utility. The United States Supreme Court established the guiding principles for determining an appropriate level of profitability for regulated public utilities in two cases: (1) *Hope* and (2) *Bluefield*.[2] In those cases, the Court recognized that the fair rate of return on equity should be:

(1) comparable to returns investors expect to earn on other investments of similar risk;

(2) sufficient to assure confidence in the company's financial integrity; and

(3) adequate to maintain and support the company's credit and to attract capital.

Accordingly, finding the appropriate ROE for a regulated utility requires determining the market-based cost of capital. The market-based cost of capital for a regulated firm represents the return investors could expect from other investments, while assuming no more and no less risk. The purpose of the economic models and formulas in cost of capital testimony, such as my testimony's Discounted Cash Flow ("DCF") Model and the Capital Asset Pricing Model ("CAPM"), is to use market data of firms with similar risk to estimate the rate of return on equity investors require for this specific risk-class of firms, in order to set an appropriate ROE for a regulated firm.

B. SUMMARY OF POSITIONS

Q. PLEASE REVIEW YOUR PROPOSED RECOMMENDATIONS REGARDING THE APPROPRIATE RATE OF RETURN FOR THE COMPANY.

A. I provide CEHE's proposed capital structure and debt and equity cost rates in Table 1. The Company has proposed a capital structure consisting of 55.10% long-term debt and 44.90% common equity. CEHE has proposed a long-term debt cost rate of 4.29%. As noted above, CEHE witness Ms. Ann E. Bulkley has proposed a ROE of 10.40% for CEHE. CEHE is proposing an overall rate of return or cost of capital of 7.03%.

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[2] *Fed. Power Comm'n v. Hope Natural Gas Co.*, 320 U.S. 591 (1944) (hereinafter "*Hope*"); *Bluefield Water Works and Improvement Co. v. Pub. Serv. Comm'n of W. Va.*, 262 U.S. 679 (1923) (hereinafter "*Bluefield*").

Table 1
CEHE's Rate of Return Recommendation

Capital Source	Capitalization Ratio	Cost Rate	Weighted Cost Rate
Long-Term Debt	55.10%	4.29%	2.36%
Common Equity	44.90%	10.40%	4.67%
Total	100.00%		7.03%

The Company's proposed capital structure includes a higher common equity ratio and lower financial risk than the companies in the proxy groups. The City of Houston's witness Mr. Breandan Mac Mathuna has recommended a capital structure with a common equity ratio of 42.50%. In his capital structure he also included a long-term debt cost rate of 4.29%. I am incorporating Mr. Mac Mathuna's capital structure in my analysis.

I have applied the Discounted Cash Flow Model ("DCF") and the Capital Asset Pricing Model ("CAPM") to my Electric Proxy Group as well as Ms. Bulkley's proxy group ("Bulkley Proxy Group") (collectively, the "Proxy Groups"). My analysis indicates an equity cost rate in the range of 8.55% to 10.10% is appropriate for the Company. Given these results, I believe that the appropriate ROE for CEHE is in the 9.00%-10.00%. Given that: (1) I rely primarily on the DCF model and the results for the Electric Proxy Group; and (2) the Company's investment risk is slightly less than the average of the two proxy groups, I am recommending a ROE of 9.50%. This represents the midpoint of my recommended range (midpoint of 9.00% - 10.00%) for CEHE.

Based on Mr. Mac Mathuna's proposed capital structure and debt cost rate, I am recommending an overall fair rate of return or cost of capital of 6.50% for CEHE. This recommendation is provided in Table 2 and Exhibit JRW-1.

Table 2
TCUC's Rate of Return Recommendation

Capital Source	Capitalization Ratio	Cost Rate	Weighted Cost Rate
Long-Term Debt	57.50%	4.29%	2.47%
Common Equity	42.50%	9.50%	4.04%
Total	100.00%		6.50%

C. PRIMARY RATE OF RETURN ISSUES IN THIS CASE

Q. PLEASE DESCRIBE THE PRIMARY RATE OF RETURN ISSUES IN THIS CASE.

A. The primary rate of return issues in this case are the appropriate capital structure and ROE for CEHE. These overarching issues are informed by the factors I set out below:

1. **<u>CEHE'S Assessment of Capital Market Conditions</u>**: Ms. Bulkley's analyses, ROE results, and recommendations suggest that higher interest rates and capital costs are on the horizon. However, despite the increase in inflation and interest rates over the past two years, several factors suggest the equity cost rate for utilities has not risen significantly. To support this contention, I show that: (1) despite the higher inflation of the past two years, long-term inflation expectations are about 2.25%; (2) the yield curve is currently inverted – which suggests that investors expect yields to decline and that a recession in the next year is very likely, which would also put downward pressure on interest rates; and (3) while authorized ROEs for utilities hit all-time lows in 2020 and 2021, these ROEs did not decline nearly as much as interest rates during those years. Hence, now that interest rates have increased, authorized ROEs have not increased at the same magnitude.

2. <u>Capital Structure</u> – The Company has proposed a capital structure with a common equity ratio of 44.90%. This represents an increased common equity ratio, up from the Company's current authorized common equity ratio of 42.50%. Mr. Breandan Mac Mathuna has recommended a capital structure with a common equity ratio of 42.50%. This is similar to the average capitalizations and common equity ratios maintained by the utilities in the two proxy groups.

4. <u>CEHE'S Investment Risk is Equal to the Average of the Electric and Bulkley Proxy Groups</u> – CEHE'S S&P and Moody's issuer credit ratings of BBB+ and Baa1 indicate that the Company's investment risk is a little below the average of the two proxy groups who have average S&P and Moody's issuer credit ratings of BBB+ and Baa2.

5. <u>DCF Approach</u> – Ms. Bulkley and I have both employed the traditional constant-growth DCF model. Ms. Bulkley has overstated her reported DCF results by relying exclusively on the overly-optimistic and upwardly-biased earnings per share ("EPS") growth-rate forecasts of Wall Street analysts and *Value Line*. In contrast, in developing the DCF growth rate that I used in my analysis, I have reviewed thirteen growth rate measures, including historical and projected growth rate measures, and have evaluated growth in dividends, book value, and earnings per share.

6. <u>CAPM Approach</u> – The CAPM approach requires an estimate of the risk-free interest rate, beta, and the market or risk premium. There are two primary issues with Ms. Bulkley's CAPM analyses: (1) she has used a non-traditional CAPM approach, the empirical CAPM ("ECAPM"), as an equity-cost-rate approach; and (2) most significantly, she has used a market-risk premium of 8.03%. The 8.03% market risk premium is much larger than: (1) indicated by historic stock and bond return data; and (2) well above that found in the published studies and surveys of the market risk premium.

In addition, I demonstrate that the 8.03% market risk premium is based on totally unrealistic assumptions of future economic and earnings growth and stock returns. To compute her market risk premium, Ms. Bulkley has applied the DCF model to the S&P 500 and employed analysts' three-to-five-year earnings per share ("EPS") growth-rate projections as a growth rate to compute an expected market return and market risk premium. As I demonstrate later in my testimony, the EPS growth-rate projection of 10.51% Ms. Bulkley used for the S&P 500 and the resulting expected market return (12.22%) and market risk premium (8.03%) include unrealistic assumptions regarding future economic and earnings growth and stock returns.

As I highlight in my testimony, there are three commonly-used procedures for estimating a market risk premium – historic returns, surveys, and expected return models. I have used a market risk premium of 5.00%, which: (1) factors in all three approaches – historic returns, surveys, and expected return models – to estimate a market premium; and (2) employs the results of many studies of the market risk premium. As I note, the 5.00% figure reflects the market risk premiums: (1) determined in recent academic studies by leading finance scholars; (2) employed by leading investment banks and management consulting firms; and (3) found in surveys of companies, financial forecasters, financial analysts, and corporate CFOs.

7. **Alternative Risk Premium Model**: Ms. Bulkley also estimates an equity cost rate using an alternative risk premium model, calling it the Bond Yield Risk Premium approach. Ms. Bulkley computes this risk premium using a regression of the historical relationship between the yields on long-term Treasury bonds and authorized ROEs for electric utility companies. Ms. Bulkley computes the estimated ROE as the projected risk-free rate plus the risk premium.

I discuss several issues with this approach in more depth later, but the primary problems with this approach are that:

(1) this particular risk premium approach is a gauge of *commission* behavior rather than *investor* behavior;

(2) this methodology produces an inflated measure of the risk premium because this approach uses historical authorized ROEs and Treasury yields, and the resulting risk premium is applied to projected Treasury yields;

(3) the risk premium in this approach is inflated as a measure of investors' required risk premium, since electric distribution utilities have been selling at market-to-book ratios in excess of 1.0; and

(4) the ROE is dependent on the authorized ROEs from state utility commissions, and the Werner and Jarvis study (2022), which as discussed below, demonstrated that authorized ROEs over the past four decades have overstated the actual cost of equity capital because they have not declined in line with capital costs.

8. **Other Factors:** Ms. Bulkley also considers three other factors in arriving at her 10.40% ROE recommendation: (1) CEHE's capital expenditures; (2) regulatory risks; and (3) customer concentration. However, these factors are already considered in the credit-rating process and, as previously noted, CEHE'S S&P and Moody's issuer credit ratings of BBB+ and Baa1 are slightly better than the average of the two proxy groups, who have S&P and

Moody's issuer credit ratings of BBB+ and Baa2. Hence, there is no reason to adjust for these factors in arriving at a ROE for CEHE.

III. CAPITAL MARKET CONDITIONS AND AUTHORIZED ROES

Q. PLEASE PROVIDE A SUMMARY OF THE UTILITY CAPITAL MARKET INDICATORS IN EXHIBIT JRW-2.

A. Page 1 of Exhibit JRW-2 shows the yields on Baa rated public utility bonds. These yields have gradually declined in the past decade from 7.5% to the 3.0% range. These yields bottomed out in the 3.0% range in 2020 and 2021 due to the economic fallout from the COVID-19 pandemic. They increased with interest rates in general in 2022, 2023, and 2024 and now are in the 5.75% range in 2024.

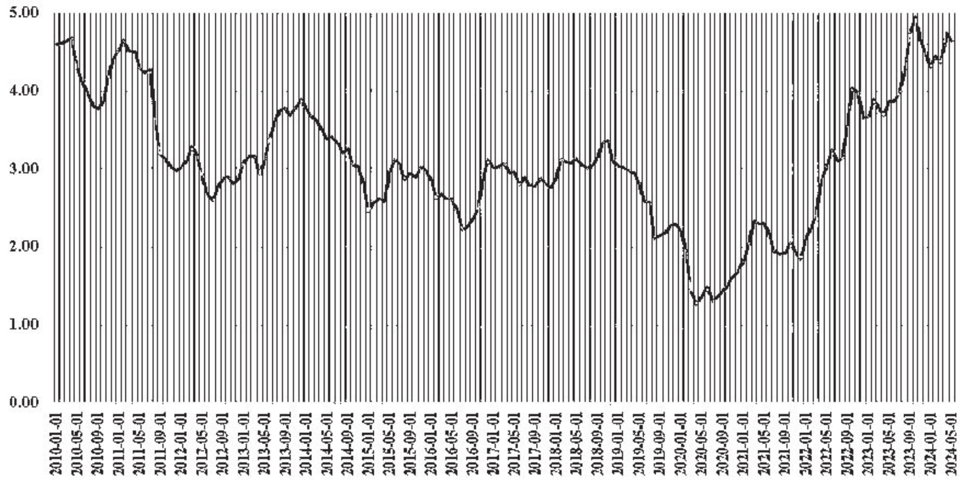
Page 2 of Exhibit JRW-2 shows the average dividend yield for electric utilities. These yields declined over the past decade, bottoming out at 3.1% in 2019. They have increased since that time, and the average was 3.9% as of 2023.

Page 3 of Exhibit JRW-2, provides the average earned ROEs and market-to-book ratios for electric utilities. The average earned ROE has been in the 9.0% to 10.0% range over the past five years. The average market-to-book ratio increased over the last 13 years, peaked at 2.0X in 2019, and declined to the 1.75X range in 2020-2022, and declined to 1.50X in 2023.

Q. PLEASE REVIEW INTEREST RATE MOVEMENTS IN RECENT YEARS.

A. Figure 1, below, shows 30-year Treasury yields over the past 15 years (2010 to 2024). These yields were in the 3.0% range at the end of 2018. They declined to the 2.25% range in 2019 due primarily to slow economic growth and low inflation. In 2020, with the advent of the COVID-19 pandemic in February of that year, 30-year Treasury yields declined to record low levels, dropping about 100 basis points to settle in the 1.25% range. They began their recovery in the Summer of 2020 and increased to the 2.00% - 2.50% in 2021. They increased significantly in 2022 and 2023 with the improving economy and higher inflation. In 2023, these yields increased from the 3.50% range and peaked at about 5.00% in the fourth quarter. In 1024, these yields have since deceased and currently are in the 4.50% range.

Figure 1
30-Year Treasury Yields

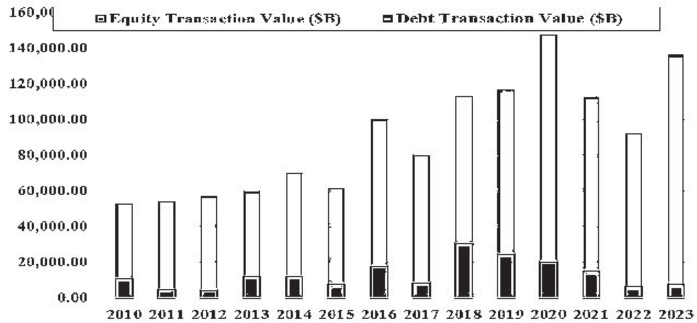


Data source: https://fred.stlouisfed.org/series/DGS30.

Q. DID UTILITIES TAKE ADVANTAGE OF THE RECORD LOWER BOND YIELDS IN 2020 AND 2021 TO RAISE CAPITAL?

A. Yes. Figure 2 shows the annual amounts of debt and equity capital raised by public utility companies over the past 13 years. Electric utility and gas distribution companies have taken advantage of the low interest rate and capital cost environment of recent years and raised record amounts of capital in the markets. In fact, in four of the past five years, public utilities have annually raised more than $100 billion in combined debt and equity capital.

Figure 2
Debt and Equity Capital Raised by Public Utilities
2010–2023



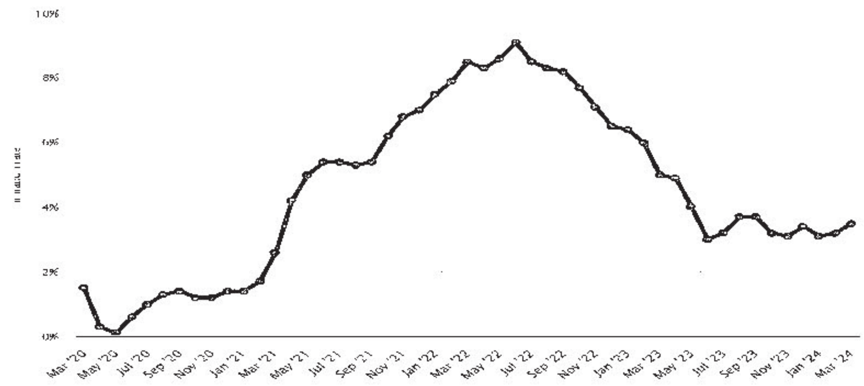
Data Source: S&P Global Market Intelligence, S&P Cap IQ, 2024.

Q. PLEASE DISCUSS THE INCREASE IN INTEREST RATES SINCE THE BEGINNING OF 2022.

A. Several factors led to higher interest rates since 2022. Coming out of the pandemic, real GDP growth has increased 5.95% in 2021, 2.06% in 2022, and 3.25% in 2023, compared to a decline of -3.4% in 2020. This recovery led to greater business activity, higher levels of business and consumer spending, and large increases in housing prices. Unemployment was 6.7% in 2020 and has steadily declined to 3.5% in 2024. The recovery in the economy puts upward pressure on interest rates by increasing the demand for capital.

In addition, as reported extensively in the financial press, inflation picked up significantly in 2022, putting additional pressure on interest rates. Reported year-over-year inflation has been as high as 9.20% in 2022. Year-over-year inflation declined since that time, and is at 3.30% as of May, 2024. The high inflation reported in the past two years primarily reflects three factors: (1) the recovering and growing U.S. economy; (2) the production shutdowns during the pandemic, which led to supply chain shortages as the global economy has recovered; and (3) the war in Ukraine, which has led to higher energy and gasoline prices worldwide.

Figure 3
Year-Over-Year Inflation Rates
2020-2024

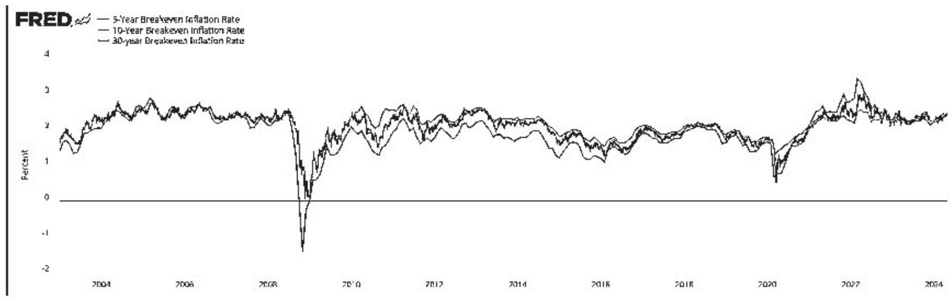


Source: https://www.statista.com/statistics/273418/unadjusted-monthly-inflation-rate-in-the-us/

In response to the higher inflation, the Federal Reserve in 2022 increased the discount rate by 25 basis points in March, 50 basis points in May, and 75 basis points in June, July, September, and November, 50 basis points in December, and 25 basis points in February, March, May, and July of 2023. Since the last rate increase, the Federal Reserve has held the discount rate steady while monitoring economic activity, with the expectation that once inflation falls to the target 2.0% range, the Fed will begin cutting the discount rate.

Investors' inflation expectations can be seen by looking at the difference between yields on ordinary Treasuries and the yields on inflation-protected Treasuries, known as TIPS. Figure 4 shows the expected inflation rate over the next five, ten, and thirty years. One can see that the expected inflation rate has declined since 2022, and is now at an expected inflation rate of 2.25% over the next five years. The expected inflation rates over the next ten and thirty years are also in the 2.25% range. The bottom line is that the expected long-term inflation rate is around 2.25%.

Figure 4
5-Year, 10-Year, and 30-Year Breakeven Inflation Rates

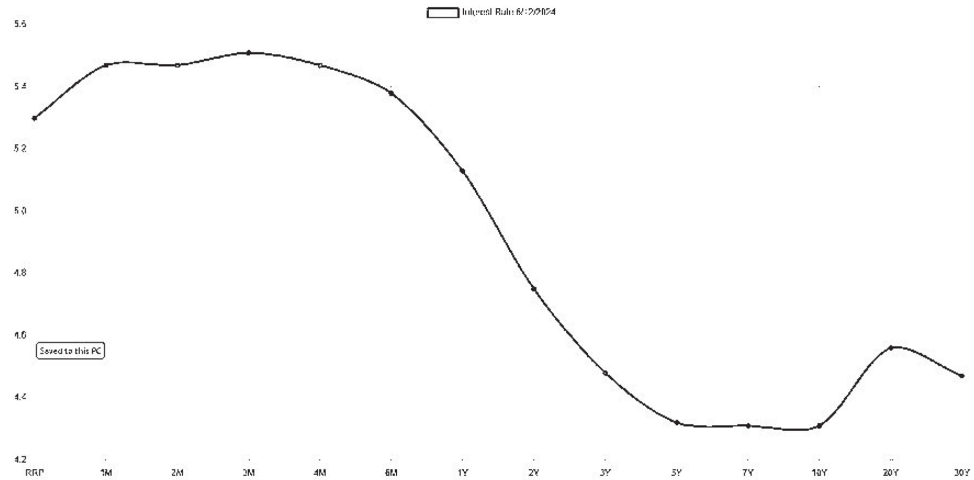


Date source: https://fred.stlouisfed.org/.

Q. DO YOU BELIEVE THAT INTEREST RATES WILL INCREASE IN 2024?

A. No. As discussed above, the current inflationary environment has pushed up interest rates over the past year. Also, as noted above, the Federal Reserve has responded with a series of discount rate increases, intended to slow the economy and cool down inflation, which would lower interest rates. Figure 5 shows the yield curve, which plots the yield-to-maturity and time-to-maturity for Treasury securities. The yield curve is usually upward sloping because investors require higher returns to commit capital for longer periods of time. Currently, the yield curve is said to be "inverted," which means that the yields on shorter-term maturity securities are higher than the yields on longer-term securities. This means that investors do not expect interest rates to remain where they are and expect that they should decline.

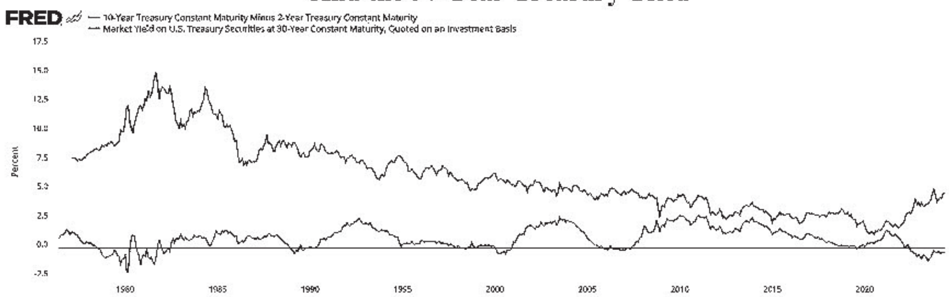
Figure 5
The Yield Curve:
Yield-to-Maturity and Time-to-Maturity for Treasury Securities



Source: https://www.ustreasuryyieldcurve.com/ - 6-13-24.

The financial press has focused on another aspect of an inverted yield curve. An inverted yield curve also is an indicator of a pending recession, which would also put downward pressure on interest rates. An inverted yield curve is usually indicated when the 2-year Treasury yield is above the 10-year Treasury yield. Figure 6 graphs two lines: (1) the 10-year Treasury yield minus the 2-year Treasury yield (blue line); and (2) the 30-year Treasury yield (red line). In Figure 6, the shaded areas are economic recessions, defined as two-straight quarters with negative GDP growth. In Figure 6, one can see that every time the yield curve inverted (2-year > 10-year) in the last 50 years, a recession followed. In addition, one can see that interest rates, as indicated by the 30-year Treasury yield in Figure 6, decline during recessions. Since the yield curve is currently inverted, a recession and lower interest rates are likely to follow.

Figure 6
Treasury 10-Year Minus 2-Year Yields
And the 30-Year Treasury Yield



Source: https://fred.stlouisfed.org/series/T10Y2Y

Q. PLEASE SUMMARIZE YOUR ASSESSMENT OF THE CURRENT CAPITAL MARKET SITUATION.

A. The U.S. economy, as measured by nominal GDP, declined twenty percent in the first half of 2020, rebounded significantly in 2021 and continued to rebound in 2022 and 2023. This rebound has seen big increases in consumer and business spending, lower unemployment, and higher housing prices. The rebounding economy has put pressure on prices, which has been further exacerbated by the post-COVID supply chain issues and the higher energy prices brought on by the Russia-Ukraine conflict. In recent months market participants have been focusing on economic growth, the labor market and unemployment, and inflation in anticipation of a cut in the discount rate by the Federal Reserve. Such a discount rate cut would signal that the Fed believes its target inflation rate of 2.0% is within range.

Utilities did take advantage of the low yields in 2020 and 2021 to raise record amounts of capital. But the big economic issue has been reported inflation and interest rates. However, while year-over-year inflation has remained above the 2.0% target, the yields on TIPS suggest that longer-term inflationary expectations are still about 2.25%. In addition, as I noted above, with an inverted yield curve, the prospect of a recession is likely, which would lead to lower interest rates.

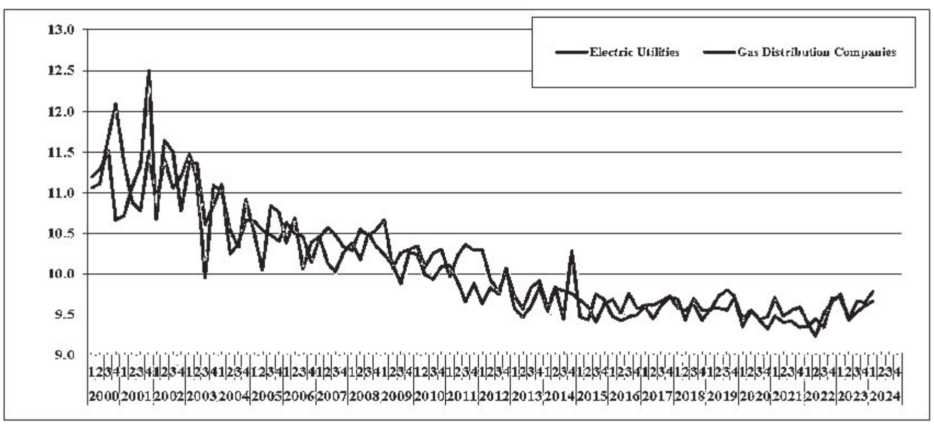
A. AUTHORIZED ROES

Q. PLEASE DISCUSS THE TREND IN AUTHORIZED ROES FOR ELECTRIC AND GAS COMPANIES.

A. In 2020 and 2021, authorized ROEs for utilities hit an all-time low as the low interest rate and capital cost environment put downward pressure on authorized ROEs.[3]

Figure 7 reflects the authorized ROEs for electric utility and gas distribution companies from 2000-2024. The authorized ROEs have trended down with interest rates and capital costs in the past fifteen years. The average authorized ROEs fell below 10% for electric utilities in 2012. The average ROE authorized for electric utility companies was 9.44% in 2020, 9.38% in 2021, 9.54% in 2022, 9.60% in 2023, and 9.66% in the first quarter of 2024.

Figure 7
Authorized ROEs for Electric Utilities and Gas Distribution Companies
2000-2024



Data Source: S&P Global Market Intelligence, RRA *Regulatory Focus*, 2024.

[3] The data and numbers discussed in this section come from S&P Global Market Intelligence, RRA *Regulatory Focus*, 2024.

Table 3
Average Annual Authorized ROEs for Electric Utilities and Gas Distribution Companies
2010–2024

	Electric	Gas		Electric	Gas
2010	10.37	10.15	2017	9.74	9.72
2011	10.29	9.92	2018	9.65	9.59
2012	10.17	9.94	2019	9.66	9.72
2013	10.03	9.68	2020	9.44	9.47
2014	9.91	9.78	2021	9.38	9.56
2015	9.78	9.6	2022	9.54	9.53
2016	9.77	9.54	2023	9.60	9.64
			Q1-2024	9.66	9.78

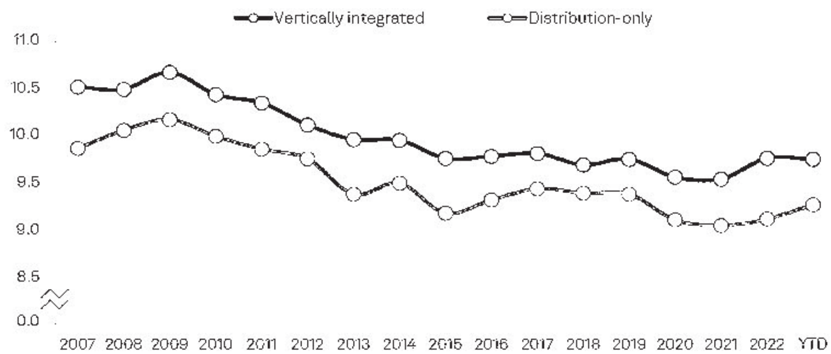
Data Source: S&P Global Market Intelligence, RRA Regulatory Focus, 2024.

Q. DO AUTHORIZED ROES FOR ELECTRIC DISTRIBUTION-ONLY OR DELIVERY-ONLY COMPANIES LIKE CEHE DIFFER FROM THE AUTHORIZED ROES FOR VERTICALLY-INTEGRATED ELECTRIC UTILITIES?

A. Yes. One consistent factor in electric utility authorized ROEs is that the ROEs for distribution only companies have consistently been below those of vertically integrated utilities. This is shown in Figure 8 below. The lower authorized ROEs are usually attributed to the fact that these delivery or distribution companies do not own and operate electric generation which is perceived by investors to be the riskier part of electric utility operations. I believe that commissions in states who have deregulated the electric-utility industry recognize the lesser risk of "wires-only" companies like CEHE, and award lower ROEs. The authorized ROEs for electric delivery companies have been 30 to 50 basis points below those of vertically integrated electric utilities in recent years. ROEs for electric delivery companies were 9.10% in 2020, 9.04% in 2021, 9.11% in 2022, 9.24% in 2023, and 9.60% in the first quarter of 2024.[4]

[4] S&P Global Market Intelligence, RRA *Regulatory Focus*, 2024.

Figure 8
Authorized ROEs for Vertically-Integrated versus
Delivery-Only Electric Utilities
2006-2024



Data Source: S&P Global Market Intelligence, RRA Regulatory Focus, 2024.

Q. DID THE HIGHER INTEREST RATES IN 2022 AND 2023 MEAN THAT AUTHORIZED ROES MUST INCREASE IN LINE WITH INTEREST RATES?

A. Not necessarily. As noted above, authorized ROEs for utilities reached record low levels in 2020 and 2021 due to the record low interest rates and capital costs. However, authorized utility ROEs never declined to the same extent that interest rates declined in these two years.

Table 4 shows the average annual 30-year Treasury yields and authorized ROEs for electric distribution companies from 2018-23. In Table 4, I have averaged the 2018/2019 (pre-COVID period) figures and the 2020/2021 (COVID period) figures for the Treasury yields and ROEs, and then compared the pre-COVID and COVID period ROEs and yields to those in 2022 and 2023 (post-COVID period).

A key observation from Table 4 is that authorized ROEs for electric distribution companies, despite hitting record lows in 2020–21, did not decline as much as interest rates. The daily 30-year Treasury yield averaged 2.85% in 2018 and 2019, versus 1.81% in 2020 and 2021, a decrease of 1.04% or 104 basis points. However, the authorized ROE for electric distribution companies averaged 9.38% in 2018 and 2019, and declined to an average of 9.07% in 2020 and 2021, a decline of -0.31%.

In 2022, the average daily 30-year Treasury yield increased by 105 basis points to 3.11%, while authorized ROEs for electric distribution companies increased 0.07% to 9.11%. Likewise, the average daily 30-year Treasury yield increased by 92 basis points to 4.03% in 2023, while authorized ROEs for electric distribution companies increased by 0.13% to 9.24%.

Table 4
Average Annual 30-Year Treasury Yields and Authorized ROEs for Electric Distribution Companies
2018–2023

	2018	2019	2018-19 Average	2020	2021	2020-21 Average	2020-21 Avg. Minus 2018-19 Avg.	2022	2022 Minus 2021	2023	2023 Minus 2022
30-Year Treasury Yield	3.11%	2.58%	2.85%	1.56%	2.06%	1.81%	-1.04%	3.11%	1.05%	4.03%	0.92%
Average Elec. Dist. ROE	9.38%	9.37%	9.38%	9.10%	9.04%	9.07%	-0.31%	9.11%	0.07%	9.24%	0.13%

Data Source: S&P Global Market Intelligence, RRA Regulatory Focus, 2024.

Q. PLEASE REVIEW THE AUTHORIZED ELECTRIC UTILITY ROES FOR TEXAS.

A. Table 5 shows the rate case outcomes for Texas's electric utility companies over the 2010-24 time period. These authorized ROEs were in the 9.60%-9.80% range prior to Covid, and declined to the 9.25%-9.50% during the Covid years. In the post-Covid years (2022-24), authorized ROEs have been in the 9.35%-9.70% range. In the Company's last rate case in 2020, the parties agreed to a settlement with a 9.40% ROE and a capital structure with a common equity ratio of 42.50%.

Table 5
Texas Authorized Electric ROEs
2010–24

Company	TKR	Service	Type	Date	Docket	Decision Type	ROE	Common Equity Ratio
Entergy Texas Inc.	ETR	Electric	Vertically Integrated	12/1/2010	D-37744	Settled	10.13	NA
Texas-New Mexico Power Co.	PNM	Electric	Distribution	1/20/2011	D-38480	Settled	10.13	45.00
CenterPoint Energy Houston	CNP	Electric	Distribution	2/3/2011	D-38339	Fully Litigated	10.00	45.00
Oncor Electric Delivery Co.	SRE	Electric	Distribution	8/19/2011	D-38929	Settled	10.25	40.00
Entergy Texas Inc.	ETR	Electric	Vertically Integrated	9/13/2012	D-39896	Fully Litigated	9.80	49.92
Lone Star Transmission LLC	NEE	Electric	Transmission	10/12/2012	D-40020	Settled	9.60	45.00
Cross Texas Transmission		Electric	Transmission	1/16/2013	D-40604	Settled	9.60	40.00
Wind Energy Transmission Texas		Electric	Transmission	1/16/2013	D-40606	Settled	9.60	40.00
Southwestern Electric Power Co	AEP	Electric	Vertically Integrated	10/3/2013	D-40443	Fully Litigated	9.65	49.10
Lone Star Transmission LLC	NEE	Electric	Transmission	9/11/2014	D-42469	Settled	9.60	45.00
Cross Texas Transmission		Electric	Transmission	5/1/2015	D-43950	Settled	9.60	40.00
Wind Energy Transmission Texas		Electric	Transmission	9/25/2015	D-44746	Settled	9.60	40.00
Southwestern Public Service Co	XEL	Electric	Vertically Integrated	12/17/2015	D-43695	Fully Litigated	9.70	51.00
Electric Transmission Texas		Electric	Transmission	1/12/2017	D-46817	Settled	9.60	40.00
Oncor Electric Delivery Co.	SRE	Electric	Distribution	9/28/2017	D-46957	Settled	9.80	42.50
El Paso Electric Co.		Electric	Vertically Integrated	12/14/2017	D-46831	Settled	9.65	48.35
Southwestern Electric Power Co	AEP	Electric	Vertically Integrated	12/14/2017	D-46449	Fully Litigated	9.60	48.46
Texas-New Mexico Power Co.	PNM	Electric	Distribution	12/20/2018	D-48401	Settled	9.65	45.00
CenterPoint Energy Houston	CNP	Electric	Distribution	2/14/2020	D-49421	Settled	9.40	42.50
AEP Texas Inc.	AEP	Electric	Distribution	2/27/2020	D-49494	Settled	9.40	42.50
Southwestern Public Service Co	XEL	Electric	Vertically Integrated	8/27/2020	D-49831	Settled	9.45	54.62
Sharyland Utilities L.L.C.	SRE	Electric	Transmission	7/15/2021	D-51611	Settled	9.38	40.00
Southwestern Electric Power Co	AEP	Electric	Vertically Integrated	11/18/2021	D-51415	Fully Litigated	9.25	49.37
El Paso Electric Co.		Electric	Vertically Integrated	9/15/2022	D-52195	Settled	9.35	51.00
Oncor Electric Delivery Co.	SRE	Electric	Distribution	3/9/2023	D-53601	Fully Litigated	9.70	42.50
Entergy Texas Inc.	ETR	Electric	Vertically Integrated	8/3/2023	D-53719	Settled	9.57	51.21
Southwestern Public Svc Co.	XEL	Electric	Vertically Integrated	4/11/2024	D-54634	Settled	NA	NA

Data Source: S&P Global Market Intelligence, RRA Regulatory Focus, 2024.

Q. DO YOU BELIEVE THAT YOUR ROE RECOMMENDATION MEETS *HOPE* AND *BLUEFIELD* STANDARDS?

A. Yes. As previously noted, according to the *Hope* and *Bluefield* decisions, returns on capital should be: (1) comparable to returns investors expect to earn on other investments of similar risk; (2) sufficient to assure confidence in the company's financial integrity; and (3) adequate to maintain and support the company's credit and to attract capital.

As shown on page 3 of Exhibit JRW-2, electric utility companies have been earning ROEs in the range of 9.0% to 10.0% in recent years. With these ROEs, electric utility companies such as those in the proxy group have strong investment-grade credit ratings, their stocks have been selling well over book value, and they have been raising abundant amounts of capital.

While my recommendation is below the average authorized ROEs for electric utility companies, the Werner and Jarvis (2022) study, which is discussed below, concluded that, over the past four decades, authorized ROEs have not declined in line with capital costs over time and therefore past authorized ROEs have overstated the actual cost of equity capital. Hence, the Commission should not be concerned that my recommended ROE is below other authorized ROEs. Therefore, I believe that my recommendation meets the criteria established in *Hope* and *Bluefield*.

Q. WITH RESPECT TO THIS DISCUSSION, PLEASE DISCUSS THE *WALL STREET JOURNAL* ARTICLE ON UTILITIES' AUTHORIZED ROES IN THE CURRENT ENVIRONMENT.

A. The *Wall Street Journal* article, entitled "Utilities Have a High-Wire Act Ahead," discussed the issues utilities face today to meet the needs of their primary stakeholders – customers and investors.[5] The article also highlights current utility rate issues in the context of a recent study on rate of return regulation. In the study, Werner and Jarvis (2022) evaluated the authorized ROEs in 3,500 electric and gas rate case decisions in the U.S. from 1980-2021. They compared the allowed rate of return on equity to a number of capital cost benchmarks (government and corporate bonds, CAPM equity cost rate estimates, and U.K. authorized ROEs) and focused on three questions: (1) To what extent are utilities being allowed to earn excess returns on equity by their regulators?; (2) How has this return on equity affected utilities' capital investment decisions?; and (3) What impact has this had on the costs paid by consumers?[6]

The authors reported the following empirical results:

(1) The real (inflation-adjusted) return regulators allow equity investors to earn has remained steady over the last 40 years, while the many different cost of capital measures have been declining;

(2) The gap between the authorized ROEs and the benchmarks suggest that regulators have been approving ROEs that are from 0.50% to 5.50% above the cost of equity estimates;

(3) One potential explanation is that utilities have become riskier. However, the authors find that utility credit ratings, on average, have not changed much over the past 40 years;

[5] Jinjoo Lee, "Utilities Have a High-Wire Act Ahead," *Wall Street Journal*, October 9, 2022.

[6] Karl Dunkle Werner and Stephen Jarvis, "Rate of Return Regulation Revisited," Working Paper, Energy Institute, University of California at Berkeley, 2022.

(4) An extra 1.0% of allowed return on equity causes a utility's capital rate base to expand by an extra 5% on average. This supports the Averch-Johnson effect that utilities have the incentive to overinvest in capital projects if they are earning an outsized return on those investments;

(5) Both the return on equity requested by utilities and the return granted by regulators respond more quickly to rises in market measures of capital cost than to declines. The time adjustment for decreases is twice as long as for increases;

(6) Authorized ROEs tend to be approved at round numbers (1.0, 0.5, 0.25), with 10.0% being the most common authorized ROE;

(7) Overall, based on the gap, consumers may be paying $2-20 billion per year more than if authorized ROEs had fallen in line with other capital market indicators; and

(8) The authors also indicated that their results are similar to those found in a previous study by Rode and Fischback (2019).[7]

In summary, these results indicate that over the past four decades authorized ROEs have not declined in line with capital costs and therefore past authorized ROEs have overstated the actual cost of equity capital. Hence, again underscoring that though my recommended ROE is below other authorized ROEs, it nonetheless meets the *Hope* and *Bluefield* tests.

IV. PROXY GROUP SELECTION

Q. PLEASE DESCRIBE YOUR APPROACH TO DEVELOPING A FAIR RATE OF RETURN RECOMMENDATION FOR CEHE.

A. To develop a fair rate of return recommendation for the Company, I evaluated the return requirements of investors on the common stock using two proxy groups: (1) my proxy group of publicly held electric utility companies ("Electric Proxy Group"); and (2) Ms. Bulkley proxy group ("Bulkley Proxy Group").

[7] David C. Rode and Paul S. Fischbeck, "Regulated Equity Returns: A Puzzle." *Energy Policy*, October, 2019.

Q. PLEASE DESCRIBE YOUR PROXY GROUP OF ELECTRIC COMPANIES.

A. The selection criteria for my Electric Proxy Group include the following:

1. Receives at least 50% of revenues from regulated electric operations as reported in its SEC Form 10-K Report;
2. *Value Line Investment Survey* lists it as a U.S.-based electric utility;
3. Holds an investment-grade corporate credit and bond rating;
4. Paid a cash dividend in the past six months, with no cuts or omissions;
5. Is not involved in an acquisition of another utility, and not the target of an acquisition; and
6. Its analysts' long-term EPS growth rate forecasts are available from Yahoo, S&P Cap IQ, and/or Zacks.

My Electric Proxy Group includes 24 companies. Exhibit JRW-3-1 provides summary of financial statistics for the proxy group, showing mean operating revenues and net plant among members of the Electric Proxy Group of $10.78 billion and $41.55 billion, respectively. The group on average receives 85% of its revenues from regulated electric operations; has a BBB+ bond rating from S&P and a Baa2 rating from Moody's; has a current average common equity ratio of 40.9%; and an average earned return on common equity of 9.36%.

Q. PLEASE DESCRIBE THE BULKLEY PROXY GROUP.

A. Ms. Bulkley's group includes fifteen electric utilities. Panel B of Exhibit JRW-3-1 provides summary financial statistics for the Bulkley Proxy Group, showing mean operating revenues and net plant of $10.65 billion and $42.51 billion, respectively. The group on average receives 92% of its revenues from regulated electric operations; has a BBB+ bond rating from S&P's and a Baa2 rating from Moody's; has an average common equity ratio of 40.2%; and has an earned return on common equity of 8.69%.

Q. HOW DOES THE INVESTMENT RISK OF THE COMPANY COMPARE TO THAT OF THE PROXY GROUPS?

A. I believe bond ratings provide a good assessment of a company's investment risk. The Standard & Poor's (S&P) and Moody's issuer credit ratings for CEHE are BBB+ and Baa1, respectively, while the average S&P and Moody's issuer credit ratings for the two proxy groups are BBB+ and Baa2. Hence, CEHE Moody's issuer credit rating is one notch above the average of the two groups, which suggests that CEHE'S investment risk is a little below the average of the two proxy groups.

Q. PLEASE DISCUSS THE RISK ANALYSIS YOU PERFORMED IN EXHIBIT JRW-2-2.

A. In Exhibit JRW-3 at page 2, I assessed the riskiness of the two proxy groups using five different accepted risk measures. These measures include Beta, Financial Strength, Safety, Earnings Predictability, and Stock Price Stability. These risk measures suggest that the two proxy groups are similar in risk. As seen in Exhibit JRW-3 at page 2, the comparisons of the risk measures for the Electric and Bulkley Proxy Groups include Beta (0.92 versus 0.94), Financial Strength (A/B++ versus A/B++) Safety (2.2 versus 2.1), Earnings Predictability (88 versus 89), and Stock Price Stability (87 versus 87). On balance, these measures suggest that these two proxy groups are low risk relative to the overall stock market and are similar in risk to each other.

V. CAPITAL STRUCTURE RATIOS AND DEBT COST RATES

Q. WHAT ARE CEHE'S RECOMMENDED CAPITAL STRUCTURE AND SENIOR CAPITAL COST RATES FOR RATEMAKING PURPOSES?

A. Panel A of Exhibit JRW-4 provides CEHE'S proposed capital structure and debt cost rates. The Company has proposed a capital structure consisting of 55.10% long-term debt and 44.90%. CEHE has proposed a long-term debt cost rate of 4.29%.

Q. WHAT WAS THE CAPITAL STRUCTURE APPROVED IN THE COMPANY'S LAST RATE CASE?

A. In its last rate case (PUC Docket No. 49421)[8], the Commission approved a capital structure with a common equity ratio of 42.50%.

Q. PLEASE DISCUSS THE CAPITAL STRUCTURES OF THE COMPANIES IN THE PROXY GROUPS.

A. Page 1 of Exhibit JRW-3 provides the average common equity ratios for the companies in the two proxy groups. As of December 31, 2023, the average common equity ratios for the Electric and Bulkley Proxy Groups were 40.9% and 40.2%, respectively. As such, the Company's proposed capital structure includes a higher common equity ratio and lower financial risk than the average of the two proxy groups.

Q. IS IT APPROPRIATE TO USE THE COMMON EQUITY RATIOS OF THE PARENT HOLDING COMPANIES OR SUBSIDIARY OPERATING UTILITIES FOR COMPARISON PURPOSES WITH CEHE'S PROPOSED CAPITALIZATION?

A. Yes. It is appropriate to use the common equity ratios of the utility holding companies because the *holding companies* are publicly traded, and their stocks are used in the cost-of-equity capital studies. The equities of the *operating utilities* are not publicly traded, and hence their stocks cannot be used to compute the cost of equity capital for CEHE.

Q. IS IT APPROPRIATE TO INCLUDE SHORT-TERM DEBT IN THE CAPITALIZATION IN COMPARING THE COMMON EQUITY RATIOS OF THE HOLDING COMPANIES WITH CEHE'SS PROPOSED CAPITALIZATION?

A. Yes. Short-term debt, like long-term debt, has a higher claim on the assets and earnings of the company and requires timely payment of interest and repayment of principal. Thus, in comparing the common equity ratios of the holding companies with CEHE's recommendation, it is appropriate to include short-term debt when computing the holding

[8] *Application of CenterPoint Energy Houston Electric, LLC for Authority to Change Rates*, Docket No. 49421, Order, Ordering Paragraph No. 16 (Mar. 9, 2020).

company common equity ratios. Additionally, the financial risk of a company is based on total debt, which includes both short-term and long-term debt.

Q. PLEASE DISCUSS THE SIGNIFICANCE OF THE AMOUNT OF EQUITY THAT IS INCLUDED IN A UTILITY'S CAPITAL STRUCTURE.

A. A utility's decision as to the amount of equity capital it will incorporate into its capital structure involves fundamental trade-offs relating to the amount of financial risk the firm carries, the return on equity that investors will require, and the overall revenue requirements its customers are required to bear through the rates they pay.

Q. PLEASE DISCUSS A UTILITY'S DECISION TO USE DEBT VERSUS EQUITY TO MEET ITS CAPITAL NEEDS.

A. Utilities satisfy their capital needs through a mix of equity and debt. Because equity capital is more expensive than debt, the issuance of debt enables a utility to raise more capital for a given commitment of dollars than it could raise with just equity. Debt is, therefore, a means of "leveraging" capital dollars. However, as the amount of debt in the capital structure increases, its financial risk increases and the risk of the utility, as perceived by equity investors also increases. Significantly for this case, the converse is also true. As the amount of debt in the capital structure decreases, the financial risk decreases. The required return on equity capital is a function of the amount of overall risk that investors perceive, including financial risk in the form of debt.

Q. WHY IS THIS RELATIONSHIP IMPORTANT TO THE UTILITY'S CUSTOMERS?

A. Just as there is a direct correlation between the utility's authorized return on equity and the utility's revenue requirements (the higher the return, the greater the revenue requirement), there is a direct correlation between the amount of equity in the capital structure and the revenue requirements the customers are called on to bear. Again, equity capital is more expensive than debt. Not only does equity command a higher cost rate, but it also adds more to the income tax burden that ratepayers are required to pay through rates. As the equity ratio increases, the utility's revenue requirements increase, and the rates paid by customers increase. If the proportion of equity is too high, rates will be higher than they need to be. For this reason, the utility's management should pursue a capital acquisition strategy that results in the proper balance in the capital structure to minimize the overall cost of capital.

Q. HOW HAVE UTILITIES TYPICALLY STRUCK THIS BALANCE?

A. Due to regulation and the essential nature of its output, a regulated utility is exposed to less business risk than other companies that are not regulated. This means that a regulated company can reasonably carry relatively more debt in its capital structure than can most unregulated companies. Thus, a utility should take appropriate advantage of its lower business risk to employ cheaper debt capital at a level that will benefit its customers through lower revenue requirements. Typically, one may see equity ratios for electric utilities range from 40% to 50%.

Q. PLEASE COMMENT ON MS. BULKLEY'S CAPITAL STRUCTURE STUDY FOUND IN EXHIBIT AEB-13.

A. Ms. Bulkley claims to support the Company's proposed capital structure in a study she performed in Exhibit AEB-14. She reports that the operating subsidiary companies owned by her proxy utilities have a mean common equity ratio of 52.42%. The error is that the operating subsidiary companies are not the proxy utility companies in her proxy group. The proxy utilities are the parent holding companies that own the operating companies. Exhibit. JRW-3 at page 1, shows that the average common equity ratios for the parent holding companies in the two proxy groups as of December 31, 2023, were 40.9% for the Electric Proxy Group and 40.2% for the Bulkley Proxy Group. Hence, Ms. Bulkley's study does not support the Company's proposed capital structures, since she did not use the actual proxy companies in her own proxy group for her study.

Q. GIVEN THAT CEHE HAS PROPOSED AN EQUITY RATIO THAT IS HIGHER THAN THAT OF THE PROXY GROUPS, WHAT SHOULD THE COMMISSION DO IN THIS RATEMAKING PROCEEDING TO PROTECT CONSUMERS?

A. When a regulated utility's actual capital structure contains a high equity ratio, the options are: (1) to impute a more reasonable capital structure and reflect the imputed capital structure in revenue requirements; or (2) to recognize the downward impact that an unusually high equity ratio will have on the financial risk of a utility and authorize a lower common equity cost rate than that for the proxy group.

Q. WHAT CAPITAL STRUCTURE ARE YOU RECOMMENDING FOR CEHE IN YOUR RATE OF RETURN RECOMMENDATION?

A. As noted above, the Company has proposed a capital structure with a 44.90% common equity; this capital structure includes more equity capital and less financial leverage than the capital structures of other electric utility companies. As noted above, the City of Houston's witness Mr. Breandan Mac Mathuna has recommended a capital structure with a common equity ratio of 42.50%. As a result, I am adopting a capital structure with a common equity ratio of 42.50%, which was approved in the last rate case. With this approved capital structure, CEHE has been able to raise capital to finance its operations and maintained its investment-grade credit ratings.

Q. ARE YOU ADOPTING THE COMPANY'S PROPOSED LONG-TERM DEBT COST RATE?

A. Yes, I am adopting the Company's proposed long-term debt cost rate of 4.29%.

VI. THE COST OF COMMON EQUITY CAPITAL

A. OVERVIEW

Q. WHY MUST AN OVERALL COST OF CAPITAL OR FAIR RATE OF RETURN BE ESTABLISHED FOR A PUBLIC UTILITY?

A. In a competitive industry, the return on a firm's common equity capital is determined through the competitive market for its goods and services. Due to the capital requirements needed to provide utility services and the economic benefit to society from avoiding duplication of these services and the construction of utility-infrastructure facilities, most public utilities are monopolies. Because of the lack of competition and the essential nature of their services, it is not appropriate to permit monopoly utilities to set their own prices.

Thus, regulation seeks to establish prices that are fair to consumers and, at the same time, sufficient to meet the operating and capital costs of the utility, *i.e.*, provide an adequate return on capital to attract investors.

Q. PLEASE PROVIDE AN OVERVIEW OF THE COST OF CAPITAL IN THE CONTEXT OF THE THEORY OF THE FIRM.

A. The total cost of operating a business includes the cost of capital. The cost of common-equity capital is the expected return on a firm's common stock that the marginal investor would deem sufficient to compensate for risk and the time value of money. In equilibrium, the expected and required rates of return on a company's common stock are equal.

Normative economic models of a company or firm, developed under very restrictive assumptions, provide insight into the relationship between a firm's performance or profitability, capital costs, and the value of the firm. Under the economist's ideal model of perfect competition, where entry and exit are costless, products are undifferentiated, and there are increasing marginal costs of production, firms produce up to the point where price equals marginal cost. Over time, a long-run equilibrium is established where the price of the firm equals average cost, including the firm's capital costs. In equilibrium, total revenues equal total costs, and because capital costs represent investors' required return on the firm's capital, actual returns equal required returns, and the market value must equal the book value of the firm's securities.

In a competitive market, firms can achieve competitive advantage due to product-market imperfections. Most notably, companies can gain competitive advantage through product differentiation (adding real or perceived value to products) and by achieving economies of scale (decreasing marginal costs of production). Competitive advantage allows firms to price products above average cost and thereby earn accounting profits greater than those required to cover capital costs. When these profits are more than those required by investors, or when a firm earns a return on equity in excess of its cost of equity, investors respond by valuing the firm's equity in excess of its book value.

James M. McTaggart, founder of the international management consulting firm Marakon Associates, described this essential relationship between the return on equity, the cost of equity, and the market-to-book ratio in the following manner:

> Fundamentally, the value of a company is determined by the cash flow it generates over time for its owners, and the minimum acceptable rate of return required by capital investors. This "cost of equity capital" is used to discount the expected equity cash flow, converting it to a present value. The cash flow is, in turn, produced by the interaction of a company's return on equity and the annual rate of equity growth. High return on equity (ROE) companies in low-growth markets, such as Kellogg, are prodigious generators of cash flow, while low ROE companies in high-growth markets, such as Texas Instruments, barely generate enough cash flow to finance growth.
>
> A company's ROE over time, relative to its cost of equity, also determines whether it is worth more or less than its book value. If its ROE is consistently greater than the cost of equity capital (the investor's minimum acceptable return), the business is economically profitable and its market value will exceed book value. If, however, the business earns an ROE consistently less than its cost of equity, it is economically unprofitable and its market value will be less than book value.[9]

As such, the relationship between a firm's return on equity, cost of equity, and market-to-book ratio is relatively straightforward. A firm that earns a return on equity above its cost of equity will see its common stock sell at a price above its book value. Conversely, a firm that earns a return on equity below its cost of equity will see its common stock sell at a price below its book value.

Q. PLEASE PROVIDE ADDITIONAL INSIGHTS INTO THE RELATIONSHIP BETWEEN ROE AND MARKET-TO-BOOK RATIOS.

A. This relationship is discussed in a classic Harvard Business School case study entitled "Note on Value Drivers." On page 2 of that case study, the author describes the relationship very succinctly:

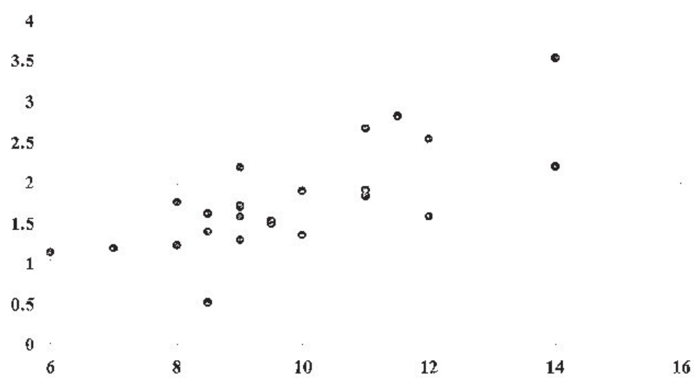
[9] James M. McTaggart, "The Ultimate Poison Pill: Closing the Value Gap," *Commentary* (Spring 1986), p. 3.

For a given industry, more profitable firms – those able to generate higher returns per dollar of equity – should have higher market-to-book ratios. Conversely, firms which are unable to generate returns in excess of their cost of equity [(K)] should sell for less than book value. [10]

Profitability	*Value*
If ROE > K	*then Market/Book > 1*
If ROE = K	*then Market/Book = 1*
If ROE < K	*then Market/Book< 1*

To assess the relationship by industry, as suggested above, I performed a regression study between estimated ROE and market-to-book ratios of the Electric Proxy Group companies. The results are presented in Figure 9. The average R-square is 0.58.[11] This demonstrates the strong positive relationship between ROEs and market-to-book ratios for public utilities. Given that the market-to-book ratios have been above 1.0 for a number of years, this also demonstrates that utilities have been earning ROEs above the cost of equity capital for many years.

Figure 9
The Relationship Between Expected ROE and Market-to-Book Ratios
***Value Line* Electric Utilities**



Data: *Value Line Investment Survey*, 2024
R-Square – 0.61, n=31.

[10] Benjamin C. Esty, *Note on Value Drivers*, HARVARD BUSINESS SCHOOL BACKGROUND NOTE 297-082, April 1997.

[11] R-square measures the percent of variation in one variable (e.g., market-to-book ratios) explained by another variable (e.g., expected ROE). R-squares vary between 0 and 1.0, with values closer to 1.0 indicating a higher relationship between two variables.

Q. WHAT FACTORS DETERMINE INVESTORS' EXPECTED OR REQUIRED RATE OF RETURN ON EQUITY?

A. The expected or required rate of return on common stock is a function of market-wide as well as company-specific factors. The most important market factor is the time value of money, as indicated by the level of interest rates in the economy. Common-stock investor requirements generally increase and decrease with like changes in interest rates. The perceived risk of a firm is the predominant factor that influences investor return requirements on a company-specific basis. A firm's investment risk is often separated into business risk and financial risk. Business risk encompasses all factors that affect a firm's operating revenues and expenses. Financial risk results from incurring fixed obligations in the form of debt in financing its assets.

Q. HOW DOES THE INVESTMENT RISK OF UTILITIES COMPARE WITH THAT OF OTHER INDUSTRIES?

A. Due to the essential nature of their service as well as their regulated status, public utilities are exposed to a lesser degree of business risk than other, non-regulated businesses. The relatively low level of business risk allows public utilities to meet much of their capital requirements through borrowing in the financial markets, thereby incurring greater than average financial risk. Nonetheless, the overall investment risk of public utilities is below most other industries.

Table 6 provides an assessment of investment risk for 91 industries as measured by beta, which, according to modern capital market theory, is the only relevant measure of investment risk. These betas come from the *Value Line Investment Survey*. The study shows that the investment risk of utilities is low compared to other industries.[12] The average betas for electric, gas, and water utility companies are 0.89, 0.88, and 0.82,

[12] As I discuss in more detail below, a stock whose price movement is greater than that of the market, such as a technology stock, is riskier than the market and has a beta greater than 1.0. A stock with below-average price movement, such as that of a regulated public utility, is less risky than the market and has a beta less than 1.0.

respectively.[13] As such, the cost of equity for utilities is the lowest of all industries in the U.S., based on modern capital market theory.

Table 6
Industry Average Betas*
Value Line* Investment Survey Betas*

Industry Average Betas*
Value Line Investment Survey Betas**
13-Jan-24

Rank	Industry	Beta	Rank	Industry	Beta	Rank	Industry	Beta
1	Hotel/Gaming	1.52	33	Bank	1.18	65	Railroad	1.07
2	Oilfield Svcs/Equip.	1.44	34	Heavy Truck & Equip	1.18	66	IT Services	1.05
3	Apparel	1.41	35	R.E.I.T.	1.18	67	Cable TV	1.05
4	Insurance (Life)	1.40	36	Pipeline MLPs	1.18	68	Thrift	1.04
5	Air Transport	1.39	37	Electrical Equipment	1.17	69	Information Services	1.03
6	Petroleum (Producing)	1.37	38	Med Supp Invasive	1.16	70	Retail Store	1.03
7	Petroleum (Integrated)	1.36	39	Computers/Peripherals	1.16	71	Packaging & Container	1.01
8	Office Equip/Supplies	1.36	40	Entertainment	1.16	72	Human Resources	1.00
9	Advertising	1.36	41	Computer Software	1.16	73	Investment Co.	0.99
10	Shoe	1.33	42	Chemical (Specialty)	1.15	74	Retail Building Supply	0.99
11	Metals & Mining (Div.)	1.33	43	Healthcare Information	1.15	75	Med Supp Non-Invasive	0.99
12	Public/Private Equity	1.33	44	Engineering & Const	1.15	76	Environmental	0.98
13	Homebuilding	1.30	45	Maritime	1.15	77	Educational Services	0.97
14	Building Materials	1.30	46	Automotive	1.15	78	Drug	0.94
15	Auto Parts	1.30	47	Wireless Networking	1.15	79	Telecom. Services	0.92
16	Metal Fabricating	1.28	48	Semiconductor	1.15	80	Electric Utility (West)	0.91
17	Recreation	1.28	49	Medical Services	1.14	81	Beverage	0.91
18	Steel	1.28	50	Diversified Co.	1.14	82	Trucking	0.90
19	Retail (Hardlines)	1.27	51	Chemical (Basic)	1.13	83	Electric Utility (East)	0.90
20	Natural Gas (Div.)	1.27	52	Machinery	1.13	84	Tobacco	0.89
21	Retail (Softlines)	1.26	53	E-Commerce	1.13	85	Electric Util. (Central)	0.88
22	Restaurant	1.25	54	Power	1.13	86	Natural Gas Utility	0.88
23	Furn/Home Furnishings	1.23	55	Electronics	1.12	87	Biotechnology	0.83
24	Retail Automotive	1.22	56	Toiletries/Cosmetics	1.11	88	Household Products	0.82
25	Semiconductor Equip	1.21	57	Industrial Services	1.10	89	Retail/Wholesale Food	0.82
26	Chemical (Diversified)	1.21	58	Publishing	1.09	90	Water Utility	0.82
27	Financial Svcs. (Div.)	1.20	59	Investment Co.(Foreign)	1.09	91	Food Processing	0.77
28	Internet	1.20	60	Entertainment Tech	1.08			
29	Aerospace/Defense	1.20	61	Reinsurance	1.07			
30	Oil/Gas Distribution	1.19	62	Insurance (Prop/Cas.)	1.07			
31	Paper/Forest Products	1.19	63	Telecom. Equipment	1.07			
32	Bank (Midwest)	1.18	64	Precision Instrument	1.07		Mean	1.13

* Industry averages for 92 industries using *Value Line*'s database of 1,700 companies - Updated 1-13-24.
** *Value Line* computes betas using monthly returns regressed against the New York Stock Exchange Index for five years. These betas are then adjusted as follows: VL Beta = [[(2/3) * Regressed Beta] + [(1/3) * (1.0)]] to account to tendency for Betas to regress toward average of 1.0. See M. Blume, "On the Assessment of Risk," *Journal of Finance*, March 1971.

Q. WHAT IS THE COST OF COMMON EQUITY CAPITAL?

A. The costs of debt and preferred stock are normally based on historical or book values and can be determined with a great degree of accuracy. The cost of common-equity capital, however, cannot be determined precisely and must instead be estimated from market data and informed judgment. This return requirement of the stockholder should be commensurate with the return requirement on investments in other enterprises having comparable risks.

[13] The beta for the *Value Line* electric utilities is the simple average of *Value Line*'s Electric East (0.90), Central (0.88), and West (0.91) group betas.

According to valuation principles, the present value of an asset equals the discounted value of its expected future cash flows. Investors discount these expected cash flows at their required rate of return that, as noted above, reflects the time value of money and the perceived riskiness of the expected future cash flows. As such, the cost of common equity is the rate at which investors discount expected cash flows associated with common stock ownership.

Q. HOW CAN THE EXPECTED OR REQUIRED RATE OF RETURN ON COMMON EQUITY CAPITAL BE DETERMINED?

A. Models have been developed to ascertain the cost of common-equity capital for a firm. Each model, however, has been developed using restrictive economic assumptions. Consequently, judgment is required in selecting appropriate financial valuation models to estimate a firm's cost of common-equity capital, in determining the data inputs for these models, and in interpreting the models' results. All these decisions must take into consideration the firm involved as well as current conditions in the economy and the financial markets.

Q. HOW DID YOU ESTIMATE THE COST OF EQUITY CAPITAL FOR THE COMPANY?

A. Primarily, I rely on the DCF model to estimate the cost-of-equity capital. Given the investment-valuation process and the relative stability of the utility business, the DCF model provides the best measure of equity-cost rates for public utilities. I have also performed an analysis using the capital asset pricing model ("CAPM"); however, I give these results less weight because I believe that risk-premium studies, of which the CAPM is one form, provide a less reliable indication of equity-cost rates for public utilities.

Q. PLEASE EXPLAIN WHY YOU BELIEVE THAT THE CAPM PROVIDES A LESS RELIABLE INDICATOR OF EQUITY COST RATES.

A. I believe that the CAPM provides a less reliable measure of a utility's equity-cost rate because it requires an estimate of the market-risk premium. As discussed below, there is a wide variation in estimates of the market-risk premium found in studies by academics and investment firms as well as in surveys of market professionals.

B. DISCOUNTED CASH FLOW (DCF) APPROACH

Q. PLEASE DESCRIBE THE THEORY BEHIND THE TRADITIONAL DCF MODEL.

A. According to the DCF model, the current stock price is equal to the discounted value of all future dividends that investors expect to receive from investment in the firm. As such, stockholders' returns ultimately result from current as well as future dividends. As owners of a corporation, common stockholders are entitled to a *pro rata* share of the firm's earnings. The DCF model presumes that earnings that are not paid out in the form of dividends are reinvested in the firm to provide for future growth in earnings and dividends. The rate at which investors discount future dividends, which reflects the timing and riskiness of the expected cash flows, is interpreted as the market's expected or required return on the common stock. Therefore, this discount rate represents the cost of common equity. Algebraically, the DCF model can be expressed as:

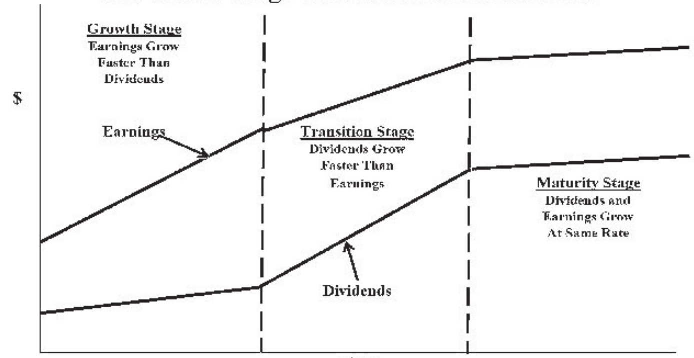
$$P = \frac{D_1}{(1+k)^1} + \frac{D_2}{(1+k)^2} + \cdots + \frac{D_n}{(1+k)^n}$$

where P is the current stock price, D_1, D_2, D_n are the dividends in (respectively) year 1, 2, and in the future years n, and k is the cost of common equity.

Q. IS THE DCF MODEL CONSISTENT WITH VALUATION TECHNIQUES EMPLOYED BY INVESTMENT FIRMS?

A. Yes. Virtually all investment firms use some form of the DCF model as a valuation technique. One common application for investment firms is called the three-stage DCF or dividend discount model ("DDM"). The stages in a three-stage DCF model are shown in Figure 10. This model presumes that a company's dividend payout progresses initially through a growth stage, then proceeds through a transition stage, and finally assumes a maturity (or steady state) stage. The dividend-payment stage of a firm depends on the profitability of its internal investments, which, in turn, is a function of the life cycle of the product or service.

Figure 10
The Three-Stage Dividend Discount Model



1. **Growth stage**: Characterized by rapidly expanding sales, high profit margins, and an abnormally high growth in earnings per share. Because of highly profitable expected investment opportunities, the payout ratio is low. Competitors are attracted by the unusually high earnings, leading to a decline in the growth rate.
2. **Transition stage**: In later years, increased competition reduces profit margins and earnings growth slows. With fewer new investment opportunities, the company begins to pay out a larger percentage of earnings.
3. **Maturity (steady-state) stage**: Eventually, the company reaches a position where its new investment opportunities offer, on average, only slightly more attractive ROEs. At that time, its earnings growth rate, payout ratio, and ROE stabilize for the remainder of its life. As I will explain below, the constant-growth DCF model is appropriate when a firm is in the maturity stage of the life cycle.

In using the 3-stage model to estimate a firm's cost-of-equity capital, dividends are projected into the future using the different growth rates in the alternative stages, and then the equity-cost rate is the discount rate that equates the present value of the future dividends to the current stock price.

Q. PLEASE BRIEFLY EXPLAIN THE CONCEPT OF "PRESENT VALUE."

A. Present value is the concept that an amount of money today is worth more than that same amount in the future. In other words, money received in the future is not worth as much as an equal amount received today. Present value tells an investor how much he or she would need in today's dollars to earn a specific amount in the future.

Q. HOW DO YOU ESTIMATE STOCKHOLDERS' EXPECTED OR REQUIRED RATE OF RETURN USING THE DCF MODEL?

A. Under certain assumptions, including a constant and infinite expected growth rate, and constant dividend/earnings and price/earnings ratios, the DCF model can be simplified to the following:

$$P = \frac{D_1}{k - g}$$

where P is the current stock price, D_1 represents the expected dividend over the coming year, k is investor's required return on equity, and g is the expected growth rate of dividends. This is known as the constant-growth version of the DCF model. To use the constant-growth DCF model to estimate a firm's cost of equity, one solves for "k" in the above expression to obtain the following:

$$k = \frac{D_1}{P} + g$$

Q. IN YOUR OPINION, IS THE CONSTANT-GROWTH DCF MODEL APPROPRIATE FOR PUBLIC UTILITIES?

A. Yes. The economics of the public utility business indicate that the industry is in the steady-state or constant-growth stage of a three-stage DCF. The economics include the relative stability of the utility business, the maturity of the demand for public utility services, and the regulated status of public utilities (especially the fact that their returns on investment are effectively set through the ratemaking process). The DCF valuation procedure for companies in this stage is the constant-growth DCF. In the constant-growth version of the DCF model, the current dividend payment and stock price are directly observable. However, the primary problem and controversy in applying the DCF model to estimate equity-cost rates entails estimating investors' expected dividend growth rate.

Q. WHAT FACTORS SHOULD ONE CONSIDER WHEN APPLYING THE DCF METHODOLOGY?

A. One should be sensitive to several factors when using the DCF model to estimate a firm's cost of equity capital. In general, one must recognize the assumptions under which the

DCF model was developed in estimating its components (the dividend yield and the expected growth rate). The dividend yield can be measured precisely at any point in time; however, it tends to vary somewhat over time. Estimation of expected growth is considerably more difficult. One must consider recent firm performance, in conjunction with current economic developments and other information available to investors, to accurately estimate investors' expectations.

Q. WHAT DIVIDEND YIELDS HAVE YOU REVIEWED?

A. I have calculated the dividend yields for the companies in the proxy groups using the current annual dividend and the 30-day, 90-day, and 180-day average stock prices. The dividend yields for the Electric Proxy Group are provided in Panel A of page 2 of Exhibit JRW-5. For the group, the average of the mean and median dividend yields using the 30-day, 90-day, and 180-day average stock prices range is 4.10%, which I am using as the dividend yield for the Electric Proxy Group. The dividend yields for the Bulkley Proxy Group are provided in Panel B of page 2 of Exhibit JRW-5. For the group, the average of the mean and median dividend yields using the 30-day, 90-day, and 180-day average stock prices is 4.3%, which I am using as the dividend yield for the Proxy Group.

Q. PLEASE DISCUSS THE APPROPRIATE ADJUSTMENT TO THE SPOT DIVIDEND YIELD.

A. According to the traditional DCF model, the dividend yield term relates the dividend paid over the coming period to the current stock price. As indicated by Professor Myron Gordon, who is commonly associated with the development of the DCF model for popular use, this is obtained by: (1) multiplying the expected dividend over the coming quarter by 4, and (2) dividing this dividend by the current stock price to determine the appropriate dividend yield for a firm that pays dividends on a quarterly basis.[14]

In applying the DCF model, some analysts adjust the current dividend for growth over the coming year as opposed to the coming quarter. This can be complicated because firms

[14] *Petition for Modification of Prescribed Rate of Return*, Federal Communications Commission, Docket No. 79-05, Direct Testimony of Myron J. Gordon and Lawrence I. Gould at 62 (April 1980).

tend to announce changes in dividends at different times during the year. As such, the dividend yield computed based on presumed growth over the coming quarter as opposed to the coming year can be quite different. Consequently, it is common for analysts to adjust the dividend yield by some fraction of the long-term expected growth rate.

Q. GIVEN THIS DISCUSSION, WHAT ADJUSTMENT FACTOR DO YOU USE FOR YOUR DIVIDEND YIELD?

A. I adjust the dividend yield by one-half (1/2) of the expected growth to reflect growth over the coming year. The DCF equity-cost rate ("K") is computed as:

$$K = \left[\left(\frac{D}{P}\right) \times (1 + 0.5g)\right] + g$$

Q. PLEASE DISCUSS THE GROWTH RATE COMPONENT OF THE DCF MODEL.

A. There is debate as to the proper methodology to employ in estimating the growth component of the DCF model. By definition, this component is investors' expectations of the long-term dividend growth rate. Presumably, investors use some combination of historical and/or projected growth rates for earnings and dividends per share and for internal or book-value growth to assess long-term potential.

Q. WHAT GROWTH DATA HAVE YOU REVIEWED FOR THE PROXY GROUPS?

A. I have analyzed a number of measures of growth for companies in the proxy groups. I reviewed *Value Line's* historical and projected growth-rate estimates for earnings per share ("EPS"), dividends per share ("DPS"), and book value per share ("BVPS"). In addition, I utilized the average EPS growth-rate forecasts of Wall Street analysts as provided by Yahoo, Zacks, and S&P Cap IQ. These services solicit five-year earnings growth-rate projections from securities analysts and compile and publish the means and medians of these forecasts. Finally, I also assessed prospective growth as measured by prospective earnings retention rates and earned returns on common equity.

Q. PLEASE DISCUSS HISTORICAL GROWTH IN EARNINGS AND DIVIDENDS, AS WELL AS INTERNAL GROWTH.

A. Historical growth rates for EPS, DPS, and BVPS are readily available to investors and are presumably an important ingredient in forming expectations concerning future growth. However, one must use historical growth numbers as measures of investors' expectations with caution. In some cases, past growth may not reflect future growth potential. Also, employing a single growth-rate number (for example, for five or ten years) is unlikely to accurately measure investors' expectations, due to the sensitivity of a single growth-rate figure to fluctuations in individual firm performance as well as overall economic fluctuations (*i.e.*, business cycles). Thus, one must appraise the context in which the growth rate is being employed. According to the conventional DCF model, the expected return on a security is equal to the sum of the dividend yield and the expected long-term growth in dividends. Therefore, to best estimate the cost of common-equity capital using the conventional DCF model, one must look to long-term growth rate expectations.

Q. PLEASE DEFINE AND EXPLAIN THE RELEVANCE OF INTERNAL GROWTH.

A. A company's internal (or "organic") growth occurs when a business expands its own operations rather than relying on takeovers and mergers. It can come about through various means, for example, increasing existing production capacity through investment in new capital and technology, or development and launch of new products.

Internally generated growth is a function of the percentage of earnings retained within the firm (the earnings retention rate) and the rate of return earned on those earnings (the return on equity). The internal growth rate is computed as the retention rate times the return on equity. Internal growth is significant in determining long-run earnings and, therefore, dividends. Investors recognize the importance of internally generated growth and pay premiums for stocks of companies that retain earnings and earn high returns on internal investments.

Q. PLEASE DISCUSS THE SERVICES THAT PROVIDE ANALYSTS' EPS FORECASTS.

A. Analysts' EPS forecasts for companies are collected and published by several different investment information services, including Institutional Brokers Estimate System ("I/B/E/S"), Bloomberg, FactSet, S&P Cap IQ, Zacks, First Call, and Reuters, among others. Thompson Reuters publishes analysts' EPS forecasts under different product names, including I/B/E/S, First Call, and Reuters. Bloomberg, FactSet, S&P Cap IQ, and Zacks each publish their own set of analysts' EPS forecasts for companies. These services do not reveal (1) the analysts who are solicited for forecasts; or (2) the identity of the analysts who actually provide the EPS forecasts that are used in the compilations published by the services.

I/B/E/S, Bloomberg, FactSet, S&P Cap IQ, and First Call are fee-based services. These services usually provide detailed reports and other data in addition to analysts' EPS forecasts.

In contrast, Thomson Reuters and Zacks provide limited EPS forecast data free-of-charge on the Internet. Yahoo finance (http://finance.yahoo.com) lists Thomson Reuters as the source of its summary EPS forecasts. Zacks (www.zacks.com) publishes its summary forecasts on its website. Zacks estimates are also available on other websites, such as MSN.money (http://money.msn.com).

Q. ARE YOU RELYING EXCLUSIVELY ON THE EPS FORECASTS OF WALL STREET ANALYSTS IN ARRIVING AT A DCF GROWTH RATE FOR THE PROXY GROUP?

A. No. There are several issues with using the EPS growth rate forecasts of Wall Street analysts as DCF growth rates. First, the appropriate growth rate in the DCF model is the dividend growth rate, not the earnings growth rate. Nonetheless, over the very long term, dividend and earnings will have to grow at a similar growth rate. Therefore, consideration must be given to other indicators of growth, including prospective dividend growth, internal growth, as well as projected earnings growth.

Second, a study by Lacina, Lee, and Xu (2011) has shown that analysts' three-to-five year EPS growth-rate forecasts are not more accurate at forecasting future earnings than naïve random walk forecasts of future earnings.[15] Employing data over a twenty-year period, these authors demonstrate that using the most recent year's actual EPS figure to forecast EPS in the next 3-5 years proved to be just as accurate as using the EPS estimates from analysts' three-to-five year EPS growth-rate forecasts. In the authors' opinion, these results indicate that analysts' long-term earnings growth-rate forecasts should be used with caution as inputs for valuation and cost-of-capital purposes.

Finally, and most significantly, it is well known that the long-term EPS growth-rate forecasts of Wall Street securities analysts are overly optimistic and upwardly biased. This has been demonstrated in a number of academic studies over the years.[16] Hence, using these growth rates as a DCF growth rate will provide an overstated equity cost rate. On this issue, a study by Easton and Sommers (2007) found that optimism in analysts' growth rate forecasts leads to an upward bias in estimates of the cost of equity capital of almost 3.0 percentage points.[17]

Q. ARE ANALYSTS' PROJECTED EPS GROWTH RATES FOR ELECTRIC UTILITIES LIKEWISE OVERLY OPTIMISTIC AND UPWARDLY BIASED?

A. Yes. I have completed a study of the accuracy of analysts' EPS growth rates for electric utilities and gas distribution companies over the 1985 to 2022 time period. In the study, I

[15] M. Lacina, B. Lee & Z. Xu, *Advances in Business and Management Forecasting (Vol. 8)*, Kenneth D. Lawrence, Ronald K. Klimberg (ed.), Emerald Group Publishing Limited, pp. 77-101. According to random walk theory in this context, annual changes in earnings are normally distributed and are independent of each other. Therefore, the theory presumes the past movement or trend of earnings cannot be used to predict its future earnings.

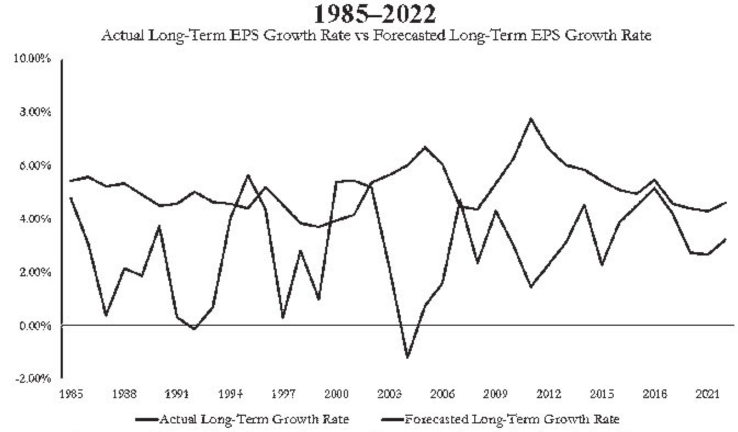
[16] The studies that demonstrate analysts' long-term EPS forecasts are overly-optimistic and upwardly biased include: R.D. Harris, "The Accuracy, Bias, and Efficiency of Analysts' Long Run Earnings Growth Forecasts," *Journal of Business Finance & Accounting*, pp. 725-55 (June/July 1999); P. DeChow, A. Hutton, and R. Sloan, "The Relation Between Analysts' Forecasts of Long-Term Earnings Growth and Stock Price Performance Following Equity Offerings," *Contemporary Accounting Research* (2000); K. Chan, L., Karceski, J., & Lakonishok, J., "The Level and Persistence of Growth Rates," *Journal of Finance*, pp. 643–684, (2003); M. Lacina, B. Lee, and Z. Xu, *Advances in Business and Management Forecasting (Vol. 8)*, Kenneth D. Lawrence, Ronald K. Klimberg (ed.), Emerald Group Publishing Limited, pp.77-101; and Marc H. Goedhart, Rishi Raj, and Abhishek Saxena, "Equity Analysts, Still Too Bullish," *McKinsey on Finance*, pp. 14-17, (Spring 2010).

[17] Peter D. Easton & Gregory A. Sommers, *Effect of Analysts' Optimism on Estimates of the Expected Rate of Return Implied by Earnings Forecasts*, 45 J. ACCT. RES. 983–1015 (2007).

used the utilities listed in the electric utilities and gas distribution companies covered by *Value Line*.

I collected the three-to-five-year projected EPS growth rate from I/B/E/S for each utility and compared that growth rate to the utility's actual subsequent three-to-five-year EPS growth rate. As shown in Figure 11, the mean forecasted EPS growth rate (depicted in the red line in Figure 11) is consistently greater than the achieved actual EPS growth rate over the time period, with the exception of short periods in 1996, 2001, and 2007. Over the entire period, the mean forecasted EPS growth rate is over 200 basis points above the actual EPS growth rate. As such, the projected EPS growth rates for electric utilities are overly optimistic and upwardly based.

Figure 11
Mean Forecasted vs. Actual Long-Term EPS Growth Rates
Electric Utilities and Gas Distribution Companies
1985–2022



Data Source: S&P Global Market Intelligence, Capital IQ, I/B/E/S, 2023.

Q. ARE THE PROJECTED EPS GROWTH RATES OF *VALUE LINE* ALSO OVERLY OPTIMISTIC AND UPWARDLY BIASED?

A. Yes. A study by Szakmary, Conover, and Lancaster (2008) evaluated the accuracy of *Value Line*'s three-to-five-year EPS growth rate forecasts using companies in the Dow Jones Industrial Average over a thirty-year time period and found these forecasted EPS growth rates to be significantly higher than the EPS growth rates that these companies subsequently achieved.[18]

Szakmary, Conover, and Lancaster (SCL) studied the predicted versus the projected stock returns, sales, profit margins, and earnings per share made by Value Line over the 1969 to 2001 time period. Value Line projects variables from a three-year base period (e.g., 2012 to 2014) to a future three-year projected period (e.g., 2016 to 2018). SCL used the 65 stocks included in the Dow Jones Indexes (30 Industrials, 20 Transports and 15 Utilities).

SCL found that the projected annual stock returns for the Dow Jones stocks were "incredibly overoptimistic" and of no predictive value. The mean annual stock return of 20% for the Dow Jones stocks' *Value Line*'s forecasts was nearly double the realized annual stock return.

The authors also found that *Value Line*'s forecasts of earnings per share and profit margins were "strikingly overoptimistic." *Value Line*'s forecasts of annual sales were higher than achieved levels, but not statistically significant. SCL concluded that the overly optimistic projected annual stock returns were attributable to *Value Line*'s upwardly biased forecasts of earnings per share and profit margins.

Q. IS IT YOUR OPINION THAT STOCK PRICES REFLECT THE UPWARD BIAS IN THE EPS GROWTH RATE FORECASTS?

A. Yes; I believe that investors are well aware of the bias in analysts' EPS growth-rate forecasts, and therefore stock prices reflect the upward bias.

Q. HOW DOES THAT AFFECT THE USE OF THESE FORECASTS IN A DCF EQUITY COST RATE STUDY?

A. According to the DCF model, the equity cost rate is a function of the dividend yield and expected growth rate. Because I believe that investors are aware of the upward bias in analysts' long-term EPS growth-rate forecasts, stock prices reflect the bias. But the DCF

[18] Szakmary, A., Conover, C., & Lancaster, C., *An Examination of* Value Line*'s Long-Term Projections*, J. BANKING & FIN., May 2008, at 820–33.

growth rate needs to be adjusted downward from the projected EPS growth rate to reflect the upward bias in the DCF model.

Q. PLEASE DISCUSS THE HISTORICAL GROWTH OF THE COMPANIES IN THE PROXY GROUPS, AS PROVIDED BY *VALUE LINE.*

A. Panel A of page 3 of Exhibit JRW-5 provides the 5- and 10-year historical growth rates for EPS, DPS, and BVPS for the companies in the Electric Proxy Group, as published in the *Value Line Investment Survey*. The median historical growth measures for EPS, DPS, and BVPS for the Electric Proxy Group range from 3.5% to 5.0%, with an average of the medians of 4.3%. Panel B of page 3 of Exhibit JRW-5 provides the *Value Line* 5- and 10-year historical growth rates for EPS, DPS, and BVPS for the companies in the Bulkley Proxy Group. The median historical growth measures for EPS, DPS, and BVPS for the Bulkley Proxy Group range from 3.8% to 5.8%, with an average of the medians of 4.8%.

Q. PLEASE SUMMARIZE *VALUE LINE'S* PROJECTED GROWTH RATES FOR THE COMPANIES IN THE PROXY GROUP.

A. *Value Line's* projections of EPS, DPS, and BVPS growth for the companies in the proxy groups are shown on page 4 of Exhibit JRW-5. Due to the presence of outliers, I relied on the medians in the analysis. For the Electric Proxy Group, as shown on in Panel A of page 4 of Exhibit JRW-5, the medians range from 4.0% to 6.0%, with an average of the medians of 5.0%.[19] For the Bulkley Proxy Group, as shown on in Panel B of page 4 of Exhibit JRW-5, the medians range from 4.5% to 6.0%, with an average of the medians of 5.3%.

Also provided on page 4 of Exhibit JRW-5 are the prospective sustainable growth rates for the companies in the proxy groups as measured by *Value Line*'s average projected retention rate and return on shareholders' equity. As noted above, sustainable growth is a significant

[19] It should be noted that *Value Line* uses a different approach in estimating projected growth. *Value Line* does not project growth from today, but *Value Line* projects growth from a three-year base period – 2020-2022 – to a projected three-year period for the period 2026-2028. Using this approach, the three-year based period can have a significant impact on the *Value L*ine growth rate if this base period includes years with abnormally high or low earnings. Therefore, I evaluate these growth rates separately from analysts EPS growth rates.

and a primary driver of long-run earnings growth. For the Gas and Bulkley Proxy Groups, the median prospective sustainable growth rates are 4.1% and 4.0%.

Q. PLEASE ASSESS THE GROWTH FOR THE PROXY GROUPS AS MEASURED BY ANALYSTS' FORECASTS OF EXPECTED 5-YEAR EPS GROWTH.

A. Yahoo, Zacks, and S&P Cap IQ collect, summarize, and publish Wall Street analysts' long-term EPS growth rate forecasts for the companies in the proxy group. These forecasts are provided for the companies in the proxy groups on page 5 of Exhibit JRW-5. I have reported both the mean and median growth rates for the group. Since there is considerable overlap in analyst coverage between the two services, and not all the companies have forecasts from the different services, I have averaged the expected five-year EPS growth rates from the two services for each company to arrive at an expected EPS growth rate for each company. As shown in Panel A of page 5 of Exhibit JRW-5, the mean/median of analysts' projected EPS growth rates for the Proxy Group are 6.1%/6.3%. The mean/median of analysts' projected EPS growth rates for the Bulkley Proxy Group , as shown in Panel B of page 5 of Exhibit JRW-5, are 6.2%/6.3%.

Q. PLEASE SUMMARIZE YOUR ANALYSIS OF THE HISTORICAL AND PROSPECTIVE GROWTH OF THE PROXY GROUP.

A. Page 6 of Exhibit JRW-5 shows the summary DCF growth rate indicators for the proxy group.

The historical growth rate indicators for the Electric Proxy Group imply a baseline growth rate of 4.3%. The average of the projected EPS, DPS, and BVPS growth rates from Value Line is 5.0%, and Value Line's projected sustainable growth rate is 4.1%. The mean/median projected EPS growth rates of Wall Street analysts for the Proxy Group are 6.1%/6.3% (average = 6.2%) as measured by the mean and median growth rates. The overall range for the projected growth-rate indicators (ignoring historical growth) is 4.10% to 6.20% and the average of the three projected growth rates is 5.25% (4.1%, 5.0%, 6.2%).

Giving primary weight to the projected growth rates of Wall Street analysts and Value Line, but recognizing the upward bias nature of these forecasts, I believe that the appropriate projected growth rate is the range of 5.25% to 6.20%. Given this range, I will use 5.70%, which is the midpoint of the range, for my DCF growth rate for the Electric Proxy Group. This growth rate figure is in the upper end of the range of historic and projected growth rates for the Electric Proxy Group.

For the Bulkley Proxy Group, the historical growth rate indicators suggest a growth rate of 4.80%. The average of the projected EPS, DPS, and BVPS growth rates from *Value Line* is 5.3%, and *Value Line*'s projected sustainable growth rate is 4.0%. The projected EPS growth rates of Wall Street analysts are 6.2% and 6.3% (average = 6.25%) as measured by the mean and median growth rates. The overall range for the projected growth-rate indicators (ignoring historical growth) is 4.0% to 6.25% and the average of the three projected growth rates is 5.20% (5.3%, 4.0%, 6.25%).

Again, giving primary weight to the projected EPS growth rate of Wall Street analysts but recognizing the upward bias nature of these forecasts, I believe that the appropriate DCF growth rate range is 5.20% to 6.25%. Given these figures, I will use the midpoint of this range, 5.70%, as the DCF growth rate for the Bulkley Proxy Group. As with the Electric Proxy Group, this growth rate figure is in the upper end of the range of historic and projected growth rates for the Bulkley Proxy Group.

Q. WHAT ARE THE RESULTS FROM YOUR APPLICATION OF THE DCF MODEL?

A. My DCF-derived equity cost rate for the group is summarized on page 1 of Exhibit JRW-5 and in Table 7.

Table 7
DCF-derived Equity Cost Rate/ROE

	Dividend Yield	1 + ½ Growth Adjustment	DCF Growth Rate	Equity Cost Rate
Electric Proxy Group	**4.10%**	**1.02850**	**5.70%**	**9.90%**
Bulkley Proxy Group	**4.30%**	**1.02850**	**5.70%**	**10.10%**

The result for the Electric Proxy Group is the 4.10% dividend yield, times the one and one-half growth adjustment of 1.02850, plus the DCF growth rate of 5.70%, which results in an equity cost rate of 9.90%. The result for the Bulkley Proxy Group is the 4.30% dividend yield, times the one and one-half growth adjustment of 1.02850, plus the DCF growth rate of 5.70%, which results in an equity cost rate of 10.10%.

C. CAPITAL ASSET PRICING MODEL

Q. PLEASE DISCUSS THE CAPITAL ASSET PRICING MODEL ("CAPM").

A. The CAPM is a risk premium approach to gauging a firm's cost of equity capital. According to the risk premium approach, the cost of equity is the sum of the interest rate on a risk-free bond (R_f) and a risk premium (RP), as in the following:

$$k = R_f + RP$$

The yield on long-term U.S. Treasury securities is normally used as R_f. Risk premiums are measured in different ways. The CAPM is a theory of the risk and expected returns of common stocks. In the CAPM, two types of risk are associated with a stock: firm-specific risk or unsystematic risk, and market or systematic risk, which is measured by a firm's beta. The only risk that investors receive a return for bearing is systematic risk.

According to the CAPM, the expected return on a company's stock, which is also the equity cost rate (K), is equal to:

$$K = (R_f) + \beta \times [E(R_m) - (R_f)]$$

Where:

K represents the estimated rate of return on the stock;

$E(R_m)$ represents the expected return on the overall stock market. (Frequently, the 'market' refers to the S&P 500);

(R_f) represents the risk-free rate of interest;

$[E(R_m) - (R_f)]$ represents the expected equity or market risk premium—the excess return that an investor expects to receive above the risk-free rate for investing in risky stocks; and

Beta—(ß) is a measure of the systematic risk of an asset.

To estimate the required return or cost of equity using the CAPM requires three inputs: the risk-free rate of interest (R_f), the beta (β), and the expected equity or market risk premium $[E(R_m) - (R_f)]$. R_f is the easiest of the inputs to measure – it is represented by the yield on long-term U.S. Treasury bonds. β, the measure of systematic risk, is a little more difficult to measure because there are different opinions about what adjustments, if any, should be made to historical betas due to their tendency to regress to 1.0 over time. And finally, an even more difficult input to measure is the expected equity or market risk premium $(E(R_m) - (R_f))$. I will discuss each of these inputs below.

Q. PLEASE DISCUSS EXHIBIT JRW-6.

A. Exhibit JRW-6 provides the summary results for my CAPM study. Page 1 shows the results, and the following pages contain the supporting data.

Q. PLEASE DISCUSS THE RISK-FREE INTEREST RATE.

A. The yield on long-term U.S. Treasury bonds has usually been viewed as the risk-free rate of interest in the CAPM. The yield on long-term U.S. Treasury bonds, in turn, has been considered to be the yield on U.S. Treasury bonds with 30-year maturities.

Q. WHAT RISK-FREE INTEREST RATE ARE YOU USING IN YOUR CAPM?

A. As shown on page 2 of Exhibit JRW-6, the yield on 30-year U.S. Treasury bonds has been in the 1.3% to 5.00% range over the 2010–2024 time period. The current 30-year Treasury yield is above the average of this range. Kroll, a division of the investment firm Duff & Phelps, recommends using a normalized risk-free interest rate.[20] Currently, Kroll is recommending a normalized risk-free interest rate of 3.50% or, if the spot 20-year Treasury yield is above 3.50%, Kroll recommends using the spot 20-year Treasury yield.

However, they have also noted these yields are distorted currently. "We are aware of lack of liquidity issues in the U.S. Treasury market for the 20-year maturity, which is causing

[20] Kroll, *Cost of Capital Resource Center* (2023). https://www.kroll.com/en/insights/publications/cost-of-capital/recommended-us-equity-risk-premium-and-corresponding-risk-free-rates.

some distortion in the 20-year yield relative to that observed for 10- and 30-year maturities." The illiquidity and resulting yield distortion has also been highlighted in the financial press.[21] As shown in Figure 5 (page 16), the yield curve is currently inverted with a yield "hump" at the 20-year mark. The current 30-year Treasury yields are in the 4.50% range. Given the recent range of yields, and recognizing the "hump," I am using 4.50% as the risk-free rate, or R_f, in my CAPM.

Q. DOES THE 4.50% RISK-FREE INTEREST RATE TAKE INTO CONSIDERATION FORECASTS OF HIGHER INTEREST RATES?

A. No. The 4.50% percent risk-free interest rate takes into account the range of interest rates in the past and effectively synchronizes the risk-free rate with the market risk premium. The risk-free rate and the market risk premium are interrelated in that the market risk premium is developed in relation to the risk-free rate. As discussed below, my market risk premium is based on the results of many studies and surveys that have been published over time.

Q. PLEASE DISCUSS BETAS IN THE CAPM.

A. Beta (ß) is a measure of the systematic risk of a stock. The market, usually taken to be the S&P 500, has a beta of 1.0. The beta of a stock with the same price movement as the market also has a beta of 1.0. A stock whose price movement is greater than that of the market, such as a technology stock, is riskier than the market and has a beta greater than 1.0. A stock with below average price movement, such as that of a regulated public utility, is less risky than the market and has a beta less than 1.0. Estimating a stock's beta involves running a linear regression of a stock's return on the market return.

As shown on page 3 of Exhibit JRW-6, the slope of the regression line is the stock's ß. A steeper line indicates that the stock is more sensitive to the return on the overall market. This means that the stock has a higher ß and greater-than-average market risk. A less steep line indicates a lower ß and less market risk. Several online investment information

[21] For example, see Duguid and Smith, "The market is just dead - Investors steer clear of 20-year Treasuries," *Financial Times*, July 22, 2022.

services, such as Yahoo and Reuters, provide estimates of stock betas. Usually these services report different betas for the same stock. The differences are usually due to: (1) the time period over which ß is measured; and (2) any adjustments that are made to reflect the fact that betas tend to regress to 1.0 over time.

Q. PLEASE DISCUSS THE 2020 CHANGE IN BETAS.

A. I have traditionally used the betas as provided in the *Value Line Investment Survey*. As discussed above, the betas for utilities recently increased significantly as a result of the volatility of utility stocks during the stock market meltdown associated with the novel coronavirus in March 2020. Utility betas as measured by *Value Line* have been in the 0.55 to 0.70 range for the past 10 years. But utility stocks were much more volatile relative to the market in March and April of 2020, and this resulted in an increase of above 0.30 to the average utility beta.

Value Line defines their computation of beta as:[22]

> Beta - A relative measure of the historical sensitivity of a stock's price to overall fluctuations in the New York Stock Exchange Composite Index. A Beta of 1.50 indicates a stock tends to rise (or fall) 50% more than the New York Stock Exchange Composite Index. The ''Beta coefficient'' is derived from a regression analysis of the relationship between weekly percent-age changes in the price of a stock and weekly percentage changes in the NYSE Index over a period of five years. In the case of shorter price histories, a smaller time period is used, but two years is the minimum. The Betas are adjusted for their long-term tendency to converge toward 1.00. Value Line then adjusts these Betas to account for their long-term tendency to converge toward 1.00.

However, there are several issues with *Value Line* betas:

1. *Value Line* betas are computed using weekly returns, and the volatility of utility stocks during March 2020 was impacted by using weekly and not monthly returns. Yahoo Finance

[22] https://www.valueline.com/investment-education/glossary/b.

uses five years of monthly returns to compute betas, and Yahoo Finance's betas for utilities are lower than *Value Line*'s.

2. *Value Line* betas are computed using the New York Stock Exchange Index as the market. While about 3,000 stocks trade on the NYSE, most technology stocks are traded on the NASDAQ or over-the-counter market and not the NYSE. Technology stocks, which make up about 25 percent of the S&P 500, tend to be more volatile. If they were traded on the NYSE, they would increase the volatility of the measure of the market and thereby lower utility betas.

3. Major vendors of CAPM betas such as Merrill Lynch, Value Line, and Bloomberg publish adjusted betas. The so-called Blume adjustment cited by Value Line adjusts betas calculated using historical returns data to reflect the tendency of stock betas to regress toward 1.0 over time, which means that the betas of typical low beta stocks tend to increase toward 1.0, and the betas of typical high beta stocks tend to decrease toward 1.0.[23]

The Blume adjustment procedure is:

Regressed Beta = .67 * (Observed Beta) + 0.33

For example, suppose a company has an observed past beta of 0.50. The regressed (Blume-adjusted) beta would be:

Regressed Beta = .67 * (0.50) + 0.33 = 0.67

Blume offered two reasons for betas to regress toward 1.0. First, he suggested it may be a by-product of management's efforts to keep the level of firm's systematic risk close to that of the market. He also speculated that it results from management's efforts to diversify through investment projects.

Q. GIVEN THIS DISCUSSION, WHAT BETAS ARE YOU USING IN YOUR CAPM?

A. In the past, I have used *Value Line* betas exclusively. However, given the discussion above, I am also using betas published by S&P Capital IQ. S&P Capital IQ computes betas over

[23] M. Blume, *On the Assessment of Risk*, J. OF FIN. (Mar. 1971).

a five-year period using monthly returns and the S&P 500 as the market return. S&P Capital IQ does not use the Blume adjustment, but I have included that adjustment in my analysis. As shown on page 3 of Exhibit JRW-6, I have averaged the *Value Line* betas and my adjusted S&P Capital IQ for the proxy groups. The median betas for the Electric and Bulkley Proxy Groups are 0.81 and 0.81.

Q. PLEASE DISCUSS THE MARKET RISK PREMIUM.

A. The market risk premium is equal to the expected return on the stock market (e.g., the expected return on the S&P 500, $E(R_m)$ minus the risk-free rate of interest (R_f)). The market risk premium is the difference in the expected total return between investing in equities and investing in "safe" fixed-income assets, such as long-term government bonds. However, while the market risk premium is easy to define conceptually, it is difficult to measure because it requires an estimate of the expected return on the market—$E(R_m)$. As I discuss below, there are different ways to measure $E(R_m)$, and studies have come up with significantly different magnitudes for $E(R_m)$. As Merton Miller, the 1990 Nobel Prize winner in economics, indicated, $E(R_m)$ is very difficult to measure and is one of the great mysteries in finance.[24]

Q. PLEASE DISCUSS THE ALTERNATIVE APPROACHES TO ESTIMATING THE MARKET RISK PREMIUM.

A. Page 4 of Exhibit JRW-6 highlights the primary approaches to, and issues in, estimating the expected market risk premium. The traditional way to measure the market risk premium was to use the difference between historical average stock and bond returns. In this case, historical stock and bond returns, also called *ex post* returns, were used as the measures of the market's expected return (known as the *ex ante* or forward-looking expected return). This type of historical evaluation of stock and bond returns is often called the "Ibbotson approach" after Professor Roger Ibbotson, who popularized this method of using historical financial market returns as measures of expected returns. However, this historical evaluation of returns can be a problem because: (1) *ex post* returns are not the same as *ex*

[24] Merton Miller, *The History of Finance: An Eyewitness Account*, J. APPLIED CORP. FIN., 3 (2000).

ante expectations; (2) market risk premiums can change over time, increasing when investors become more risk-averse and decreasing when investors become less risk-averse; and (3) market conditions can change such that *ex post* historical returns are poor estimates of *ex ante* expectations.

The use of historical returns as market expectations has been criticized in numerous academic studies, which I discuss later. The general theme of these studies is that the large equity risk premium discovered in historical stock and bond returns cannot be justified by the fundamental data. These studies, which fall under the category "*ex ante* models and market data," compute *ex ante* expected returns using market data to arrive at an expected equity risk premium. These studies have also been called "puzzle research" after the famous study by Mehra and Prescott in which the authors first questioned the magnitude of historical equity risk premiums relative to fundamentals.[25]

In addition, there are a number of surveys of financial professionals regarding the market risk premium, as well as several published surveys of academics on the equity risk premium. Duke University has published a CFO Survey on a quarterly basis for over 10 years.[26] Questions regarding expected stock and bond returns are also included in the Federal Reserve Bank of Philadelphia's annual survey of financial forecasters, which is published as the *Survey of Professional Forecasters*.[27] This survey of professional economists has been published for almost 50 years. In addition, Pablo Fernandez conducts annual surveys of financial analysts and companies regarding the equity risk premiums used in their investment and financial decision making.[28]

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[25] Rajnish Mehra & Edward C. Prescott, *The Equity Premium: A Puzzle*, J. MONETARY ECON. 145 (1985).

[26] *The CFO Survey*, DUKE UNIVERSITY, https://www.richmondfed.org/cfosurvey.

[27] *Survey of Professional Forecasters*, FEDERAL RESERVE BANK OF PHILADELPHIA (Feb. 10, 2023), https://www.philadelphiafed.org/-/media/frbp/assets/surveys-and-data/survey-of-professional-forecasters/2020/spfq120.pdf?la=en. The Survey of Professional Forecasters was formerly conducted by the American Statistical Association (ASA) and the National Bureau of Economic Research (NBER) and was known as the ASA/NBER survey. The survey, which began in 1968, is conducted each quarter. The Federal Reserve Bank of Philadelphia, in cooperation with the NBER, assumed responsibility for the survey in June 1990.

[28] Pablo Fernandez, Teresa Garcia, and Pablo Acín, SURVEY: MARKET RISK PREMIUM AND RISK-FREE RATE USED FOR 80 COUNTRIES IN 2023, IESE BUSINESS SCHOOL WORKING PAPER (April 4, 2023).

Q. PLEASE HIGHLIGHT THE RESULTS OF THE ACADEMIC AND PROFESSIONAL STUDIES DISCUSSING THE MARKET RISK PREMIUM.

A. Derrig and Orr, Fernandez, and Song completed the most comprehensive reviews of the research on the market risk premium.[29] Derrig and Orr's study evaluated the various approaches to estimating market risk premiums, discussed the issues with the alternative approaches, and summarized the findings of the published research on the market risk premium. Fernandez examined four alternative measures of the market risk premium – historical, expected, required, and implied. He also reviewed the major studies of the market risk premium and presented the summary market risk premium results. Song provided an annotated bibliography and highlighted the alternative approaches to estimating the market risk premium.

Page 5 of Exhibit JRW-6 provides a summary of the results of the market risk premium studies that I have reviewed. These include the results of: (1) the various studies of the historical risk premium, (2) *ex ante* market risk premium studies, (3) market risk premium surveys of CFOs, financial forecasters, analysts, companies, and academics, and (4) the building blocks approach to the market risk premium. There are results reported for over 30 studies, and the median market risk premium of these studies is 4.56%.

Q. PLEASE HIGHLIGHT THE RESULTS OF THE MORE RECENT RISK PREMIUM STUDIES AND SURVEYS.

A. The studies cited on page 5 of Exhibit JRW-6 include every market risk premium study and survey I could identify that was published over the past 20 years and that provided a market risk premium estimate. Many of these studies were published prior to the financial crisis that began in 2008. In addition, some of these studies were published in the early 2000s at the market peak. It should be noted that many of these studies (as indicated) used data over long periods of time (as long as 50 years of data) and so were not estimating a market risk premium as of a specific point in time (e.g., the year 2001). To assess the effect

[29] *See* Richard Derrig & Elisha Orr, *Equity Risk Premium: Expectations Great and Small (Version 3.0)*, Aug. 28, 2003 (https://www.casact.org/sites/default/files/database/forum_04wforum_04wf001.pdf); Pablo Fernandez, EQUITY PREMIUM: HISTORICAL, EXPECTED, REQUIRED, AND IMPLIED, IESE BUSINESS SCHOOL WORKING PAPER (2007); ZHIYI SONG, THE EQUITY RISK PREMIUM: AN ANNOTATED BIBLIOGRAPHY (The CFA Institute Research (2007).

of the earlier studies on the market risk premium, I have reconstructed page 5 of Exhibit JRW-6 on page 6 of Exhibit JRW-6; however, I have eliminated all studies dated before January 2, 2010. The median market risk premium estimate for this subset of studies is 5.03%.

Q. PLEASE SUMMARIZE THE MARKET RISK PREMIUM STUDIES AND SURVEYS.

A. As noted above, there are three approaches to estimating the market risk premium—historic stock and bond returns, *ex ante* or expected returns models, and surveys. The studies on page 6 of Exhibit JRW-6 can be summarized in the following manners:

Historic Stock and Bond Returns: Historic stock and bond returns suggest a market risk premium in the 4.40% to 6.80% range, depending on whether one uses arithmetic or geometric mean returns.

***Ex Ante* Models**: Market risk-premium studies that use expected or *ex ante* return models indicate a market risk premium in the range of 2.61% to 6.00%.

Surveys: Market risk premiums developed from surveys of analysts, companies, financial professionals, and academics are lower, with a range from 3.40% to 5.70%.

Building Block: The mean reported market risk premiums reported in studies using the building blocks approach range from 3.00% to 5.21%.

Q. PLEASE HIGHLIGHT THE *EX ANTE* MARKET RISK PREMIUM STUDIES AND SURVEYS THAT YOU BELIEVE ARE MOST TIMELY AND RELEVANT.

A. I will highlight several studies/surveys.

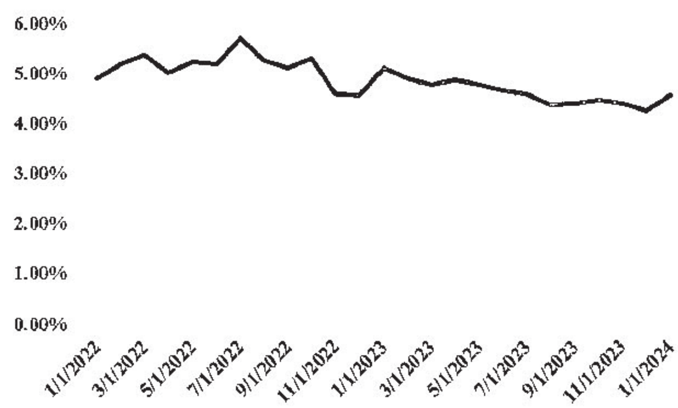
First, Pablo Fernandez conducts annual surveys of financial analysts and companies regarding the equity risk premiums used in their investment and financial decision-making.[30] His survey results are included in Exhibits JRW-6-5 and JRW-6-6. The results

[30] Pablo Fernandez, Teresa Garcia, & Pablo Acín, *Survey: Market Risk Premium and Risk-Free Rate Used for 80 Countries in 2024, IESE Business School Working Paper* (March 2024).

of his 2024 survey of academics, financial analysts, and companies, which included 4,000 responses, indicated a mean market risk premium employed by U.S. analysts and companies of 5.5%.31 His estimated market risk premium for the U.S. has been in the 5.00% to 5.70% range in recent years.

Second, Professor Aswath Damodaran of New York University, a leading expert on valuation and the market risk premium, provides a monthly updated market risk premium based on projected S&P 500 EPS and stock-price level and long-term interest rates. His estimated market risk premium has been in the range of 4.0% to 6.0% since 2010. As shown in Figure 12 as of May, 2024, Damodaran's estimate of the equity risk premium was 4.12%.[32]

Figure 12
Damodaran Implied Market Risk Premium



Source: http://pages.stern.nyu.edu/~adamodar/.

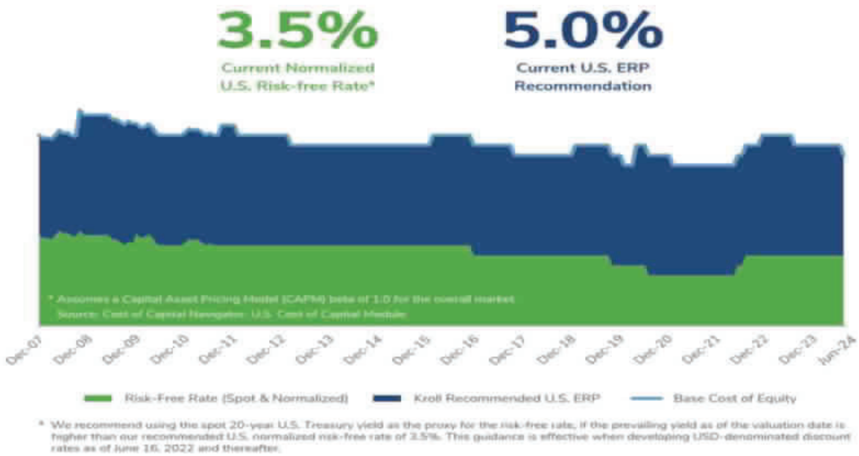
Next, as explained previously, Kroll provides recommendations for the normalized risk-free interest rate and market risk premiums to be used in calculating the cost-of-capital data. Its recommendations over the 2008 to 2024 period are shown in Exhibit JRW-6-7 and are also depicted graphically in Figure 13 below. Over the past decade, Kroll's

31 *Id.* at 3.

32 Aswath Damodaran, *Damodaran Online*, N.Y. Univ., http://pages.stern.nyu.edu/~adamodar/. (On August 12, 2023, Professor Damodaran appeared on CNBC to discuss the equity risk premium. *See* CNBC Television, *Equity Risk Premium is Core to Understanding Long-Term Market Returns, says NYU Aswath Damodaran*, YouTube https://www.youtube.com/watch?v=VPkQ7_3Sf1E.

recommended normalized risk-free interest rates have been in the 2.50% to 4.50% range and market risk premiums have been in the 5.0% to 6.0% range. Most recently, Kroll reduced its market risk premium from 6.00% to 5.50% on June 8, 2023 and to 5.00% on June 5, 2024.[33]

Figure 13
Kroll
Normalized Risk-Free Rate and Market Risk Premium Recommendations
2007–2024



Source:https://www.kroll.com/en/insights/publications/cost-of-capital/recommended-us-equity-risk-premium-and-corresponding-risk-free-rates.

Fourth, Dr. David Kelly, the Chief Global Strategist at *J.P. Morgan Asset Management*, is one of the best-known market strategists on Wall Street. His annual publication and their monthly updates, the *JP Morgan Guide to the Markets*, is a must-read guide for stockbrokers and financial professionals. In presenting their annual expectations for the markets, JP Morgan provides details about inputs and assumptions of expected market returns. In his 2023 update, JP Morgan details their 2023 expected long-term stock market return of 7.90%, bond yield of 3.50%, and resulting market risk premium of 4.40%.[34]

[33] https://www.kroll.com/en/insights/publications/cost-of-capital/recommended-us-equity-risk-premium-and-corresponding-risk-free-rates.pdf.

[34] JP Morgan, *2023 Long-Term Capital Market Assumptions*, 70 (2023). (Provided in Dr. Woolridge's work papers.

Finally, KPMG, the international accounting firm, regularly publishes an update to their market risk premium to be used in their valuation practice. KPMG's market risk premium is shown in Figure 14, which was as high as 6.75% in 2020, and was lowered to as low as 5.00% on September 30, 2021. KPMG increased its market risk premium to 6.00% on June 30, 2022, but lowered it to 5.75% on December 31, 2022, to 5.50% on March 31, 2023, to 5.25% on June 30, 2023, and to 5.00% on September 30, 2023.[35]

Figure 14
KPMG
Market Risk Premium Recommendations
2020–2024

https://indialogue.io/clients/reports/public/5d9da61986db2894649a7ef2/5d9da63386db2894649a7ef5

Q. GIVEN THESE RESULTS, WHAT MARKET RISK PREMIUM ARE YOU USING IN YOUR CAPM?

A. The studies in Exhibit JRW-6-6 and, more importantly, the more timely and relevant studies cited in the previous section, suggest that the appropriate market risk premium in the U.S. is in the 4.0% to 6.0% range. In the last year, as interest rates have increased, estimates of the market risk premium have declined. I give most weight to the market risk-premium estimates of Kroll, KPMG, JP Morgan, Damodaran, and the Fernandez and Duke-CFO surveys. Given the recent estimates, I believe a market risk premium of 5.00% is appropriate at this time.

[35] *KPMG Corporate Finance & Valuations NL Recommends A MRP of 5.0% as per March 31, 2024*, KMPG (Mar. 31, 2024). https://indialogue.io/clients/reports/public/5d9da61986db2894649a7ef2/5d9da63386db2894649a7ef5.

Q. WHAT EQUITY COST RATE IS INDICATED BY YOUR CAPM ANALYSIS?

A. The results of my CAPM study for the proxy group are summarized on page 1 of Exhibit JRW-6 and in Table 8.

Table 8
CAPM-derived Equity Cost Rate/ROE
$K = (R_f) + \beta * [E(R_m) - (R_f)]$

		Risk-Free Rate	Beta	Equity Risk Premium	Equity Cost Rate
Electric Proxy Group		4.50%	0.81	5.00%	8.55%
Bulkley Proxy Group		4.50%	0.81	5.00%	8.55%

For both groups, the risk-free rate of 4.50% plus the product of the beta of 0.81 times the equity risk premium of 5.00% results in an 8.55% equity cost rate.

D. EQUITY COST RATE SUMMARY

Q. PLEASE SUMMARIZE THE RESULTS OF YOUR EQUITY COST RATE STUDIES.

A. Table 9 provides my DCF and CAPM analyses for the proxy groups.

Table 9
ROEs Derived from DCF and CAPM Models

	DCF	CAPM
Electric Proxy Group	9.90%	8.55%
Bulkley Proxy Group	10.10%	8.55%

Q. GIVEN THESE RESULTS, WHAT IS YOUR ESTIMATED EQUITY COST RATE FOR THE GROUPS?

A. My analysis indicates an equity cost rate in the range of 8.55% to 10.10% is appropriate for the Company. Given these results, I believe that the appropriate ROE for CEHE is in the 9.00%-10.00% range. Given that: (1) I rely primarily on the DCF model and the results for the Electric Proxy Group; and (2) the Company's investment risk is slightly less than the average of the two proxy groups, I am recommending a ROE of 9.50%. This represents the midpoint of my recommended range (midpoint of 9.00% - 10.00%) for CEHE.

Q. PLEASE INDICATE WHY AN EQUITY COST RATE OF 9.50% IS APPROPRIATE FOR CEHE.

A. There are a few reasons why an equity cost rate of 9.50% is appropriate and fair for the Company in this case:

1. As shown in Table 6, the electric utility industry is among the lowest risk industries in the U.S. as measured by beta. As such, the cost of equity capital for this industry is amongst the lowest in the U.S., according to the CAPM.

2. The investment risk of CEHE, as indicated by the Company's S&P credit ratings, is slightly below the average of the two proxy groups.

3. The authorized ROEs for electric distribution companies was 9.10% in 2020, 9.04% in 2021, 9.11% in 2022, 9.24% in 2023, and 9.60% in the first quarter of 2024.[36] While interest rates have increased coming out of the pandemic, which led to record low authorized ROEs for utilities, I show that authorized ROEs for utilities never declined as much as interest rates in 2020 and 2021. In addition, as discussed above, the Werner and Jarvis (2022) study concluded that, over the past four decades, authorized ROEs have not declined in line with capital costs over time and therefore past authorized ROEs have overstated the actual cost of equity capital. Hence, the Commission should not be concerned that my recommended ROE is below other authorized ROEs.

Q. DO YOU BELIEVE THAT YOUR 9.50% ROE RECOMMENDATIONS MEET THE *HOPE* AND *BLUEFIELD* STANDARDS?

A. Yes. As I previously noted, according to the *Hope* and *Bluefield* decisions, returns on capital should be: (1) comparable to returns investors expect to earn on other investments of similar risk, (2) sufficient to assure confidence in the company's financial integrity, and (3) adequate to maintain and support the company's credit and to attract capital.

As page 3 of Exhibit JRW-2 shows, electric utility and gas distribution companies have been earning in the 8.0% to 10.0% range in recent years. While my recommendation is below the average authorized ROEs for electric distribution companies, it reflects the

[36] S&P Global Market Intelligence, RRA *Regulatory Focus*, 2024.

downward trend in authorized and earned ROEs of utilities. In addition, as discussed above, the Werner and Jarvis study (2022), demonstrated that authorized ROEs over the past four decades have not declined in line with capital costs and therefore past authorized ROEs have overstated the actual cost of equity capital. Therefore, I believe that my ROE recommendation meets the criteria *Hope* and *Bluefield* established.

VII. CRITIQUE OF CEHE'S RATE OF RETURN TESTIMONY

Q. PLEASE SUMMARIZE THE COMPANY'S COST OF CAPITAL RECOMMENDATION.

A. The Company has proposed a capital structure consisting of 55.10% long-term debt and 44.90%. CEHE has proposed a long-term debt cost rate of 4.29%. CEHE witness Ms. Bulkley proposes a ROE of 10.40% for CEHE. CEHE is proposing an overall rate of return or cost of capital of 7.03%. These recommendations are summarized on page 1 of Exhibit JRW-7.

Q. PLEASE REVIEW MS. BULKLEY'S EQUITY COST RATE APPROACHES AND RESULTS.

A. Ms. Bulkley has developed a proxy group of electric utility companies and employs DCF, CAPM, and risk premium models. Ms. Bulkley' equity-cost-rate estimates for CEHE are summarized on page 2 of Exhibit JRW-7. Based on these figures, she concludes that the appropriate equity-cost rate is 10.40% for CEHE electric utility operations.

Q. WHAT ARE THE AREAS OF DISAGREEMENT IN ESTIMATING THE RATE OF RETURN OR COST OF CAPITAL IN THIS PROCEEDING?

A. As I discuss above, the primary issues related to the Company's rate of return include the following: (1) capital market conditions; (2) the capital structure; (3) the proxy group; (4) the Company's investment risk; (5) DCF Approach; (6) CAPM Approach; and (7) business and regulatory risks.

The capital market conditions, capital structure, the proxy group, and the Company's investment risk and business and regulatory risks were previously discussed. I address the remaining items below.

A. DCF APPROACH

Q. PLEASE SUMMARIZE MS. BULKLEY' DCF ESTIMATES.

A. On pages 67-70 of her testimony and in Exhibit No. AEB-4, Ms. Bulkley develops an equity cost rate by applying the DCF model to her proxy group. Ms. Bulkley's DCF results are summarized on page 2 of Exhibit JRW-7. In the traditional DCF approach, the equity cost rate is the sum of the dividend yield and expected growth. Ms. Bulkley uses three dividend yield measures (30, 90, and 180 days) in the DCF models conducted. In the constant-growth DCF models, Ms. Bulkley has relied on the forecasted EPS growth rates of Zacks, Yahoo Finance, and *Value Line*. Ms. Bulkley's mean DCF ROEs, using average growth rates, is 9.96%.

Q. WHAT ARE THE ERRORS IN MS. BULKLEY'S DCF ANALYSES?

A. The primary issue in Ms. Bulkley's DCF analysis is that she relies exclusively on the overly-optimistic and upwardly-biased earnings per share ("EPS"), growth-rate forecasts of Wall Street analysts and *Value Line*.

Q. PLEASE REVIEW MS. BULKLEY'S DCF GROWTH RATE.

A. In her constant-growth DCF model, Ms. Bulkley's DCF growth rate is the average of the projected EPS growth-rate forecasts of Wall Street analysts as compiled by Yahoo Finance, Zack's, and *Value Line*.

Q. WHAT IS THE EFFECT OF MS. BULKLEY EXCLUSIVE RELIANCE ON THE PROJECTED GROWTH RATES OF WALL STREET ANALYSTS AND *VALUE LINE*?

A. Ms. Bulkley's exclusive reliance on the projected growth rates published by Wall Street analysts and *Value Line* inflates her estimates of growth rates. It seems highly unlikely that investors today would rely exclusively on the EPS growth-rate forecasts of Wall Street analysts and *Value Line* and ignore other growth-rate measures in arriving at their expected growth rates for equity investments.

As I stated previously, the appropriate growth rate in the DCF model is the dividend growth rate rather than the earnings growth rate. Hence, consideration must be given to other indicators of growth, including historical prospective dividend growth, internal growth, as well as projected earnings growth. Due to the inaccuracy of analysts' long-term-earnings and growth-rate forecasts, the weight given to analysts' projected EPS growth rates should be limited.

Finally, not only are those forecasts inaccurate, but they are also overly optimistic and upwardly biased. I have provided a full discussion of this issue on pages 37-40 of this testimony and report on a study I conducted in Figure 11 on page 40. Using the electric utilities and gas-distribution companies covered by Value Line, this study demonstrates that the mean forecasted EPS growth rates are consistently greater than the achieved actual EPS growth rates over the 1985-2022 time period. Over the entire period, the mean forecasted EPS growth rate is over 200 basis points above the actual EPS growth rate. As such, the projected EPS growth rates for utilities are overly optimistic and upwardly based. Hence, exclusively using these growth rates to create a DCF growth rate produces an overstated equity-cost rate.

In addition. I also highlighted a study by Szakmary, Conover, and Lancaster (2008) who evaluated the accuracy of Value Line's three-to-five-year EPS growth rate forecasts using companies in the Dow Jones Industrial Average over a thirty-year time period and found these forecasted EPS growth rates to be significantly higher than the EPS growth rates that these companies subsequently achieved.[37]

[37] Szakmary, A., Conover, C., & Lancaster, C., *An Examination of* Value Line*'s Long-Term Projections*, J. BANKING & FIN., May 2008, at 820–33.

Q. HAVE CHANGES IN REGULATIONS IMPACTING WALL STREET ANALYSTS AND THEIR RESEARCH IMPACTED THE UPWARD BIAS IN THEIR PROJECTED EPS GROWTH RATES?

A. No. A number of studies I cite above demonstrate the upward bias has continued despite changes in regulations and reporting requirements over the past two decades. This observation is supported further by a 2010 McKinsey study entitled "Equity Analysts: Still Too Bullish," which reviewed the accuracy of analysts' long-term EPS growth rate forecasts. The authors concluded that, after a decade of stricter regulation, analysts' long-term earnings forecasts continue to be excessively optimistic. They made the following observation:[38]

> Alas, a recently completed update of our work only reinforces this view—despite a series of rules and regulations, dating to the last decade, that were intended to improve the quality of the analysts' long-term earnings forecasts, restore investor confidence in them, and prevent conflicts of interest. For executives, many of whom go to great lengths to satisfy Wall Street's expectations in their financial reporting and long-term strategic moves, this is a cautionary tale worth remembering. This pattern confirms our earlier findings that analysts typically lag behind events in revising their forecasts to reflect new economic conditions. When economic growth accelerates, the size of the forecast error declines; when economic growth slows, it increases. So as economic growth cycles up and down, the actual earnings S&P 500 companies report occasionally coincide with the analysts' forecasts, as they did, for example, in 1988, from 1994 to 1997, and from 2003 to 2006. *Moreover, analysts have been persistently overoptimistic for the past 25 years, with estimates ranging from 10 to 12 percent a year, compared with actual earnings growth of 6 percent. Over this time frame, actual earnings growth surpassed forecasts in only two instances, both during the earnings recovery following a recession. On average, analysts' forecasts have been almost 100 percent too high.*

This is the same observation made in a *Bloomberg Businessweek* article.[39] The author concluded there:

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[38] Marc H. Goedhart, Rishi Raj, and Abhishek Saxena, *Equity Analysts, Still Too Bullish*, McKinsey on Fin., 14–17, (Spring 2010) (emphasis added).

[39] Roben Farzad, *For Analysts, Things Are Always Looking Up*, Bloomberg Businessweek, June 10, 2010, https://www.bloomberg.com/news/articles/2010-06-10/for-analysts-things-are-always-looking-up.

> **The bottom line:** Despite reforms intended to improve Wall Street research, stock analysts seem to be promoting an overly rosy view of profit prospects.

B. CAPM APPROACH

Q. PLEASE DISCUSS MS. BULKLEY'S CAPM ANALYSIS.

A. On pages 70-5 of her testimony and in Exhibit Nos. AEB-5 – AEB-7, Ms. Bulkley develops an equity cost rate by applying the CAPM model to her proxy group. Ms. Bulkley's CAPM/ECAPM results are summarized on page 2 of Exhibit JRW-7. Ms. Bulkley calculates an equity cost rate by using not only the traditional CAPM, but also the so-called Empirical CAPM ("ECAPM") model for her proxy group. The ECAPM is a variant of the traditional CAPM. The CAPM/ECAPM approach requires an estimate of the risk-free interest rate, Beta, and the equity risk premium. Ms. Bulkley uses: (1) current (4.19%), near-term projected (4.10%), and long-term projected (4.10%) 30-year Treasury yields; (2) betas from *Value Line*; and (3) a market risk premium of 8.03%. Based on these figures, Ms. Bulkley finds CAPM/ECAPM equity cost rates ranging from 10.34% to 11.73%.

Q. WHAT ARE THE ERRORS IN MS. BULKLEY'S CAPM ANALYSIS?

A. The primary errors with Ms. Bulkley's CAPM/ECAPM analyses are: (1) the use of the ECAPM version of the CAPM and (2) the expected market risk premium of 8.03%.

1. <u>ECAPM Approach</u>

Q. WHAT ISSUES DO YOU HAVE WITH MS. BULKLEY'S USE OF THE ECAPM?

A. In addition to CAPM, Ms. Bulkley has employed a variation of CAPM called "ECAPM." ECAPM, as popularized by rate of return consultant Dr. Roger Morin, attempts to model the well-known finding of tests of the CAPM that have indicated the Security Market Line (SML) is not as steep as predicted by CAPM. Accordingly, ECAPM is an alternative version of the CAPM. However, the ECAPM has not been theoretically or empirically validated in refereed journals. The ECAPM provides for weights that are used to adjust the risk-free rate and market risk premium in applying ECAPM. Ms. Bulkley uses 0.25 and 0.75

factors to boost the equity risk premium measure but provides no empirical justification for those figures.

Beyond the lack of any theoretical or empirical validation of ECAPM, there are two errors in Ms. Bulkley's version of ECAPM: (1) I am not aware of any tests of the CAPM that use adjusted betas such as those used by Ms. Bulkley; and (2) adjusted betas, which were previously discussed, already address the empirical issues with CAPM. Specifically, the beta adjustment (1) increases the beta and resulting expected return for low beta (beta<1.0) stocks, and (2) decreases the beta and resulting expected return for high beta (beta>1.0) stocks.

2. Overstated Market Risk Premium

Q. PLEASE ASSESS MS. BULKLEY'S MARKET RISK PREMIUM DERIVED FROM APPLYING THE DCF MODEL TO THE S&P 500 USING BLOOMBERG PROJECTED EPS GROWTH RATES.

A. The most blatant error in Ms. Bulkley's CAPM/ECAPM analysis is the magnitude of the market (or equity) risk premium – which she then uses to produce very high CAPM ROE results, as high as 11.78%. Ms. Bulkley develops an expected market risk premium by: (1) applying the DCF model to the S&P 500 to get an expected market return; and (2) subtracting the risk-free rate of interest. As shown in Exhibit AEP-7 and Table 10, Ms. Bulkley's estimated market return of 12.22% for the S&P 500 equals the sum of the adjusted dividend yield of 1.71% and expected EPS growth rate of 10.51%. The expected EPS growth rate is the average of the expected EPS growth rates from S&P. The primary error in this approach is Ms. Bulkley's expected DCF growth rate. As previously discussed, the expected EPS growth rates of Wall Street analysts are upwardly biased. In addition, as explained below, the projected growth rate is inconsistent with historical and projected economic and earnings growth rates in the U.S.

Table 10
Bulkley CAPM Market Risk Premium

Adjusted Dividend Yield	**1.71%**
+ Expected EPS Growth	**10.51%**
= Expected Market Return	**12.22%**
+ Risk-Free Rate	**4.19%**
= Market Risk Premium	**8.03%**

Q. INITIALLY, PLEASE PROVIDE ADDITIONAL INSIGHTS INTO THE EXPECTED STOCK MARKET RETURN OF 12.22%.

A. Simply put, the assumption of a 12.22% expected stock market return is excessive and unrealistic. The compounded annual return in the U.S. stock market is about 10% (9.80% according to Damodaran between 1928–2023).[40] Ms. Bulkley's CAPM results assume that the return on the U.S. stock market will be more than 20 percent higher in the future than it has been in the past. Her inflated expected stock market return, and the resulting market risk premium and equity cost rate, results from computing the expected stock market return as the sum of the adjusted dividend yield plus the expected EPS growth rate of 10.51%.

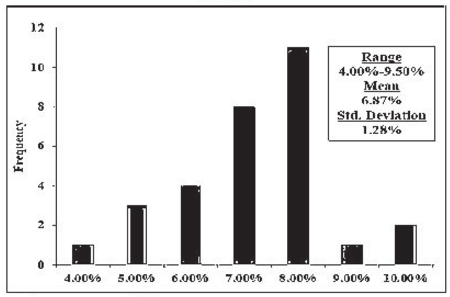
Q. IS MS. BULKLEY'S EXPECTED STOCK MARKET RETURN OF 12.22% REFLECTIVE OF THE STOCK MARKET RETURNS THAT INVESTMENT FIRMS TELL INVESTORS TO EXPECT?

A. No. Many investment firms provide investors with their estimates of the annual stock returns that they should expect in the future. Most publish these expected returns in documents entitled "Capital Market Assumptions" and are available online at their websites. If you search the Internet for "Capital Market Assumptions," you get a long list of investment firms and their base case expected annual return assumptions for stocks, bonds, and other financial assets. In my search, I found thirty investment firms that published their capital market assumptions. These are listed in Exhibit JRW-8, and include many of the largest, best-known investment firms, including J.P. Morgan, BlackRock, BNY Mellon, Fidelity Investments, Northern Trust, Vanguard Group, and State Street. Combined, these thirty firms manage more than $50 trillion in assets.

[40] Aswath Damodaran, *Damodaran Online*, N.Y. Univ., http://pages.stern.nyu.edu/~adamodar/.

Figure 15 provides a histogram of the expected returns listed in Exhibit JRW-8. The average duration of the long-term forecasts is 10 years. The range of the forecasted U.S. annual large cap equity returns is 4.00% to 9.50%. The mean and standard deviation of these expected returns are 6.87% and 1.28%.

Figure 15
Histogram of Investment Firm Expected Large Cap Equity Annual Returns
2023



Date Source: Exhibit JRW-8.

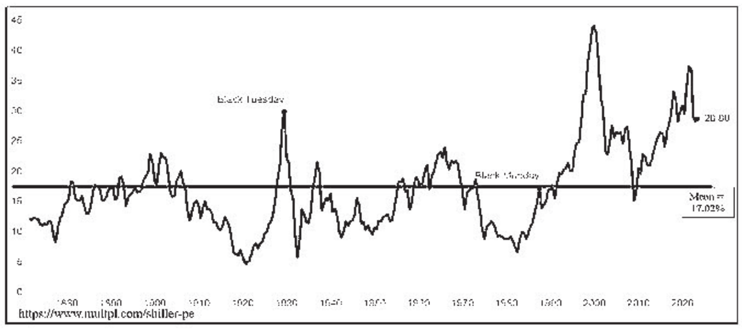
Q. WHAT ARE YOUR OBSERVATIONS ON THE STOCK MARKET RETURNS THAT INVESTMENT FIRMS TELL INVESTORS TO EXPECT?

A. I have three comments: (1) These returns are below the historical average compounded annual stock market return of 9.80% cited above (more on this below); (2) the standard deviation of 1.28% is very low, which indicates that the expected returns provided by these firms are quite similar, especially compared to historical stock market returns; and (3) these expected returns indicate that Ms. Bulkley's average expected stock market return of 12.22%, which she calculates using three alternative models using *Value Line* and Bloomberg expected return data is more than double the returns investment firms tell investors they should expect.

Q. WHY DO YOU THINK THE STOCK MARKET RETURNS THAT INVESTMENT FIRMS TELL INVESTORS TO EXPECT ARE LOWER THAN HISTORICAL STOCK RETURNS?

A. The biggest factor is that the valuation of the overall stock market is high relative to historical standards. When stock prices are high, investors must pay higher prices to buy in, which lowers their future expected returns. Figure 16 provides Schiller's cyclically-adjusted PE ratio (CAPE) over the last 100+ years. Stocks prices have remained above the mean historical CAPE level of 17.02% since 2009, with a current level of 28.03. Hence, the higher valuation of the stock market leads to lower expected returns.

Figure 16
Schiller S&P 500 CAPE Ratio
2023



The Schiller S&P 500 CAPE ratio is based on average inflation-adjusted earnings from the previous 10 years. Data Source: https://www.multpl.com/shiller-pe.

Q. HOW DO ISSUES WITH ANALYSTS' EPS GROWTH RATE FORECASTS IMPACT MS. BULKLEY'S CAPM?

A. The key point is that Ms. Bulkley's CAPM market risk premium methodology is based entirely on the concept that analyst projections of companies' three-to-five-year EPS growth rates reflect investors' expected *long-term* EPS growth for those companies. However, this assumption is highly unrealistic given the published research on these projections. As previously noted, numerous studies have shown that the long-term EPS growth rate forecasts of Wall Street securities analysts are overly optimistic and upwardly biased.[41] Moreover, as I referenced above, the Lacina, Lee, and Xu study showed that analysts' forecasts of EPS growth over the next three-to-five years are no more accurate than their forecasts of the next single year's EPS growth (and the single year forecasts are

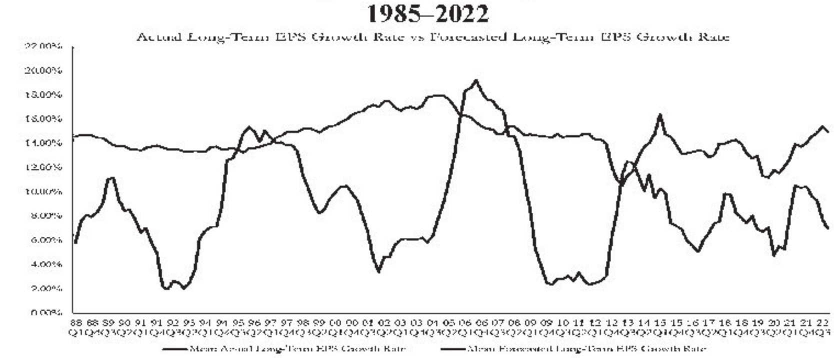
[41] Such studies include: R.D. Harris, *The Accuracy, Bias, and Efficiency of Analysts' Long Run Earnings Growth Forecasts*, *J. of Business Fin. & Accounting*, 725–55 (June/July 1999); P. DeChow, A. Hutton, and R. Sloan, *The Relation Between Analysts' Forecasts of Long-Term Earnings Growth and Stock Price Performance Following Equity Offerings*, Contemporary Accounting Research (2000); K. Chan, L., Karceski, J., & Lakonishok, J., *The Level and Persistence of Growth Rates*, *J. of Fin.* 643–84 (2003); 8 Michael Lacina, B. Brian Lee, and Zhao Xu, *Advances in Business and Management Forecasting*, at 77–101 (Kenneth D. Lawrence, Ronald K. Klimberg, eds., Emerald Grp. Publ'g Ltd. 2011).

notoriously inaccurate). The overly optimistic inaccuracy of analysts' growth rate forecasts leads to an upward bias in equity cost estimates of about 300 basis points.[42]

I have also completed studies on the accuracy of analysts' projected EPS growth rates. In Figure 11 (page 40), I demonstrated that the EPS growth rate forecasts of Wall Street analysts are upwardly biased for electric utilities and gas distribution companies. In Figure 17, I provide the results of a study I performed using all companies followed by I/B/E/S who have three-to-five-year EPS growth rate forecasts over the 1985 to 2022 time period.

In this study, for each company with a three-to-five-year forecast, I compared the average three-to-five-year average EPS growth rate forecasts to the actual EPS growth rates achieved over the three-to-five-year time period. In Figure 17, the mean of the projected EPS growth rates is the red line, and the mean of the actual EPS growth rates is the blue line. Over the thirty-five years of the study, the mean projected three-to-five-year EPS growth rate was 12.50%, while the average, actual-achieved three-to-five-year EPS growth rate was 6.50%. This study demonstrates that the projected three-to-five-year EPS growth rate forecasts are upwardly biased and overly optimistic. As can be seen by comparing Figures 11 and 17, the degree of upward bias for all companies is much larger than it is for electric and gas utility companies.

Figure 17
Mean Forecasted vs. Actual Long-Term EPS Growth Rates
All Companies Covered by I/B/E/S
1985–2022



Data Source: I/B/E/S, 2023.

[42] Peter D. Easton & Gregory A. Sommers, *Effect of Analysts' Optimism on Estimates of the Expected Rate of Return Implied by Earnings Forecasts*, 45 *J. of Accounting Research*, 983–1015 (2007).

Q. IS MS. BULKLEY'S MARKET RISK PREMIUM OF 8.03% REFLECTIVE OF THE MARKET RISK PREMIUMS FOUND IN PUBLISHED STUDIES AND SURVEYS?

A. No. Ms. Bulkley's figure well exceeds market risk premiums: (1) found in studies of the market risk premium by leading academic scholars; (2) produced by analyses of historic stock and bond returns; and (3) found in surveys of financial professionals.

Page 6 of Exhibit JRW-6 provides the results of over 30 market risk premium studies from the past 15 years.[43] Historic stock and bond returns suggest a market risk premium in the 4.40%–6.64% range, depending on whether one uses arithmetic or geometric mean returns. There have been many studies using expected return (also called ex ante) models, and their market risk premiums results vary from as low as 3.32% to as high as 6.0%.

Finally, the market risk premiums developed from surveys of analysts, companies, financial professionals, and academics suggest even potentially lower market risk premiums, in a range from 3.15% to 5.70%. The bottom line is that there is no support in historic return data, surveys, academic studies, or reports for investment firms for a market risk premium as high as the 8.03% used by Ms. Bulkley.

Q. IS THERE OTHER EVIDENCE TO INDICATE THAT MS. BULKLEY'S MARKET RISK PREMIUM, WHICH SHE DEVELOPED USING ANALYSTS' PROJECTED EPS GROWTH RATES, IS EXCESSIVE?

A. Yes. A long-term EPS growth rate of 10.51% is inconsistent with both historic and projected economic and earnings growth in the U.S. for several reasons: (1) long-term EPS and economic growth represent about one-half of Ms. Bulkley's projected EPS growth rate of 10.51%; (2) long-term EPS and GDP growth are directly linked; and (3) more recent trends in GDP growth, as well as projections of GDP growth, suggest slower economic and earnings growth in the near future, during the period when the rates from this case will be effective.

[43] *See* Woolridge, Exh. JRW-6 at 6.

Long-Term Historic EPS and GDP Growth Have Been in the 6%–7% Range: In Exhibit JRW-9, I performed a study of the growth in nominal GDP, S&P 500 stock price appreciation, and S&P 500 EPS and DPS growth since 1960. The results are provided on page 1 of Exhibit JRW-9, and a summary is shown in Table 11.[44]

Table 11
GDP, S&P 500 Stock Price, EPS, and DPS Growth
1960-Present

Nominal GDP	**6.45%**
S&P 500 Stock Price	**7.25%**
S&P 500 EPS	**7.00%**
S&P 500 DPS	**5.81%**
Average	**6.63%**

The results show that the historical long-run growth rates for GDP, S&P EPS, and S&P DPS are in the 6% to 7% range. By comparison, Ms. Bulkley's long-run growth rate projection of 10.51% is at best overstated. This estimate suggests that companies in the U.S. would be expected to: (1) increase their growth rate of EPS by almost 100 percent in the future and (2) maintain that growth indefinitely in an economy that is expected to grow at about one-third of Ms. Bulkley's projected growth rates.

There is a Direct Link Between Long-Term EPS and GDP Growth: The results in Exhibit JRW-9 and Table 11 show that historically there has been a close link between long-term EPS and GDP growth rates. Brad Cornell of the California Institute of Technology published a study on GDP growth, earnings growth, and equity returns. Cornell found that long-term EPS growth in the U.S. is directly related to GDP growth, with GDP growth providing an upward limit on EPS growth. In addition, the study showed that long-term stock returns are determined by long-term earnings growth. Cornell concludes with the following observations:[45]

> The long-run performance of equity investments is fundamentally linked to growth in earnings. Earnings growth, in turn, depends on growth in real GDP. This article demonstrates that both theoretical research and empirical

[44] *See* Woolridge, Exh. JRW-9 at 1.

[45] Bradford Cornell, *Economic Growth and Equity Investing*, Fin. Analysts J. at 63 (Jan.-Feb. 2010).

> research in development economics suggest relatively strict limits on future growth. In particular, real GDP growth in excess of 3 percent in the long run is highly unlikely in the developed world. In light of ongoing dilution in earnings per share, this finding implies that investors should anticipate real returns on U.S. common stocks to average no more than about 4–5 percent in real terms.

Annual growth rates in nominal GDP are shown on page 2 of Exhibit JRW-9. Nominal GDP growth was in the four percent range over the past decade until the COVID-9 Pandemic hit in 2020. Nominal GDP fell by 2.2% in 2020, before rebounding and growing by about 10.0% in 2021 and 2022 and 6.0% in 2023. The components of nominal GDP growth are real GDP growth and inflation. Page 3 of Exhibit JRW-9 shows the annual real GDP growth rate between 1961 and 2023. Real GDP growth has gradually declined from the 5.0 percent to 6.0 percent range in the 1960s to the 2.0% to 3.0% range during the 2015–2019 period. Real GDP fell by 3.5% in 2020, but rebounded and grew by 5.7% in 2021 and in the 2.0% range in 2022 and 2023.

The second component of nominal GDP growth is inflation. Page 4 of Exhibit JRW-9 shows inflation as measured by the annual growth rate in the Consumer Price Index ("CPI") from 1961 to 2022. The large increase in prices from the late 1960s to the early 1980s is readily evident. Equally evident is the rapid decline in inflation during the 1980s as inflation dropped from above ten percent to about four percent. Since that time, inflation has gradually declined and was in the 2.0% range or below from 2015 to 2020. Prices increased in the 2021-2023 years with GDP as well as its components, real GDP, and inflation. To gauge the magnitude of the decline in nominal GDP growth, Table 12 provides the compounded GDP growth rates for 10-, 20-, 30-, 40- and 50- years. Whereas the 50-year compounded GDP growth rate is 6.12%, there has been a decline in nominal GDP growth over subsequent 10-year intervals. These figures strongly suggest that nominal GDP growth in recent decades has slowed and that a figure in the range of 4.5% to 5.0% is more appropriate today for the U.S. economy.

Table 12
Historical Nominal GDP Growth Rates

10-Year Average	**5.12%**
20-Year Average	**4.52%**
30-Year Average	**4.77%**
40-Year Average	**5.21%**
50-Year Average	**6.12%**

Long-Term GDP Projections also Indicate Slower GDP Growth in the Future: A lower range is also consistent with long-term GDP forecasts. There are several forecasts of annual GDP growth that are available from economists and government agencies. These are listed in Panel B of page 5 of Exhibit JRW-9.

The mean 10-year nominal GDP growth forecast (as of February 2023) by economists in the recent *Survey of Financial Forecasters* is 4.40%.[46] The Energy Information Administration (EIA), in its projections used in preparing *Annual Energy Outlook*, forecasts long-term GDP growth of 4.3% for the period 2023 to 2053.[47] The Congressional Budget Office (CBO), in its forecasts for the period 2023 to 2053, projects a nominal GDP growth rate of 3.8%.[48] Finally, the Social Security Administration (SSA), in its Annual OASDI Report, provides a projection of nominal GDP from 2023 to 2100.[49] SSA's projected growth GDP growth rate over this period is 4.1%. The average projected GDP growth rate for these four forecasts is 4.15%.

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46 Ten-year median projected real GDP growth of 2.00% and CPI inflation of 2.37%. *Survey of Professional Forecasters*, Fed. Reserve Bank of Philadelphia, https://www.philadelphiafed.org/research-and-data/real-time-center/survey-of-professional-forecasters/.

47 *Annual Energy Outlook 2023*, U.S. ENERGY INFORMATION ADMINISTRATION, Table: Macroeconomic Indicators.

48 *The 2023 Long-Term Budget Outlook*, CONGRESSIONAL BUDGET OFFICE, July 15, 2023.

49 Social Security Administration, *2023 Annual Report of the Board of Trustees of the Old-Age, Survivors, and Disability Insurance (OASDI) Program*, Table VI.G4, (July 1, 2023). The 4.1% growth rate is the growth in projected GDP from 2023 to 2100.

The bottom line is that the trends and projections suggest a long-term GDP growth rate in the 4.0% to 4.5% range. As such, Ms. Bulkley's average projected EPS growth rate of 10.51% is more than double the projected GDP growth.

Q. WHAT FUNDAMENTAL FACTORS HAVE LED TO THE DECLINE IN PROSPECTIVE GDP GROWTH?

A. As addressed in a study by the consulting firm McKinsey & Co., two factors drive real GDP growth over time: (a) the number of workers in the economy (employment); and (2) the productivity of those workers (usually defined as output per hour).[50] According to McKinsey, population and productivity growth drove real GDP growth over the past 50 years, at compound annual rates of 1.7% and 1.8%, respectively.

However, global economic growth is projected to slow significantly in the years to come. The primary factor leading to the decline is slow growth in employment (working-age population), which results from slower population growth and longer life expectancy. McKinsey estimates that employment growth will slow to 0.3% over the next 50 years. They conclude that even if productivity remains at the rapid rate of the past 50 years of 1.8%, real GDP growth will fall by 40% to 2.1%.

Q. OVER THE MEDIUM TO LONG RUN, IS S&P 500 EPS GROWTH LIKELY TO OUTPACE GDP GROWTH?

A. No. Figure 18 shows the average annual growth rates for GDP and the S&P 500 EPS since 1960. The one very apparent difference between the two is that the S&P 500 EPS growth rates are much more volatile than the GDP growth rates, when compared using the relatively short, and somewhat arbitrary, annual conventions used in these data.[51]

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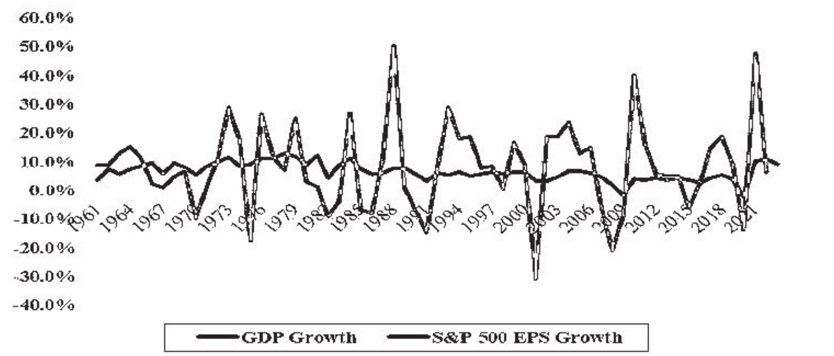
[50] James Manyika, et al., *Can Long-Term Growth be Saved?*, McKinsey Global Institute. (Jan. 1, 2015), https://www.mckinsey.com/featured-insights/employment-and-growth/can-long-term-global-growth-be-saved.

[51] Timing conventions such as years and quarters are needed for measurement and benchmarking but are somewhat arbitrary. In reality, economic growth and profit accrual occur on continuous bases. A 2014 study evaluated the timing relationship between corporate profits and nominal GDP growth. The authors found that aggregate accounting earnings growth is a leading indicator of the GDP growth with a quarter-ahead forecast horizon. *See* Yaniv Konchitchki and Panos N. Patatoukas, *Accounting Earnings and Gross Domestic Product*, 57 *J. of Accounting and Economics* 76–88 (2014).

Volatility aside, however, it is clear that over the medium to long run, S&P 500 EPS growth does not significantly outpace GDP growth.

Figure 18
Average Annual Growth Rates
GDP and S&P 500 EPS
1960-2023



Data Sources: GDPA - http://research.stlouisfed.org/fred2/series/GDPA/downloaddata.
S&P EPS - http://pages.stern.nyu.edu/~adamodar/

A more robust understanding of the relationship between GDP and S&P 500 EPS growth requires consideration of at least three factors, as follows.

Corporate Profits are Constrained by GDP: In a *Fortune* magazine article, Milton Friedman, the winner of the 1976 Nobel Prize in Economic Sciences, warned investors and others not to expect corporate-profit growth to sustainably exceed GDP growth, stating, "Beware of predictions that earnings can grow faster than the economy for long periods. When earnings are exceptionally high, they don't just keep booming."[52] In that same article, Friedman also noted that profits must move back down to their traditional share of GDP. In Table 13, I show that the aggregate net income levels for the S&P 500 companies, using 2022 figures, represent 6.11% of nominal GDP.

[52] Shaun Tully, *Corporate Profits Are Soaring. Here's Why It Can't Last*, Fortune, Dec. 7, 2017, http://fortune.com/2017/12/07/corporate-earnings-profit-boom-end/.

Table 13
S&P 500 Aggregate Net Income as a Percent of GDP

	2022 Value ($B)
Aggregate Net Income for S&P 500	$1,555.98
2022 Nominal U.S. GDP	25,461.34
Net Income/GDP (%)	6.11%

Data Sources: 2022 Net Income for S&P 500 companies https://www.gurufocus.com/economic_indicators/5749/sp-500-net-income-ttm. 2022 Nominal GDP – https://pages.stern.nyu.edu/~adamodar/.

Short-Term Factors Impact S&P 500 EPS: The growth rates in the S&P 500 EPS and GDP can diverge on a year-to-year basis due to short-term factors that impact S&P 500 EPS in a much greater way than GDP. As shown above, S&P EPS growth rates are much more volatile than GDP growth rates. The EPS growth for the S&P 500 companies has been influenced by low labor costs and interest rates, commodity prices, the recovery of different sectors such as the energy and financial sectors, and the cut in corporate tax rates. These short-term factors can make it appear that there is a disconnect between the economy and corporate profits.

The Differences Between the S&P 500 EPS and GDP: In the last two years, as the EPS for the S&P 500 has grown at a faster rate than U.S. nominal GDP, some have pointed to the differences between the S&P 500 and GDP.[53] These differences include: (a) corporate profits are about 2/3 manufacturing driven, while GDP is 2/3 services driven; (b) consumer discretionary spending accounts for a smaller share of S&P 500 profits (15%) than of GDP (23%); (c) corporate profits are more international-trade driven, while exports minus imports tend to drag on GDP; and (d) S&P 500 EPS is affected not just by corporate profits but also by share buybacks on the positive side (fewer shares boost EPS), and by share dilution on the negative side (new shares dilute EPS). While these differences may seem

[53] *See* the following studies: Burt White and Jeff Buchbinder, *The S&P and GDP are not the Same Thing*, LPL Fin. (Nov. 4, 2014, 11:31 AM), https://www.businessinsider.com/sp-is-not-gdp-2014-11; Matt Comer, *How Do We Have 18.4% Earnings Growth In A 2.58% GDP Economy?*, Seeking Alpha (Apr. 19, 2018, 1:04 PM), https://seekingalpha.com/article/4164052-18_4-percent-earnings-growth-2_58-percent-gdp-economy; Shaun Tully, *How on Earth Can Profits Grow at 10% in a 2% Economy?*, Fortune, (July 27, 2017, 1:26 PM), http://fortune.com/2017/07/27/profits-economic-growth/.

significant, it must be remembered that the Income Approach to measure GDP includes corporate profits (in addition to employee compensation and taxes on production and imports) and therefore effectively accounts for the first three factors.[54]

The bottom line is that, despite the intertemporal short-term differences between S&P 500 EPS and nominal GDP growth, corporate profits and GDP remain inevitably linked over the long-term.

Q. PLEASE PROVIDE ADDITIONAL EVIDENCE SHOWING THAT MS. BULKLEY'S S&P 500 EPS GROWTH RATE OF 10.51% IS NOT REALISTIC.

A. Beyond my previous discussion, I have performed the following analysis of S&P 500 EPS and GDP growth in Table 14. Specifically, I started with the 2022 aggregate net income for the S&P 500 companies and 2022 nominal GDP for the U.S. As shown in Table 14, the aggregate profit for the S&P 500 companies represented 6.11% of nominal GDP in 2022. In Table 14, I then projected the aggregate net income level for the S&P 500 companies and GDP as of the year 2050.

For the growth rate for the S&P 500 companies, I used Ms. Bulkley's average projected S&P 500 EPS growth rate of 10.51%. As a growth rate for nominal GDP, I used the average of the long-term projected GDP growth rates from CBO, SFF, SSA, and EIA (3.8%, 4.4%, 4.1%, and 4.3%, respectively), which is 4.15%.

The projected 2050 level for the aggregate net income level for the S&P 500 companies using Ms. Bulkley's 10.51% EPS growth rate of 10.51% is $29.87 trillion. Over the same period, GDP is expected to grow to $79.50 trillion.

As such, if the aggregate net income for the S&P 500 grows in accordance with the growth rate used by Ms. Bulkley (10.51%), and if nominal GDP grows at rates projected by major government agencies (4.15%), the net income of the S&P 500 companies will represent

[54] The Income Approach to measuring GDP includes wages, salaries, and supplementary labor income, corporate profits, interest and miscellaneous investment income, farmers' incomes, and income from non-farm unincorporated businesses.

growth from 6.11% of GDP in 2022 to 37.58% of GDP in 2050. It is totally unrealistic for the net income of the S&P 500 to become such a large component of GDP.

Table 14
Projected S&P 500 Earnings and Nominal GDP
2022-2050
S&P 500 Aggregate Net Income as a Percent of GDP

	2022 Value ($B)	Growth Rate	No. of Years	2050 Value ($B)
Aggregate Net Income for S&P 500	$1,555.98	10.51%	28	$ 25,541.62
2022 Nominal U.S. GDP	$25,461.34	4.15%	28	$ 79,495.21
Net Income/GDP (%)	6.11%			32.13%

Data Sources: 2022 Net Income for S&P 500 companies
https://www.gurufocus.com/economic_indicators/5749/sp-500-net-income-ttm.
Growth Rate - Ms. Bulkley's average projected S&P 500 EPS growth rate of 10.51%.
Nominal GDP Growth Rate – The average of the long-term projected GDP growth rates from CBO, SFF, SSA, and EIA (3.8%, 4.4%, 4.1%, and 4.3% = 4.15%).

Q. PLEASE PROVIDE A SUMMARY ASSESSMENT OF GDP AND S&P 500 EPS GROWTH RATES.

A. The long-term link between corporate profits and GDP is inevitable. The short-term differences in growth between the two indicate that corporate profits as a share of GDP tend to go far higher after periods where they are depressed, and then drop sharply after they have been hovering at historically high levels. In a famous 1999 *Fortune* article, Warren Buffet made the following observation:[55]

> You know, someone once told me that New York has more lawyers than people. I think that's the same fellow who thinks profits will become larger than GDP. When you begin to expect the growth of a component factor to forever outpace that of the aggregate, you get into certain mathematical problems. In my opinion, you have to be wildly optimistic to believe that corporate profits as a percent of GDP can, for any sustained period, hold much above 6%.

In sum, Ms. Bulkley's average long-term S&P 500 EPS growth rate of 10.51% is grossly overstated and has little (if any) basis in economic reality. In the end, the question remains whether corporate profits can grow faster than GDP. Jeremy Siegel, the renowned finance professor at the Wharton School of the University of Pennsylvania, believes that going

[55] Carol Loomis, *Mr. Buffet on the Stock Market*, Fortune (Nov. 22, 1999), https://money.cnn.com/magazines/fortune/fortune_archive/1999/11/22/269071/.

forward, earnings per share can grow about half a point faster than nominal GDP, or about five percent, due to the big gains in the technology sector. But Siegel also believes that sustained EPS growth matching analysts' near-term projections is absurd: "The idea of 8% or 10% or 12% growth is ridiculous. It will not happen."[56]

C. Alternative Risk Premium Approach

Q. PLEASE REVIEW MS. BULKLEY ALTERNATIVE RISK PREMIUM MODEL.

A. On pages 75-8 of her testimony and Exhibit AEB-8, Ms. Bulkley estimates an equity cost rate using a risk premium model. Using the quarterly authorized ROEs for electric utility companies from Q1 1992 until Q4 2023, Ms. Bulkley develops an equity cost rate by regressing the authorized returns on equity for electric utility companies on the 30-year Treasury Yield. Ms. Bulkley then adds the risk premium established by regressing the authorized returns on equity to each of her three different 30-year Treasury yields: (a) a current yield of 4.19%, (b) a near-term projected yield of 4.10%, and (c) a long-term projected yield of 4.10%. Ms. Bulkley's risk premium results are provided in page 2 of Exhibit JRW-7. Ms. Bulkley reports risk premium equity cost rates ranging from 10.31% to 10.36%.

Q. WHAT ARE THE ERRORS IN MS. BULKLEY BOND YIELD PLUS RISK PREMIUM ("BYRP") ANALYSIS?

A. There are several problems with this approach for calculating the risk premium.

First, Ms. Bulkley's risk premium approach is a gauge of *commission* behavior and not *investor* behavior. Capital costs are determined in the marketplace through the financial decisions of investors and are reflected in such fundamental factors as dividend yields, expected growth rates, interest rates, and investors' assessment of the risk and expected return of different investments. Regulatory commissions evaluate capital market data in setting authorized ROEs, but also consider other utility- and rate case-specific information in setting ROEs. As such, Bulkley's approach and results reflect other factors such as

[56] Shaun Tully, *Corporate Profits Are Soaring. Here's Why It Can't Last*, *Fortune* (Dec. 7, 2017, 3:30 AM), http://fortune.com/2017/12/07/corporate-earnings-profit-boom-end/.

capital structure, credit ratings and other risk measures, service territory, capital expenditures, energy supply issues, rate design, investment and expense trackers, and other factors used by utility commissions in determining an appropriate ROE in addition to capital costs. This may especially be true when the authorized ROE data includes the results of rate cases that are settled and not fully litigated.

Second, the methodology produces an inflated measure of the risk premium because it uses historic authorized ROEs and Treasury yields, and the resulting risk premium is applied to projected Treasury Yields. Since Treasury yields are always forecasted to increase, the resulting risk premium would be smaller if done correctly, which would be the result using projected Treasury yields in the analysis rather than historic Treasury yields.

Third, since the stocks of electric utilities have been selling above book value for the last decade, it is obvious that the authorized ROEs of state utility commissions are above the returns that investors require.

Fourth, the risk premium in this approach is overstated because Ms. Bulkley used the ROEs for all electric utilities and not just distribution electric utilities. As previously discussed, the authorized ROEs for delivery-only electric utilities are 30-40 basis points below those of vertically-integrated electric utilities.

Fifth, the ROE derived from this approach is dependent on the authorized ROEs from state utility commissions. As discussed earlier in this testimony, Werner and Jarvis (2022), demonstrated that authorized ROEs over the past four decades have not declined in line with capital costs and therefore past authorized ROEs have overstated the actual cost of equity capital.

Q. HOW DOES MS. BULKLEY'S RISK PREMIUM RESULTS COMPARE TO THE CURRENT AUTHORIZED ROES FOR ELECTRIC DISTRIBUTION COMPANIES?

A. Ms. Bulkley reports results as high as 10.36% from her risk premium model. As noted above, the average authorized ROE for electric distribution companies in 2023 was 9.24%.

VIII. RATE CASE EXPENSES

Q. WHAT IS THE PURPOSE OF ADDRESSING RATE CASE EXPENSES IN THIS PROCEEDING?

A. The purpose of addressing rate case expenses in this proceeding is to comply with Issue No. 28 in the Commission's Preliminary Order, which states:

> 28. What are the intervening cities' reasonable rate-case expenses, in accordance with PURA § 33.023(b) and 16 TAC § 25.245? Does this amount include any anticipated expenses to appeal this proceeding or a prior rate-case proceeding?
>
> a. If attorney's fees are included in the rate-case expenses, are they supported by the testimony or affidavit of a licensed attorney qualified to render admissible opinions on the reasonableness of the attorney's fees?

Q. WHAT AMOUNT OF TCUC'S REQUESTED RATE CASES EXPENSES ARE ATTRIBUTABLE TO YOUR SERVICES?

A. My actual fees through June 16, 2024 of $25,025.00 respond to time reviewing the application, testimony, schedules and workpapers, developing and reviewing discovery, analyzing the filing, collecting data, performing financial studies and analyses used in the testimony, preparing testimony and exhibits and conferring with counsel. A copy of my invoices through June 16, 2024, in the amount of $25,025.00 are included as Exhibit JRW-10 to my testimony.

After June 16, 2024, I will have additional tasks to complete, including preparing work papers, participating in settlement negotiations, reviewing and potentially responding to discovery, reviewing rebuttal testimony, preparing for hearing and assistance with post-hearing filings; thus, I expect I will have additional fees for my services related to this proceeding.

Q. WHAT CRITERIA MUST BE MET UNDER THE COMMISSION'S RATE CASE EXPENSE RULE (16 TAC § 25.245)?

A. The following criteria are set out in the rule:

> 1. Whether the fees paid to, tasks performed by, or time spent on a task by an attorney or other professional were extreme or excessive,

2. Whether the expenses incurred for lodging, meals and beverages, transportation, or other services or materials were extreme or excessive,

3. Whether there was duplication of services or testimony,

4. Whether the utility's or municipality's proposal on an issue in the rate case had no reasonable basis in law, policy, or fact and was not warranted by any reasonable argument for the extension, modification, or reversal of commission precedent,

5. Whether rate-case expenses as a whole were disproportionate, excessive, or unwarranted in relation to the nature and scope of the rate case addressed by the evidence pursuant to subsection (b)(5) of this section, or

6. Whether the utility or municipality failed to comply with the requirements for providing sufficient information pursuant to subsection (b) of this section.

Q. IN LIGHT OF THE FIRST CRITERION SET OUT IN YOUR PREVIOUS ANSWER, IS YOUR BILLING RATE AND THE TIME SPENT ON THE TASKS IN THIS CASE REASONABLE?

A. Yes. My rate is reasonable. This is my normal billing rate for services provided to similar clients. This rate is in the range of billing rates charged by other consultants with similar experience and is reasonable for a consultant providing these types of services before utility regulatory agencies in Texas. My hourly rate is especially reasonable given that I have more than 38 years of utility rate regulatory experience.

Q. IN LIGHT OF THE SECOND CRITERION, DO YOUR INVOICES INCLUDE ANY TYPE OF IDENTIFIED CHARGES OR CHARGES THE COMMISSION HAS EXCLUDED IN THE PAST?

A. No. My fees are entirely for professional fees. There are no other expenses included on my invoices.

Q. IN LIGHT OF THE THIRD CRITERION, WAS THERE ANY DUPLICATION OF SERVICES OR TESTIMONY?

A. No; there has been no duplication of services. On behalf of TCUC my analysis focused on CEHE's cost of equity and on behalf of the City of Houston, Mr. Brandean Mac Mathuna's addressed a reasonable capital structure to employ to determine CEHE's Rate of Return.

Q. IN LIGHT OF THE FOURTH CRITERION, DID THE ISSUES YOU RAISED HAVE A REASONABLE BASIS IN LAW, POLICY, OR FACT?

A. Yes. The issues raised in my testimony focus directly on whether CEHE's requested cost of capital is reasonable, and my proposed cost of capital is consistent with methodologies upon which the Commission has based a utility's cost of capital in prior cases.

Q. IN LIGHT OF THE FIFTH CRITERION, WHAT IS YOUR CONCLUSION REGARDING REC'S ACTUAL CHARGES?

A. In my opinion, my actual fees of $25,025.00 incurred through June 16, 2024, are reasonable and necessary and are not disproportionate, excessive, or unwarranted in relation to the nature and scope of the rate filing. Furthermore, to the best of my knowledge, I have fully complied with the information requirements set out in the sixth criterion. My actual fees are reasonable given the degree of complexity reflected in CEHE's application.

Q. WHO WILL BE SUPPORTING THE EXPENSES INCURRED BY HERRERA LAW & ASSOCIATES, PLLC?

A. TCUC's rate-case expenses, including the fees and expenses of Herrera Law & Associates, PLLC ("HLA"), are supported the affidavit of Mr. Alfred R. Herrera. Mr. Herrera's affidavit establishes the reasonableness of TCUC's legal fees and expenses at issue in this proceeding.

IX. SUMMARY AND CONCLUSIONS

Q. DR. WOOLRIDGE, PLEASE SUMMARIZE YOUR TESTIMONY ON THE APPROPRIATE COST OF CAPITAL FOR CEHE.

A. The Company has proposed a capital structure consisting of 55.10% long-term debt and 44.90% common equity. CEHE has proposed a long-term debt cost rate of 4.29%. CEHE witness Ms. Ann E. Bulkley has proposed a ROE of 10.40% for CEHE. CEHE is proposing an overall rate of return or cost of capital of 7.03%.

I note that the Company's proposed capital structure includes a higher common equity ratio and lower financial risk than the companies in the proxy groups. I have applied the DCF and CAPM to my Electric Proxy Group as well as Ms. Bulkley's proxy group. My analysis indicates an equity cost rate in the range of 8.55% to 10.10% is appropriate for the Company. Given these results, I believe that the appropriate ROE for CEHE is in the 9.00%-10.00%. Given that: (1) I rely primarily on the DCF model and the results for the Electric Proxy Group; and (2) the Company's investment risk is slightly less than the average of the two proxy groups, I am recommending a ROE of 9.50%. This represents the midpoint of my recommended range (midpoint of 9.00% - 10.00%) for CEHE.

With a capital structure comprised of 42.50% equity capital and a debt-cost rate of 4.29%, I am recommending an overall fair rate of return or cost of capital of 6.50% for CEHE. This recommendation is provided in Table 2 and Exhibit JRW-1.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

SOAH DOCKET NO. 473-24-13232
PUC DOCKET NO. 56211

APPLICATION OF CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC FOR AUTHORITY TO CHANGE RATES	§ § § §	**BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS**

DIRECT TESTIMONY AND EXHIBITS

OF J. RANDALL WOOLRIDGE, PH.D.

APPENDIX A: Educational Background, Research, and Related Business Experience

Appendix A

Educational Background, Research, and Related Business Experience
J. Randall Woolridge

J. Randall Woolridge is a Professor of Finance and the Goldman, Sachs & Co. and Frank P. Smeal Endowed Faculty Fellow in Business Administration in the College of Business Administration of the Pennsylvania State University in University Park, PA. In addition, Professor Woolridge is Director of the Smeal College Trading Room and President and CEO of the Nittany Lion Fund, LLC.

Professor Woolridge received a Bachelor of Arts degree in Economics from the University of North Carolina, a Master of Business Administration degree from the Pennsylvania State University, and a Doctor of Philosophy degree in Business Administration (major area-finance, minor area-statistics) from the University of Iowa. He has taught Finance courses including corporation finance, commercial and investment banking, and investments at the undergraduate, graduate, and executive MBA levels.

Professor Woolridge's research has centered on empirical issues in corporation finance and financial markets. He has published over 35 articles in the best academic and professional journals in the field, including the *Journal of Finance*, the *Journal of Financial Economics*, and the *Harvard Business Review*. His research has been cited extensively in the business press. His work has been featured in the *New York Times*, *Forbes*, *Fortune*, *The Economist*, *Barron's*, *Wall Street Journal*, *Business Week*, *Investors' Business Daily*, *USA Today*, and other publications. In addition, Dr. Woolridge has appeared as a guest to discuss the implications of his research on CNN's *Money Line*, CNBC's *Morning Call* and *Business Today*, and Bloomberg's *Morning Call*.

Professor Woolridge's co-authored stock valuation book, *The StreetSmart Guide to Valuing a Stock* (McGraw-Hill, 2003), was released in its second edition. He has also co-authored *Spinoffs and Equity Carve-Outs: Achieving Faster Growth and Better Performance* (Financial Executives Research Foundation, 1999), as well as a textbook entitled *Basic Principles of Finance* (Kendall Hunt, 2011).

Professor Woolridge has also consulted with corporations, financial institutions, and government agencies. In addition, he has directed and participated in university- and company-sponsored professional development programs for executives in 25 countries in North and South America, Europe, Asia, and Africa.

Over the past 35 years Dr. Woolridge has prepared testimony and/or provided consultation services in regulatory rate cases in the rate of return area in following states: Alaska, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Hawaii, Indiana, Kansas, Kentucky, Maine, Maryland, Massachusetts, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Washington, D.C. He has also testified before the Federal Energy Regulatory Commission.

J. Randall Woolridge

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302 Business Building
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120 Haymaker Circle
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Academic Experience

Professor of Finance, the Smeal College of Business Administration, the Pennsylvania State University (July 1, 1990 to the present).

> **President, Nittany Lion Fund LLC,** (January 1, 2005 to the present)
> **Director, the Smeal College Trading Room** (January 1, 2001 to the present)
> **Goldman, Sachs & Co. and Frank P. Smeal Endowed University Fellow in Business Administration** (July 1, 1987 to the present).

Associate Professor of Finance, College of Business Administration, the Pennsylvania State University (July 1, 1984 to June 30, 1990).
Assistant Professor of Finance, College of Business Administration, the Pennsylvania State University (September, 1979 to June 30, 1984).

Education

Doctor of Philosophy in Business Administration, the University of Iowa. Major field: Finance.
Master of Business Administration, the Pennsylvania State University.
Bachelor of Arts, the University of North Carolina. Major field: Economics.

Books

James A. Miles and J. Randall Woolridge, *Spinoffs and Equity Carve-Outs: Achieving Faster Growth and Better Performance* (Financial Executives Research Foundation), 1999
Patrick Cusatis, Gary Gray, and J. Randall Woolridge, *The StreetSmart Guide to Valuing a Stock* (2nd Edition, McGraw-Hill), 2003.
J. Randall Woolridge and Gary Gray, *The New Corporate Finance, Capital Markets, and Valuation: An Introductory Text* (Kendall Hunt, 2003).

Research

Dr. Woolridge has published over 35 articles in the best academic and professional journals in the field, including the *Journal of Finance*, the *Journal of Financial Economics,* and the *Harvard Business Review*.

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EXHIBIT JRW-1: Recommended Cost of Capital

Exhibit JRW-1

CenterPoint Energy Houston Electric, LLC

TCUC's Rate of Return Recommendation

Capital Source	Capitalization Ratio	Cost Rate	Weighted Cost Rate
Long-Term Debt	57.50%	4.29%	2.47%
Common Equity	42.50%	9.50%	4.04%
Total	100.00%		6.50%

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OF J. RANDALL WOOLRIDGE, PH.D.

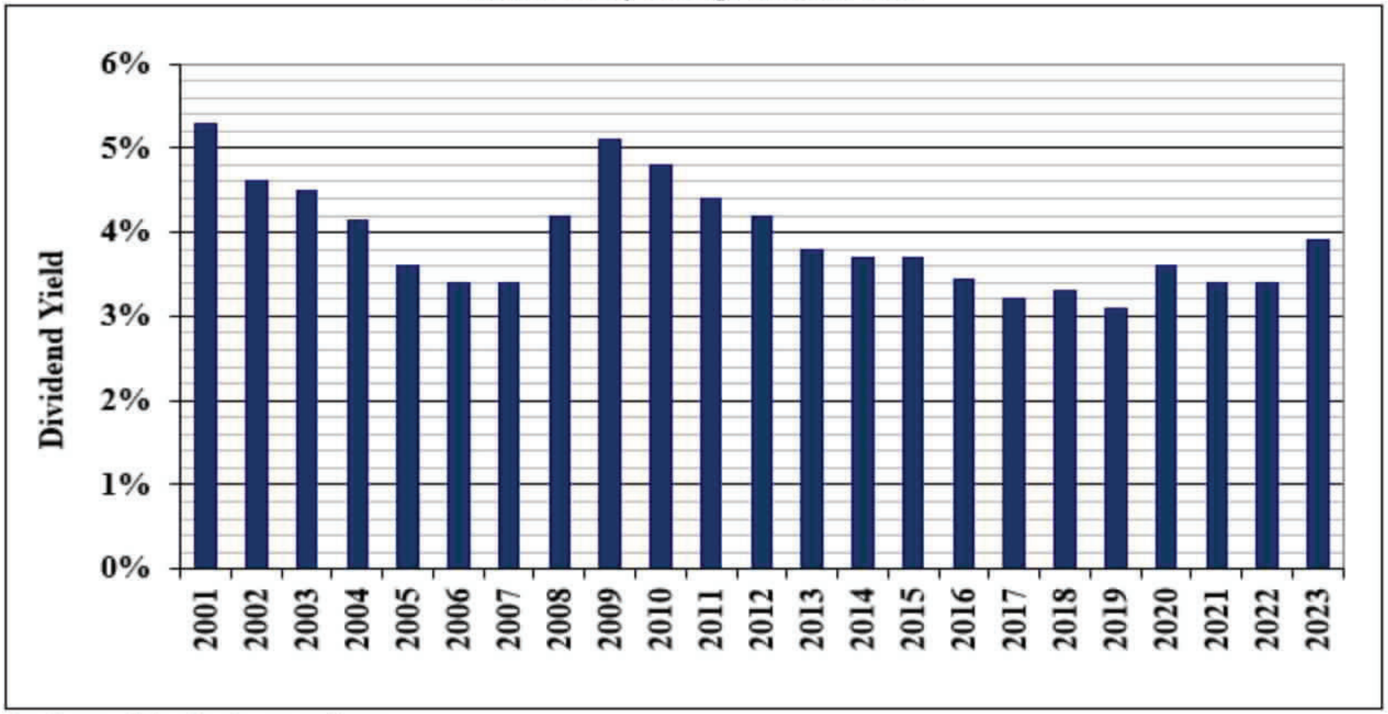
EXHIBIT JRW-2: Public Utility Capital Cost Indicators

Exhibit JRW-2
Long-Term 'Baa' Rated Public Utility Bonds

Data Source: Mergent Bond Record

Exhibit JRW-2

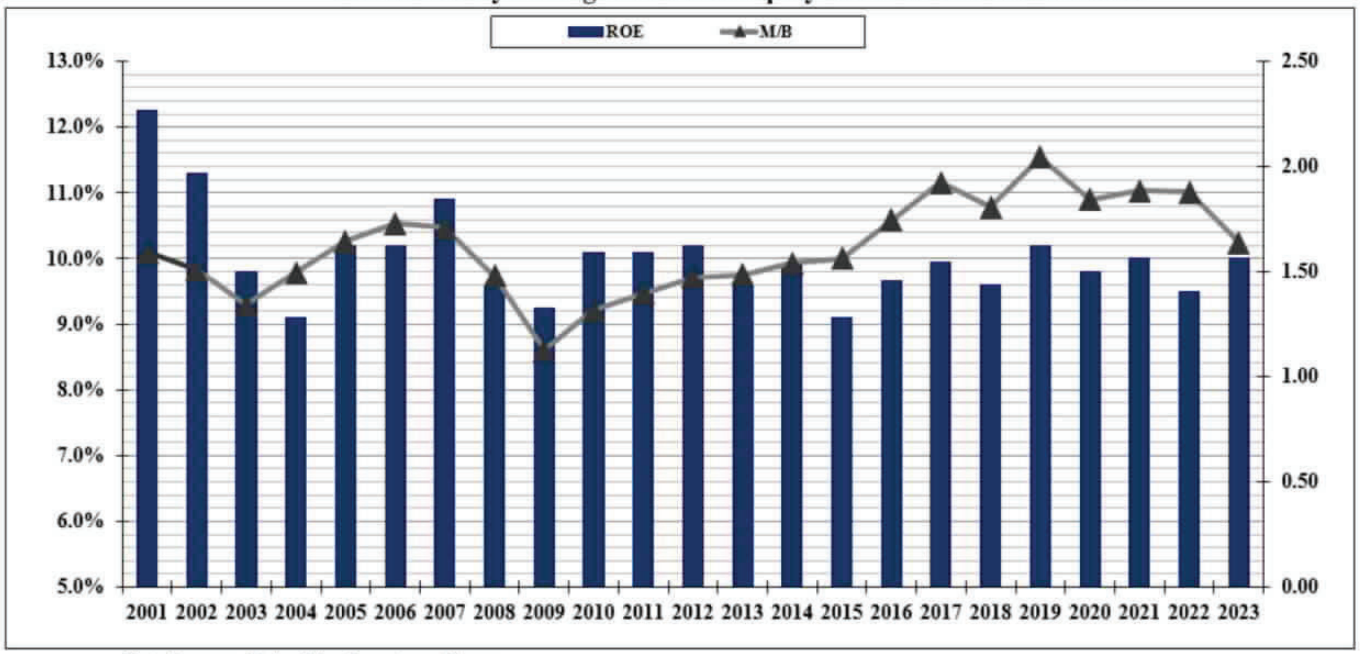
Electric Utility Average Dividend Yield



Data Source: *Value Line Investment Survey.*

Exhibit JRW-2

Electric Utility Average Return on Equity and Market-to-Book Ratios



Data Source: *Value Line Investment Survey.*

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Arithmetic versus geometric mean estimators: Setting discount rates for capital budgeting

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Abstract

This paper addresses an issue central to the estimation of discount rates for capital budgeting: should the geometric mean or arithmetic mean of past data be used when estimating the discount rate? The use of the arithmetic mean ignores estimation error and serial correlation in returns. Unbiased discount factors have been derived that correct for both these effects. In all cases, the corrected discount rates are closer to the arithmetic than the geometric mean.

Keywords: *arithmetic mean, geometric mean, discount rates, capital budgeting.*

JEL classification: *G*120; *G*310.

1. Introduction

In estimating the cost of capital using the capital asset pricing model (CAPM), the expected risk premium on the market plays a key role. This estimate is often obtained by the analysis of historical returns on an equity market index. There are two standard statistics used as the basis of this estimate: the arithmetic mean of historical returns or risk premia and the geometric mean. To illustrate the difference between these statistics, for the US during the period 1926–1992 the arithmetic mean real return on the equity market was 9.0%, whereas the geometric mean was 7.0% [SBBI (1993)]. For the UK in the period 1919–1994 the arithmetic real return was 10.3% whereas the geometric mean was 7.7% [BZW (1995)].

Standard references on estimating the expected return on the market differ in their advocacy of the arithmetic or geometric mean as the basis of discount rates for capital budgeting. Among the advocates of the arithmetic mean are Bodie *et al.* (1989), Brealey and Myers (1991a, b), Franks *et al.* (1985), Kolbe *et al.* (1984)

*I am grateful to Dick Brealey, Michael Brennan and Julian Franks for helpful discussions.

and Ross and Westerfield (1988). Advocacy of the geometric mean is found in Copeland *et al.* (1991) and Levy and Sarnat (1986). The large difference between the two statistics means that the choice of one or the other may have a dramatic effect on the valuation of any asset with other than a short life.

A reason for favouring the arithmetic mean is given in Kolbe *et al.* (1984):

> Note that the *arithmetic* mean, *not* the geometric mean, is the relevant value for this purpose. The quantity desired is the rate of return that investors expect over the next year for the random annual rate of return on the market. The arithmetic mean, or simple average, is the unbiased measure of the expected value of repeated observations of a random variable, not the geometric mean. ... the geometric mean underestimates the expected annual rate of return.

The key point of this argument is that unbiasedness is considered to be the relevant criterion. Butler and Schachter (1989) show, however, that care must be taken to decide what unbiasedness criterion one uses. In particular, even though the arithmetic average of annual returns may be an unbiased estimate of the expected return over the next year, it is not an unbiased estimate of the expected return over periods greater than one year or of the discount factor, which is the reciprocal of the expected return.

Apart from capital budgeting, the estimate of the market risk-premium is central to the regulation of privatised utilities. Allowable returns are set using the CAPM in various countries and the choice of the market risk-premium has a significant effect. For instance, the ultimate arbiter of regulated utilities in the UK, the Monopolies and Mergers Commission, is confused about the choice of arithmetic or geometric averages [MMC (1995)]:

> Under the CAPM approach to assessing the cost of capital, the WACC depends on ... the premium required by equity holders to compensate for risk. ... Estimates of these factors cannot be precise, depending as they do on the period over which returns are calculated, whether average or geometric returns are calculated.

Thus major regulatory decisions are taken in the UK on the basis that arithmetic and geometric means of past returns have similar merit in setting expected future returns.

The purpose of this paper is to derive unbiased estimates of discount factors for use in capital budgeting. The paper is organised as follows. Section 2 shows the conditions for the arithmetic mean of past returns or risk premia to be the correct estimator for use in discounting. Section 3 explains the problems with this argument. Section 4 derives unbiased estimators for discount factors when returns are not serially correlated. Numerical examples are given in Section 5. In Section 6 the implications of the 'excess volatility' literature are discussed, and Section 7 presents the conclusions of the paper.

2. Basic theory

In capital budgeting expected future cash flows are discounted. These expected cash flows are the arithmetic means of possible cash flow outcomes. The capital asset pricing model is also formally stated in terms of arithmetic expected returns over an unspecified investment horizon. A typical use of the CAPM assumes that the expected return over one year is estimated. If the cash flow to be received occurs after N years, then this expected return is compounded over N years to give the reciprocal of the discount factor.

Thus, if the cash flow to be received after N years is X, then the present value is typically estimated as:

$$V = E(X)m^{-N} \tag{1}$$

where $E(.)$ is the expectations operator and m is an estimate of the one year expected return appropriate to the risk of the investment.

The theory that motivates this is the following. Suppose that the return over the next year will be R_{T+1}, with a known arithmetic expectation of $E(R_{T+1}) = M$. Suppose now that we need the expected value of the future N-year return: $E(R_{T+1}R_{T+2} \ldots R_{T+N})$. If each return is independent with the same mean, this is equal to M^N. The expected return on the investment project is $(E(X)/V)$ and the expected return on an equivalent capital market investment is M^N. So the correct value of the project is $V = E(X)M^{-N}$ where M is the true arithmetic mean one-period return. Thus, if M is known the normal discounting formula correctly compounds M to give the n-period arithmetic expected return for use in discounting.

This argument is based on three assumptions:

A. The arithmetic expected return each period is constant.
B. Returns are serially independent.
C. The expected return is known.

The first of these assumptions can be modified to allow for changing interest rates and stated in the form of a constant risk premium. The second is based loosely on market efficiency, and corresponds to the assumption that the market is weak-form efficient with a constant expected return or risk premium. The third is untrue in most applications as the expected return is estimated with error. In general, the true mean (M) of the distribution of R is not known, and an estimate (m) is used based upon a statistic such as the arithmetic or geometric mean of past returns.

3. Problems with estimates of the expected return

To investigate the properties of the arithmetic mean and geometric mean of past returns as estimators of the discount rate, we assume that annual total return wealth relatives on the index over the past T years of $R_1, R_2, \ldots R_T$ have been observed. Then the arithmetic mean return is defined as:

$$A = \sum_i R_i / T \tag{2}$$

and the geometric mean is defined as:

$$G = \left[\prod_i R_{it}\right]^{1/T} \tag{3}$$

For instance, the arithmetic mean real rate of return on US equities in the period 1926–1992 was 9.0%. The geometric mean real rate of return for the same period was 7.0%.[1] A similar difference arises if one uses arithmetic or geometric average estimates of the risk premium.

There are three possible problems with the use of the arithmetic mean or geometric mean as estimates of the true expected return. These correspond to the three assumptions listed in Section 2 above. The first is that the expected return or the expected risk-premium may not be constant. The second problem is that returns in successive periods may not be independent. The third problem is that the true mean of the returns is not known. Instead an estimate based on either the geometric or the arithmetic mean of past returns is used instead of the true mean. The first two of these problems are discussed in Section 6 below. For the rest of this section and Sections 4 and 5 we assume that the expected real return is constant and returns are independent.[2]

Even if returns are serially independent, the arithmetic mean, A, is only an estimate of the true mean return, M. Any estimation error is, therefore compounded when the transform A^{-N} is used as an estimate of M^{-N}. To see this, assume that the cash flow to be discounted has expectation $E(X)$ and a beta of unity. Then the correct present value of the cash flow is $M^{-N}E(X)$. Suppose that we estimate the discount factor M^{-N} with some estimator M_N. For an unbiased estimate of the value we need:

$$E(M_N)=M^{-N} \tag{4}$$

Note that neither of the estimators A^{-N} or G^{-N} has this property. Blume (1974) shows that the arithmetic mean, A, is an unbiased estimate of the true expectation M, and the compounded geometric mean G^T is an unbiased estimate of the compounded wealth relative M^T. Thus A^{-N} and G^{-N}, which are non-linear functions of A and G^T respectively, are biased estimates of M^{-N}.

The direction of the biases in A^{-N} and G^{-N} as estimators of M^{-N} can be seen from the convexity of the functions A^{-N} and $(G^T)^{-N/T}$. Using Jensen's inequality:

$$E(A^{-N})>[E(A)]^{-N}=M^{-N} \qquad N>1 \tag{5}$$

Similarly:

$$E(G^{-N})=E[(G^T)^{-N/T}]>[E(G^T)]^{-N/T}=(M^T)^{-N/T}=M^{-N} \qquad T>N \tag{6}$$

Thus both A^{-N} and G^{-N} are upward biased estimators of the correct discount factor M^{-N}. As a consequence, both the arithmetic mean A and the geometric mean G are downward biased estimators of the discount rate that should be used to discount cash flows with a beta of unity. As the geometric mean is always below the arithmetic mean, it is always the more biased of the two estimates.

[1]Throughout the paper the word 'return' is used to refer to a wealth relative, so that a rate of return of 10% corresponds to a 'return' or wealth relative of 1.1.

[2]Although the assumption of a constant expected real return is not equivalent to the assumption of a constant risk-premium, the statistical arguments are essentially the same in both cases. Inclusion of a time-varying real interest rate would, therefore, add complexity to the argument without affecting the substance of the question of whether arithmetic or geometric averaging of past data (returns of risk-premiums) is the appropriate estimation procedure.

4. Unbiased estimation of discount factors with constant mean returns

This estimation error problem is partially addressed by Blume (1974). He provides a way of using the geometric mean and the arithmetic mean of past returns to form an unbiased estimate of the expected return over any future period. The procedure he proposes is that the expected return over a horizon of N periods should be formed by a weighted average of the compounded geometric and arithmetic means G^N and A^N. He shows that this is an approximately unbiased estimate of M^N, the true expected return over N periods. Note, however, that it will not provide an unbiased estimate of M^{-N}, the discount factor which is a non-linear function of the expected return, M_N.

Blume proposes two alternative nearly unbiased estimators of the N-period expected return, the 'weighted unbiased' and the 'adjusted unbiased'. He prefers the former, which is defined as:

$$M_{NB} = aA^N + (1-a)G^N \tag{7}$$

where $a = (T-N)/(T-1)$ which forms a weighted average of A^N and G^N. When $N=1$, all the weight is on the arithmetic mean. When $N=T$, all the weight is on the geometric mean. As N drops from T to one, more and more weight is given to the arithmetic and less and less weight is given to the geometric mean. Thus, the arithmetic mean is an unbiased estimate of the short-term expected return and the compounded geometric mean an unbiased estimate of the long-term expected return. This is reasonable as one may think of the compounded geometric mean as simply the arithmetic mean over the period of length T.

This procedure leads to an approximately unbiased estimate of the expected return over N periods M^N. In capital budgeting, however, we need an unbiased estimator of the discount factor M^{-N}. The Appendix demonstrates, using analysis similar to Blume, that an approximately unbiased estimator of M^{-N} is given by:

$$\hat{D}_{N1} = bA^{-N} + (1-b)G^{-N} \tag{8}$$

where $b = (N+T)/(T-1)$.

Note that, whereas, the Blume estimator of the expected return given by (7) lies between A^N and G^N, the unbiased estimator of the discount factor lies outside the range of A^{-N} and G^{-N}. Note also that, when $N=T$, the Blume estimator is simply the compound geometric mean G^N, whereas the estimator $\hat{D}_{N1}$ is approximately $(2A^{-N} - G^{-N})$.

The estimation problem is simplified if we are prepared to specify the distribution of rates of return. If we assume that the distribution of returns is lognormal then:

$$\ln R_t \sim N(\mu, s^2) \tag{9}$$

The expected return is given by:

$$E(R_t) = \exp(\mu + s^2/2) = M \tag{10}$$

The 'true' discount factor for N periods is given by:

$$M^{-N} = \exp(-N\mu - Ns^2/2) \tag{11}$$

If the variance is constant we can get an arbitrarily good estimate of s^2 from a finite time series by chopping into arbitrarily fine intervals, so we assume henceforth that s^2 is known.

The logarithm of the geometric mean, G, is distributed:

$$\ln G \sim N(\mu, s^2/T) \tag{12}$$

Thus:

$$\ln (G^{-N}) \sim N(-N\mu, N^2s^2/T) \tag{13}$$

So:

$$E(G^{-N}) = M^{-N} \exp [(T+N)Ns^2/2T] \tag{14}$$

Thus an unbiased estimate of M^{-N} based on the geometric mean is given by:[3]

$$\hat{D}_{N2} = G^{-N} \exp [-(T+N)Ns^2/2T] \tag{15}$$

Alternatively, if the empirical distribution on which A and G are based is lognormal, then:

$$A = G \exp (s^2/2) \tag{16}$$

$$A^{-N} = G^{-N} \exp (-Ns^2/2) \tag{17}$$

So we can form an unbiased estimator based on the arithmetic mean by:

$$\hat{D}_{N3} = A^{-N} \exp [-N^2s^2/2T] \tag{18}$$

We have now derived three unbiased estimators of the discount factor for N periods, M^{-N}. The first $\hat{D}_{N1}$ is a function of both the arithmetic and geometric means and the other two, $\hat{D}_{N2}$ and $\hat{D}_{N3}$ are functions of the geometric and arithmetic means respectively.

The properties of these three estimators are examined in the next section.

5. Numerical examples

Numerical examples of the three estimators are given in Table 1 for values of G, A and s^2 computed for real returns on the returns to the US stock market over the period 1926–1992.[4] The results for the UK would be very similar, as the returns series have similar properties. Indeed, the qualitative results would vertically identical.

Tables 1 and 2 show, for various horizons N, the unbiased discount factors converted to rates of return (Panel A) and annuity rates (Panel B). The three unbiased estimators are very similar and are, in all cases, much closer to the arithmetic mean return of 9.0% than the geometric mean of 7.0%. Indeed, for horizons of up to ten years, the unbiased discount rates are within 0.4% of the arithmetic mean and the annuity factors are within 0.6% of the arithmetic mean for all periods up to 30 years. Thus, although the arithmetic mean is biased, the bias is small for most practical applications and correcting this bias moves the estimator further away from the geometric mean.

---

[3]This cause of bias was first pointed out by Butler and Schachter (1989). They propose a correction to the estimate of the discount rate based upon a Taylor series expansion.

[4]The source of the returns is the SBBI (1993) Yearbook.

6. Serially correlated returns

An assumption of the above analysis is the serial independence of returns. A series of recent papers finds, however, that returns in equity markets are not serially independent. This is interpreted by some as meaning that markets are not efficient, and by others as meaning that the risk premium varies over time. The evidence on this point is not conclusive.[5]

If this evidence is interpreted as demonstrating time variation in risk-premiums it raises very complex questions about cost of capital estimation, which

Table 1

Approximately unbiased estimates of real discount rates for a unit beta investment assuming constant mean real returns.

N is the horizon in years. $\hat{D}_{N1}$ is an estimate of the discount factor based on a weighted average of G^{-N} and A^{-N} given by equation (8) in the text. G is the annual geometric mean real return over the period 1926–1992 and is equal to 1.0698. A is the annual arithmetic mean real return over the same period and is equal to 1.0904. $\hat{d}_{N1}$ is the annual discount rate equivalent to $\hat{D}_{N1}$. $\hat{D}_{N2}$ is an estimate of the discount factor based on a lognormal distribution given by equation (15) in the text. $\hat{d}_{N2}$ is the annual discount rate equivalent to $\hat{D}_{N2}$. $\hat{D}_{N3}$ is similarly given by (18) and $\hat{d}_{N3}$ is the corresponding discount rate. The estimated standard deviation of the annual log real return is 0.1991, based on annual data

Panel A Discount rates.

N	$\hat{d}_{N1}$ (%)	$\hat{d}_{N2}$ (%)	$\hat{d}_{N3}$ (%)
1	9.1	9.2	9.1
2	9.1	9.2	9.1
3	9.2	9.2	9.1
4	9.2	9.2	9.2
5	9.2	9.3	9.2
10	9.4	9.4	9.3
15	9.6	9.6	9.5
20	9.9	9.7	9.7
25	10.2	9.9	9.8
30	10.6	10.0	10.0

Panel B Real annuity rates equivalent to the discount rates in Panel A ($\hat{a}_{Ni}$ is the annuity rate corresponding to the unbiased annuity factor given by $\hat{D}_{Ni}$.

N	$\hat{a}_{N1}$ (%)	$\hat{a}_{N2}$ (%)	$\hat{a}_{N3}$ (%)
5	9.2	9.2	9.2
10	9.3	9.3	9.2
15	9.4	9.4	9.3
20	9.5	9.5	9.4
25	9.6	9.5	9.4
30	9.7	9.6	9.5

[5]A comprehensive discussion can be found in Kleidon (1986).

Table 2

Approximately unbiased estimates of discount rates for the index assuming returns are independent over different intervals.

The variance ratios are from Poterba and Summers (1988) Table 4. $\hat{D}_{N4}$ is the estimator of the N period discount factor given by (19), and $\hat{d}_{N4}$ is the corresponding discount rate. The figures along the top are the differencing intervals applied to the data to compute the variance ratios.

Interval (years)	1	2	3	4	5	6	7	8
Variance ratio	1.000	0.814	0.653	0.656	0.696	0.804	0.803	0.800
$\hat{d}_{1,4}$ (%)	9.2	8.8	8.4	8.4	8.5	8.7	8.7	8.7
$\hat{d}_{10,4}$ (%)	9.5	9.0	8.6	8.6	8.7	9.0	9.0	9.0
$\hat{d}_{30,4}$ (%)	10.1	9.5	9.0	9.0	9.2	9.5	9.5	9.5

have not been addressed in the literature. Required rates of return at any date would have to be estimated conditional on the set of variables that predict the risk-premium using the appropriate model. Similar issues to those addressed in this paper would then arise in terms of using the estimated parameters of the model to form estimates of the discount factors.

If, on the other hand, serial correlation is caused by transient disequilibrium we can see the likely size of the effect on discount rates if we maintain the assumption that returns are lognormally distributed, but allow for the fact that the variance of the distribution of returns changes as the horizon alters. Suppose that we use n-period differencing intervals for the data and maintain the assumption that n-period returns are independent and lognormal. Denoting the n-period return by R_n and the n-period geometric mean by G_n, we assume:

$$\ln R_n \sim N(\mu_n, s_n^2)$$

and derive:

$$\ln G_n \sim N(\mu_n, s_n^2/(T/n))$$

Then we can form an unbiased estimator of the N-period discount rate similar to that given by (15):

$$\hat{D}_{N4} = G_n^{-N/n} \exp\left[-[(T/n)+(N/n)](N/n)s_n^2/(2T/n)\right] \tag{19}$$

Using the fact that $G^{-N} = G_n^{-N/n}$ gives:

$$\hat{D}_{N4} = G^{-N} \exp\left[-(T+N)N(s_n^2/n)/2T\right] \tag{20}$$

Thus the estimator is the same as $\hat{D}_{N2}$ except that the estimated variance of the annual log return is given by (S_N^2/N), which is the annualised n-period variance. If the differencing interval is long enough to make the n-period returns serially independent, then this estimator eliminates transient effects in prices when constructing the discount rate.

In their study of mean reversion in stock prices, Poterba and Summers (1988) give estimates of the variance ratio $[(s_n^2/n)/s^2]$. These are shown in Table 2 for values of n up to eight years. Corresponding estimates of the discount rates for different horizons are also given. These are based on the estimator $\hat{D}_{N4}$ given in equation (20) computed for the relevant differencing interval (shown at the top of the table) and horizon. The estimates are shown as annual percentage discount rates. Thus the final column shows that using data differenced by eight years gives an annualised return variance equal to 80% of that computed usually annually differenced data. The discount rate equivalent to an unbiased discount factor for a one year horizon is then 8.7%, compared with the arithmetic mean of annual returns of 9% and the geometric mean annual returns of 7%.

These estimates are generally much closer to the arithmetic mean of past annual returns rather than the geometric mean. The attenuation of the variance to allow for 'overreaction' in share prices over short horizons does not result in estimates close to the geometric mean return. Indeed, it can be seen from equation (20) above that the condition for the geometric mean to be an unbiased discount rate is that $(s_n^2/n)=0$. Even if equity markets overreact, the limit of (s_n^2/n) as n gets large will not be zero. From the Poterba and Summers results, this limit looks to be about 80% of the one year variance, indicating that the geometric mean is a significantly downward biased estimate of discount rates even when 'market overreaction' is taken into account.

7. Summary and conclusions

This paper has addressed an issue central to the estimation of discount rates for capital budgeting: should the geometric mean or arithmetic mean of past data be used when estimating the discount rate? The use of the arithmetic mean ignores estimation error and serial correlation in returns. Unbiased discount factors have been derived that correct for both these effects. In all cases, the corrected discount rates are closer to the arithmetic than the geometric mean.

It may be that the correct model of returns is more complex than that analysed here. If so, then estimation of discount rates would involve more complicated analysis than looking at the means of past returns. Some progress in this direction has been made by Brennan (1993). It may also be that a more complex criterion than unbiasedness is correct. Past average returns are, however, the most commonly cited statistics in estimating the market risk premium, so an understanding of the relative properties of geometric and arithmetic means as estimators is essential until a more sophisticated procedure is adopted.

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Appendix: An approximately unbiased discount rate with constant mean returns

We derive an approximation to A^{-N} as follows:

$$R_t = M + e_t$$

$$A = M + \sum_{t=1}^{T} e_t/T = M + h$$

$$A^{-N} = (M+h)^{-N}$$

$$E(A^{-N}) = E(M^{-N}(1+h/M)^{-N})$$

Expanding $(1+h/M)^{-N}$ as a Taylor series and keeping only terms of order h^2 or less:

$$E(A^{-N}) \simeq M^{-N}E(1 - Nh/M + (N+1)Nh^2/2M^2)$$

Let var $(e) = \sigma^2$, then:

$$E(h^2) = \sigma^2/T$$

$$E(h) = 0$$

$$E(A^{-N}) \simeq M^{-N}(1+(N+1)K) \qquad \text{(A1)}$$

where:

$$K = N\sigma^2/2TM^2$$

Similarly, an approximation to G^{-N} is given by:

$$G = \left[\prod_{t=1}^{T}(M+e_t)\right]^{1/T}$$

$$G^{-N} = \prod_{t=1}^{T}(M+e_t)^{-N/T}$$

$$E(G^{-N}) = M^{-N}E\left[\prod_{t=1}^{T}(1+e_t/M)^{-N/T}\right]$$

Expanding $(1+e_t/M)^{-N/T}$ as a Taylor series and keeping only terms of e^2 or less:

$$E(G^{-N}) \simeq M^{-N}E\left[\prod_{t=1}^{T}(1-Ne_t/TM+((N/T+1)Ne_t^2/2TM^2)\right]$$

Using the independence of e_t, and e_τ:

$$=M^{-N}E\left[1-N\sum_{t=1}^{T}e_t/TM+(N/T+1)N\sum_{t=1}^{T}e_t^2/2TM^2\right]$$

Using:

$$E(e_t^2)=\sigma^2 \quad \text{and} \quad E(e_t)=0$$

$$E(G^{-N}) \simeq M^{-N}(1+(N/T+1)+NT\sigma^2/2TM^2)=M^{-N}(1+(T+N)K) \qquad \text{(A2)}$$

Using (A1) and (A2) gives:

$$E(bA^{-N}+(1-b)G^{-N})=M^{-N}$$

where:

$$b=(N+T)/(T-1)$$

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Estimating the ERP is one of the most important decisions you must make in developing a discount rate. For example, the effect of a decision that the appropriate ERP is 4% instead of 8% in the Capital Asset Pricing Model (CAPM) will generally have a greater impact on the concluded discount rate than alternative theories of the proper measure of other components, for example, beta. One academic study looked at sources of error in estimating expected rates of return over time and concluded:

> We find that the great majority of the error in estimating the cost of capital is found in the risk premium estimate, and relatively small errors are due to the risk measure, or beta. This suggests that analysts should improve estimation procedures for market risk premiums, which are commonly based on historical averages.[1]

In ranking what matters and what does not matter in estimating the cost of equity capital, another author categorizes the choice of the ERP as a "high impact decision," likely to make a difference of more than two percentage points and could make a difference of more than four points.[2]

Three driving forces behind the discussions that have evolved on ERP include:

1. What returns can be expected from investments by retirement plans in publicly traded common stocks by retirement plans?
2. What expected returns are being priced in the observed values of publicly traded common stocks?
3. What is the appropriate cost of capital to use in discounting future cash flows of a company or a project to their present value equivalent?

Because of the importance of the ERP estimate and the fact that we find many practitioners confused about estimating ERP, we report on recent studies and report on ERP estimates at the beginning of 2007. We conclude with our recommended ERP.

DEFINING THE EQUITY RISK PREMIUM

The ERP (or notational RP_m) is defined as:

$$RP_m = R_m - R_f$$

where:

RP_m = the equity risk premium
R_m = the expected return on a fully diversified portfolio of equity securities
R_f = the rate of return expected on a risk-free security

What is referred to as the ERP means, in practice, a general equity risk premium using as a proxy for the "market" either the Standard & Poor's (S&P) 500 or the New York Stock Exchange (NYSE) composite stock index. ERP is a forward-looking concept. It is an expectation as of the valuation date for which no market quotes are observable.

In this chapter, we are addressing returns of publicly traded stocks. Those returns establish a beginning benchmark for closely held investments.

[1] Wayne Ferson and Dennis Locke, "Estimating the Cost of Capital through Time: An Analysis of the Sources of Error," *Management Science* (April 1998): 485–500.
[2] Seth Armitage, *The Cost of Capital: Intermediate Theory* (Cambridge: Cambridge University Press, 2005), 319–320.

ESTIMATING THE ERP

While you can observe premiums realized over time by referring to historical data (i.e., realized return approach or *ex post* approach), such realized premiums do not represent the ERP expected in prior periods, nor do they represent the current ERP. Rather, realized premiums may, at best, represent only a sample from prior periods of what may have been the *expected* ERP.

To the extent that realized premiums on the average equate to expected premiums in prior periods, such samples *may be* representative of current expectations. But to the extent that events that are not expected to reoccur caused realized returns to differ from prior expectations, such samples should be adjusted to remove the effects of these nonrecurring events. Such adjustments are needed to improve the predictive power of the sample.

Alternatively, you can directly derive implied forward-looking estimates for the ERP from data on the underlying expectations of growth in corporate earnings and dividends or from projections of specific analysts as to dividends and future stock prices (*ex ante* approach).[3]

The goal of either approach is to estimate the true *expected* ERP as of the valuation date. Even then the expected ERP can be thought of in terms of a *normal* or *unconditional* ERP and a *conditional* ERP based on current prospects.[4] We address issues involving the conditional ERP later.

There is no one universally accepted standard for estimating ERP. A wide variety of premiums are used in practice and recommended by academics and financial advisors.

NOMINAL OR REAL?

Both the expected return on a fully diversified portfolio of equity securities and the rate of return expected on a risk-free security can be stated in nominal (including expected inflation) or real terms (expected inflation removed). ERP should not be affected by inflation. If both returns are expressed in nominal terms, the difference in essence removes the expected inflation; if both returns are expressed in real terms, inflation has been removed, but the difference remains the same. But *ex post* realized returns will be affected by differences between expected inflation and realized inflation.

WHICH RISK-FREE RATE TO USE IN ESTIMATING THE ERP

Any estimate of ERP must be made in relation to a risk-free security. That is, the expected return on a fully diversified portfolio of equity securities must be measured in its relationship to the rate of return expected on a risk-free security. The selection of an appropriate risk-free security with which to base the ERP estimate is a function of the expected holding period for the investment to which the discount rate (rate of return) is to apply. For example, if you were estimating the equity return on a highly liquid investment and the expected holding period were potentially short-term, a U.S. government short-term bond (e.g., Treasury or T-bill) may be an appropriate instrument to use in benchmarking the ERP estimate.

Alternatively, if you were estimating the equity return on a long-term investment, such as the valuation of a business where the value can be equated to the present value of a series of future cash flows over many years, then the yield on a long-term U.S. government bond may be the more appropriate instrument in benchmarking the ERP estimate.

[3] See, for example, Eugene F. Fama and Kenneth R. French, "The Equity Premium." *Journal of Finance* (April 2002): 637–659.
[4] Robert Arnott, "Historical Results," *Equity Risk Premium Forum, AIMR* (November 8, 2001): 27.

Common academic practice in empirical studies of rates of return realized on portfolios of stocks in excess of a risk-free rate is to benchmark stock returns against realized monthly returns of "risk-free" 90-day T-bills or one-year government bonds. A T-bill rate is the purest risk-free base rate because it contains essentially no maturity risk. If inflation is high, it does reflect the inflation component, but it contains little compensation for inflation uncertainty. Problems in using such a risk-free security as a benchmark are that (1) T-bill rates may not reflect market-determined investor return requirements on long-term investments due to central bank actions affecting the short-term interest rates, and (2) rates on short-term securities tend to be more volatile than yields on longer maturities.

Long-term government bonds are free of default risk but are not "risk-free." Long-term government bonds are sensitive to future interest fluctuations. Investors are not sure of the purchasing power of the dollars they will receive upon maturity or the reinvestment rate that will be available to them to reinvest the interest payments received over the life of the bond. As a result, the long-term empirical evidence is that returns on long-term government bonds on the average exceed the returns on T-bills.[5]

The long-term premium of government bond returns in excess of the average expected interest rates on T-bills (average of future forward rates) is commonly referred to as the *horizon premium*. The horizon premium compensates the investor for the maturity risk of the bond. The horizon premium equals the added return expected *on the average* on long-term bonds due to inflation and interest rate risk. As interest rates change unexpectedly in the future, the bond price will vary. That is, bonds are subject to market risk due to unexpected changes in interest rates. The horizon premium compensates investors for that market risk.

MATCHING RISK-FREE RATE WITH ERP

In theory, when determining the risk-free rate and the matching ERP you should be matching the risk-free security and the ERP with the period in which the investment cash flows are expected. For example (where b is a risk measure for the investment):

Short-term cash flows: Current T-bill rate $+ b \times$ (RPm over T-bills)

Cash flows expected in:

Year 1: 1-year government bond rate $+ b \times$ (RPm over1-year bonds)

Year 2: 2-year forward rate on government bonds $+ b \times$ (RPm over 2-year bonds)

Year 3: 3-year forward rate on government bonds $+ b \times$ (RPm) over3-year bonds), and so on

Cash flows expected in the long-term: Current long-term government bond rate $+ b \times$ (RPm over long-term government bonds)

MEASURING THE AVERAGE PERIOD OF THE EXPECTED CASH FLOWS

Can one measure the "average" period of expected cash flows and use an average maturity period for the risk-free security and the ERP? One measure of the length of planning horizon over which cash flows are expected is the *duration* of cash flows. We introduced the concept of duration in Chapter 6 as a measure of the effective time period over which you receive cash flows from bonds.

In a similar manner, you can calculate the expected duration of any stream of expected cash flows for any project. For valuation of a "going-concern" business, for example, assume you expect the cash flow in the first year following the valuation date of \$1 million to increase at an average

[5] When short-term interest rates exceed long-term rates, the yield curve is "inverted."

compound rate of 4% per annum. Assume a discount rate of 15%. If you project cash flows each year for 100 years, the calculated duration of the cash flows is approximately 10.5 years.[6]

In practice, few discount each cash flow using a matched maturity risk-free rate and ERP estimate. In valuing going-concern businesses and long-term investments made by businesses, practitioners generally use long-term government bonds as the risk-free security and estimate the ERP in relation to long-term government bonds. This convention both represents a realistic, simplifying assumption and is consistent with the CAPM.[7] If the expected cash flows are risky and follow a random walk, but the risk-free rate and the ERP are expected to be constant over time, then the risk-adjusted discount rate for discounting the risky cash flows is constant as well. Most business investments have long durations and suffer from a reinvestment risk comparable to that of long-term government bonds. As such, the use of long-term government bonds and an ERP estimated relative to long-term bonds more closely matches the investment horizon and risks confronting business managers in capital budgeting decisions and valuators in valuation problems than reference to T-bills.

Therefore, in the remainder of this chapter we have translated all estimates of ERP to estimates relative to long-term government bonds.

REALIZED RISK PREMIUM (*ex POST*) APPROACH

While academics and practitioners agree that ERP is a forward-looking concept, many practitioners use historical data only to estimate the ERP under the assumption that historical data are a valid proxy for current investor expectations. In the realized risk premium approach, the estimate of the ERP is the risk premium (realized return on stocks in excess of the risk-less rate) that investors have, on the average, realized over some historical holding period (realized risk premium).

The underlying theory is that the past provides a reasonable indicator of how the market will behave in the future and investors' expectations are influenced by the historical performance of the market. If period returns on stocks (e.g., monthly stock returns) are not correlated (e.g., this month's stock returns are not predictable based on last month's returns) and if expected stock returns are stable through time, then the arithmetic average of historical stock returns provides an unbiased estimate of expected future stock returns. Similarly, the arithmetic average of realized risk premiums provides an unbiased estimate of expected future risk premiums (the ERP).

A more indirect justification for use of the realized risk premium approach is the contention that, for whatever reason, securities in the past have been priced in such a way as to earn the returns observed. By using an estimated cost of equity capital incorporating the average of realized risk premiums in applying the income approach to valuation, you may to some extent replicate this level of pricing.

MEASURING REALIZED RISK PREMIUMS

The measure of the risk-free rate is not controversial once the proper duration (long term versus short term) of the investment has been estimated since the expected yield to maturity on appropriate

[6] $$\frac{[(1{,}000{,}000 \times 1)/(1.15) + (1{,}000{,}000 \times 1.04 \times 2)/(1.15)^2 + (1{,}000{,}000 \times 1.04^2 \times 3)/(1.15)^3 \ldots]}{[(1{,}000{,}000 \times 1)/(1.15) + (1{,}000{,}000 \times 1.04)/(1.15)^2 + (1{,}000{,}000 \times 1.04^2)/(1.15)^3 \ldots]} = 10.5(\textit{rounded})$$

[7] Carmelo Giaccotto, "Discounting Mean Reverting Cash Flows with the Capital Asset Pricing Model," *The Financial Review* (May 2007): 247–265. This is true for both the textbook CAPM of Sharpe and Linter and the extension of the textbook CAPM, the intertemporal CAPM of Merton.

government securities is directly observable in the marketplace. Differences in approach to estimating the ERP then hinge on the measure of expected return on equity securities.

In applying the realized risk premium approach, the analyst selects the number of years of historical return data to include in the average. One school of thought holds that the future is best estimated using a very long horizon of past returns. Another school of thought holds that the future is best measured by the (relatively) recent past. These differences in opinion result in disagreement as to the number of years to include in the average.

HISTORICAL STOCK AND BOND RETURNS

The highest-quality data are available for periods beginning in 1926 (the year that the forerunner of the current S&P 500 was first published) from the Center of Research in Security Prices (CRSP) at the University of Chicago. The *SBBI Yearbook* contains summaries of returns on United States stocks and bonds derived from that data.[8] The reported returns include the effects from the reinvestment of dividends.

Returns on common stocks have been assembled by various sources and with various qualities for earlier periods. Good stock market data are available back to 1872, and less reliable data are available from various sources back to the end of the eighteenth century. (In the earliest period, the market consisted almost entirely of bank stocks, and by the mid-nineteenth century, the market was dominated by railroad stocks.[9]) Data for government bond yield data have also been assembled for these periods. Exhibit 9.1 presents the realized average annual risk premium for stocks assembled from various sources for alternative periods through 2006.

We measure the realized risk premium by comparing the stock market returns realized during the period to the income return on long-term government bonds (or yield to maturity for the years before 1926).

While some may question looking at averages including early periods for estimating today's ERP, what is striking is that the largest arithmetic average of one-year returns is the 81 years from 1926 to 2006.

Why use the income return on long term government bonds? The income return in each period represented the expected yield on the bonds at the time of the investment. An investor makes a decision to invest in the stock market today by comparing the expected return from that investment to the rate of return today on a benchmark security (in this case the long-term government bond). While the investor did not know the stock market return when one invested at the beginning of each year, he or she did know the rate of interest promised on long-term government bonds. To try to match the expectations at the beginning of each year, we measure historical stock market returns on an expectation that history will repeat itself over the expected return on bonds in each year.

8 *Stocks, Bonds, Bills and Inflation (SBBI) Valuation Edition 2007 Yearbook* (Chicago: Morningstar, 2007).

9 See Lawrence Fisher and James Lorie, "Rates of Return on Investments in Common Stocks," *Journal of Business* 37, no. 1 (1964); J. W. Wilson and C. P. Jones, "A Comparison of Annual Stock Market Returns: 1871–1925 with 1926–1985," *Journal of Business* 60, no. 2 (1987): 239–258; G. W. Schwert, "Indexes of Common Stock Returns from 1802 to 1987," *Journal of Business* 63, no. 3 (1990): 399–425; Roger G. Ibbotson and Gary P. Brinson, *Global Investing: The Professional's Guide to the World Capital Markets* (New York: McGraw-Hill, 1993); J. W. Wilson and C. P. Jones, "An Analysis of the S&P 500 Index and Cowles's Extensions: Price Indexes and Stock Returns, 1870–1999," *Journal of Business* 75, no. 3 (2002): 505–533; S. H. Wright, "Measures of Stock Market Value and Returns for the US Nonfinancial Corporate Sector, 1900–2000," Working paper, February 1, 2002; W. Goetzmann, R. Ibbotson, and L. Peng, "A New Historical Database for NYSE 1915 to 1925: Performance and Predictability," *Journal of Financial Markets* 4 (2001): 1–32; E. Dimson, P. Marsh, and M. Staunton, *Triumph of the Optimists: 101 Years of Global Investment Returns* (Princeton, NJ: Princeton University Press, 2002) with annual updates of their Global Returns database available at http://corporate.morningstar.com/ib; W. Goetzmann and R. Ibbotson, "History and the Equity Risk Premium," *Yale ICF Working Paper No. 05-04*, April 6, 2005.

Exhibit 9.1 Historical Realized Premiums: Stock Market Returns – Treasury Bonds

Period	Arithmetic Average	Standard Error*	Geometric Average
20 years (1987–2006)	6.4%	3.7%	5.2%
30 years (1977–2006)	5.8%	2.8%	4.7%
40 years (1967–2006)	4.8%	2.6%	3.6%
50 years (1957–2006)	5.2%	2.3%	3.9%
81 years (1926–2006)**	7.1%	2.2%	5.2%
107 years (1900–2006)	6.8%	1.9%	4.9%
135 years (1872–2006)	5.9%	1.6%	4.3%
209 years (1798–2006)	5.1%	1.2%	3.6%

*Calculated as standard deviation of realized excess returns divided by square root N, number of years in sample.

***SBBI Valuation Edition* 2007 Yearbook.

Source: Data compiled from R. Ibbotson and G. Brinson, *Global Investing* (New York: McGraw-Hill, 1993); W. Schwert, "Indexes of U.S. Stock Prices from 1802 to 1987," *Journal of Business*, 1990; S. Homer and R. Sylla, *A History of Interest Rates*, 3rd ed. (Piscataway, NJ: Rutgers University Press, 1991); and *SBBI, 2007 Yearbook* (Chicago: Morningstar, 2007).

The realized risk premiums vary year to year, and the estimate of the *true* ERP resulting from this sampling is subject to a degree of error. We display the standard errors of estimate for each period in Exhibit 9.1. The standard error of estimate allows you to measure the likely accuracy of using the realized risk premium as the estimate of ERP. That statistic indicates the estimated range within which the *true* ERP falls (i.e., assuming normality, the true ERP can be expected to fall within two standard errors with a 95% level of confidence).

SUMMARIZING REALIZED RISK PREMIUM DATA

The summarized data in Exhibit 9.1 represent the arithmetic and geometric averages of realized risk premiums for one-year returns. That is, the dollars invested including reinvested dividends are reallocated to available investments annually and the return is calculated for each year. The arithmetic average is the mean of the annual returns. The geometric average is the single compound return that equates the initial investment with the ending investment assuming annual reallocation of investment dollars and reinvestment of dividends.

For example, assume this series of stock prices (assuming no dividends):

Period	Stock price	Period Return
1	$10	
2	$20	100%
3	$10	−50%

The arithmetic average of period returns equals $(100\% + -50\%)/2 = 25\%$ while the geometric average equals $(1 + r_1)(1 + r_2)^{1/2} - 1 = (1 = 1.00 \times 1 - .5)^{1/2} - 1 = 0$.

Realized return premiums measured using the geometric (compound) averages are always less than those using the arithmetic average. The geometric mean is the lower boundary of the arithmetic mean, and the two are equal in the unique situation that every observation is identical to every other observation. Further, the more variable the period returns, the greater the difference between the arithmetic and geometric averages of those returns. This is simply the result of the mathematics of a series that has experienced deviations.

The choice between which average to use is a matter of disagreement among practitioners. The arithmetic average receives the most support in the literature,[10] though other authors recommend a geometric average.[11] The use of the arithmetic average relies on the assumption that (1) market returns are serially independent (not correlated) and (2) the distribution of market returns is stable (not time-varying). Under these assumptions, an arithmetic average gives an unbiased estimate of expected future returns assuming expected conditions in the future are similar to conditions during the observation period. Moreover, the more observations available, the more accurate will be the estimate.

> ...the arithmetic mean equates the expected future value of investment with its present value. This property makes the arithmetic mean the correct return to use as the discount rate or cost of capital.[12]

> ...the geometric mean measures changes in wealth over more than one period on a buy and hold (with dividends reinvested) strategy.... The arithmetic mean would provide a better measure of typical performance over a single historical period.[13]

WHAT PERIODICITY OF PAST MEASUREMENT?

But even if we agree that stock returns are serially independent, the arithmetic average of realized risk premiums based on *one-year* returns may not be the best estimate of future returns. Textbook models of stock returns (e.g., CAPM) are generally single-period models that estimate returns over unspecified investment horizons. For example, assume that the investment horizon equals two years. Then in using realized returns to estimate expected returns, you need to calculate realized returns over two-year periods (i.e., the geometric average over consecutive two-year periods) and then calculate the arithmetic average of the two-year geometric averages to arrive at the unbiased estimate of future returns. For example, assume that the realized one-year returns are:

Year 1 = 10%
Year 2 = 25%
Year 3 = −15%

The geometric averages of the two-year holding periods are:

$$(1.10 \times 1.25)^{1/2} - 1 = 17.3\%$$

$$(1.25 \times 0.85)^{1/2} - 1 = 3.1\%$$

The arithmetic average of *typical* two-year periods is therefore:

$$\frac{(17.3 + 3.1)}{2} = 10.2\%$$

10 See, e.g., Paul Kaplan, "Why the Expected Rate of Return Is an Arithmetic Mean," *Business Valuation Review* (September 1995); *SBBI Valuation Edition 2002 Yearbook*, 71–73; Mark Kritzman, "What Practitioners Need to Know about Future Value," *Financial Analysts Journal* (May/June 1994): 12–15; Zvi Bodie, Alex Kane, and Alan J. Marcus, *Investments* (1989): 720–723.

11 See, for example, Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset*, 2nd ed. (Hoboken, N.J.: John Wiley & Sons, 2002), 161–162.

12 Roger Ibbotson and Rex Sinquefeld, *Stocks, Bonds, Bills and Inflation: Historical Returns (1926–1987)* (1989), 127.

13 Willard T. Carleton and Josef Lakonishok "Risk and Returns on Equity: the Use and Misuse of Historical Estimates," *Financial Analysts Journal* 41, no. 1 (1985): 39.

The issue then becomes what is the appropriate interval over which average realized returns should be measured (1-year periods as in the case of the returns reported in the *SBBI Yearbook*; 2-year periods; 20-year periods)? When you are valuing businesses, should you compare returns over periods greater than one year? The most likely answer is yes. Practitioners have adopted the use of interest rates on long-term government bonds, typically 20-year bonds, as the appropriate long-term benchmark risk-free rate when valuing businesses. It follows then that a longer investment horizon of, say, 20 years is the appropriate period over which you should calculate realized returns. As the investment horizon increases, the arithmetic average of realized investment returns decreases asymptotically to the geometric average of the entire series.

While Morningstar only reports on the arithmetic average of one-year returns, we calculated the realized risk premiums for various investment horizons using the data from 1926 to 2006 as shown in the next table.[14]

Arithmetic Average of	Realized Risk Premium
1-year returns[1]	7.1%
2-year returns[2]	6.1%
3-year returns[3]	5.8%
4-year returns[4]	5.5%
5-year returns[5]	5.3%
81-year returns (geometric average)[1]	5.2%

[1] *SBBI Valuation Edition 2007 Yearbook*.
[2] Excluding investment period beginning 2006.
[3] Excluding investment periods beginning 2005 and 2006.
[4] Excluding investment periods beginning 2004, 2005, and 2006.
[5] Excluding investment periods beginning 2003, 2004, 2005, and 2006.
Source: Compiled from data in *Stocks, Bonds, Bills, and Inflation 2007 Yearbook*. Copyright

Assuming that you have an investment horizon longer than one year, you can conclude that the realized risk premium that provides the "best estimate" of the ERP is likely between the arithmetic average of one-year returns and the geometric average of the entire series.

In one recent study, the authors show that compounding the arithmetic average of historical one-year returns as a forecaster of cumulative future returns results in estimates of cumulative returns that overstate the future cumulative returns that investors are likely to realize. This is due to the fact that distributions of stock market returns are skewed. The authors show that use of the geometric mean of historical one-year returns result in estimates of cumulative returns that more approximate the median of cumulative returns (50% if investors will realize more than the median cumulative return and 50% will realize less than the median return). They demonstrate that the difference between the median of forecasted cumulative returns obtained from compounding the arithmetic average versus the geometric average of one-year historical returns increases as the expected investment horizon increases.[15]

14 The equity risk premium of each investment horizon was calculated by taking equity returns (S&P 500) less the bond returns (U.S. Long-term Government Bond Income Return) for the respective periods. We calculated a series of rolling returns, one for stocks and another for bonds, for each investment horizon. We then took the arithmetic average of each series of rolling returns for the respective investment horizon. For example, the 2-year return, for equities and bonds, is the arithmetic average of a series of 2-year rolling returns from 1926 to 2006. We performed the same calculation for each investment horizon. We then subtract the bond return from the equity return to estimate the equity risk premium for each investment horizon.

15 Eric Hughson, Michael Stutzer, and Chris Yung, "The Misuse of Expected Returns," *Financial Analysts Journal* (November/December 2006): 88–96.

SELECTING A SAMPLE PERIOD

The average realized risk premium is sensitive to the period chosen for the average. While the selection of 1926 as a starting point corresponds to the initial publishing of the forerunner to the current S&P 500, that date is arbitrary. Regarding the historical time period over which equity risk should be calculated, Morningstar offers two observations[16]:

1. Reasons to focus on recent history:
   - The recent past may be most relevant to an investor.
   - Return patterns may change over time.
   - The longer period includes "major events" (e.g., World War II, the Depression) that have not repeated for over 50 years.
2. Reasons to focus on long-term history:
   - Long-term historical returns have shown surprising stability.
   - Short-term observations may lead to illogical forecasts.
   - Focusing on the recent past ignores dramatic historical events and their impact on market returns. We do not know what major events lie ahead.
   - Law of large numbers: More observations lead to a more accurate estimate.

But the average calculated using 1926 return data as a beginning point may be too heavily influenced by the unusually low interest rates during the 1930s to mid-1950s. For example, the average yield on long-term government bonds was only 2.3% during the 1940s (the lowest decade on record) and under 3% in each year from 1934 through 1955. Yields on government bonds exceeded 4% for most of the nineteenth century and have been consistently higher since the 1960s.

The years 1942 through 1951 were a period of artificial stability in U.S. government bond interest rates. In April 1942, the Federal Reserve publicly committed itself to maintaining an interest rate ceiling on government debt, both long term and short term, to support the financing of World War II. After World War II, the Fed continued maintaining an interest rate ceiling fearing return to the high unemployment of the Great Depression. But postwar inflationary pressures caused the Treasury and the Fed to reach an accord announced March 4, 1951, freeing the Fed of its obligation of pegging interest rates. Including this period in calculating realized returns is analogous to valuing airline stocks today by looking at prices of airline stocks before deregulation.

Some observers have suggested that the period, which includes the 1930s, 1940s, and the immediate post–World War II boom years, may have exhibited an unusually high average realized return premium. The 1930s exhibited extreme volatility while the 1940s and early 1950s saw a combination of record low interest rates and rapid economic growth that led the stock market to outperform Treasury bonds by a wide margin.

> The low real rates on bonds may have contributed to higher equity returns in the immediate postwar period. Since firms finance a large part of their capital investment with bonds, the real cost of obtaining such funds increased returns to shareholders. It may not be a coincidence that the highest 30-year average equity return occurred in a period marked by very low real returns on bonds. As real returns on fixed-income assets have risen in the last decade, the equity premium appears to be returning to the 2% to 3% norm that existed before the postwar surge.[17]

[16] *SBBI Valuation Edition 2007 Yearbook* (Chicago: Morningstar, 2007), 129, 134.

[17] Jeremy Siegel, *Stocks for the Long Run* (New York: McGraw-Hill, 1994), 20.

Exhibit 9.2 Realized Equity Risk Premiums over Treasury Bond Income Returns

	1926–1955	1956–2006
Nominal (i.e., without inflation removed)		
Arithmetic Average	10.5%	5.1%
Geometric Average	7.5%	3.9%
Standard Deviations		
Stock Market Annual Returns	25.3%	16.5%
Long-term Treasury Income Returns	0.5%	2.4%
Long-term Treasury Total Returns	4.7%	10.9%
Ratio of Equity to Bond Total Return Volatility	5.4	1.5

Source: Compiled from data in *Stocks, Bonds, Bills and Inflation 2007 Yearbook*. For more information on other Morningstar publications, please visit global.morningstar.com/DataPublications. Calculated (or Derived) based on CRSP® data, ©2006 Center for Research in Security Prices (CRSP®), Graduate School of Business, The University of Chicago.

If we disaggregate the 81 years reported in the *SBBI Yearbook* into two subperiods, the first covering the periods before and after the mid-1950s, we get the comparative figures for stock and bond returns shown in Exhibit 9.2.

The period since the mid-1950s has been characterized by a more stable stock market and a more volatile bond market compared to the earlier period. Interest rates, as reflected in Long-term Government Bond Income Return statistics as summarized in the *SBBI Yearbook*, have become more volatile in the later period. The effect is amplified in the volatility of Long-term Government Bond Total Returns as summarized in the *SBBI Yearbook,* which include the capital gains and losses associated with interest rate fluctuations. From these data, we can conclude that the relative risk of stocks versus bonds has narrowed; based on this reduced relative risk, we would conclude that the ERP is likely lower today. As a result, we question the validity of using the arithmetic average of one-year returns since 1926 as the basis for estimating today's ERP.

Evidence since 1871 clearly supports the premise that the difference between stock yields and bond yields is a function of the long-run difference in volatility between these two securities.[18] And if you examine the volatility in stock returns (as measured by rolling 10-year average standard deviation of real stock returns), you find that the volatility beginning in 1929 dramatically increased and that the volatility since the mid-1950s has returned to prior levels.[19] This also suggests that the arithmetic average realized risk premiums reported for the entire data series since 1926 as reported in the *SBBI Yearbook* likely overstate expected returns.

Using historical data may also tend to overstate expected returns given the increasing opportunities for international diversification. International diversification lowers the volatility of investors' portfolios, which in theory should lower the required return on the average asset in the portfolio. This would lower the expected return on U.S. government securities generally and hence would suggest a lower ERP on a forward-looking basis than indicated by historical data. Several authors have studied the influence of increased globalization, and their results suggest that costs of capital for companies operating in the international markets have decreased.[20]

[18] Clifford S. Asness, "Stocks versus Bonds: Explaining the Equity Risk Premium," *Financial Analysts Journal* (March/April 2000): 96–113.

[19] Laurence Booth, "Estimating the Equity Risk Premium and Equity Costs: New Ways of Looking at Old Data," *Journal of Applied Corporate Finance* (Spring 1999):100–112 and "The Capital Asset Pricing Model + Equity Risk Premiums and the Privately-Held Business," 1998 CICBV/ASA Joint Business Valuation Conference (September 1998): 23.

[20] See, e.g., Kate Phylaktis and Lichuan Xia, "Sources of Firm's Industry and Country Effects in Emerging Markets," *Journal of International Money and Finance* (2005): 459–475; and Gikas Hardouvelis, Dimitrious Malliartopulos, and Richard Priestly, "The Impact of Globalization on the Equity Cost of Capital," Working paper, May 9, 2004.

If the average expected risk premium has changed through time, then averages of realized risk premiums using the longest available data become questionable. A shorter-run horizon may give a better estimate if changes in economic conditions have created a different expected return environment than that of more remote past periods. Why not use the average realized return over the past 20-year period? A drawback of using averages over shorter periods is that they are susceptible to large errors in estimating the *true* ERP due to high volatility of annual stock returns. Also, the average of the realized premiums over the past 20 years may be biased high due to the general downward movement of interest rates since 1981.

While we can only observe historical realized returns in the stock market, we can observe both expected returns (yield to maturity) and realized returns in the bond market. Prior to the mid-1950s, the difference between the yield at issue and the realized returns was small since bond yields and therefore bond prices did not fluctuate very much.

Beginning in the mid-1950s until 1981, bond yields trended upward, causing bond prices to generally decrease. Realized bond returns were generally lower than returns expected when the bonds were issued (as the holder experienced a capital loss if sold before maturity). Beginning in 1981, bond yields trended downward, causing bond prices to generally increase. Realized bond returns were generally higher than returns expected when the bonds were issued (as the holder experienced a capital gain if sold before maturity). If we choose the period during which to measure realized premiums beginning from the late 1950s/early 1960s to today, we will be including a complete interest rate cycle.[21]

Even if we use long-term observations, the volatility of annual stock returns will be high. Assuming that the 81-year average gives an unbiased estimate, still a 95% confidence interval for the unobserved *true* ERP spans a range of approximately 3.0% to 11.5%.[22]

IS BIAS INTRODUCED BY USING THE ARITHMETIC AVERAGE IN ESTIMATING ERP?

The issue of bias is important from two different vantage points when using an ERP estimate derived from the arithmetic average of realized risk premium data:

1. In predicting the compound return you might expect for an investment in stocks, will you get an answer that is biased? (i.e., will measurement error be introduced simply due to the mathematics?)
2. In discounting expected cash flows where you develop a cost of equity capital estimate using that ERP estimate, will you get an answer that is biased?

Even if you accept the arithmetic average of annual realized risk premiums as an unbiased estimate of expected *annual* risk premium (i.e., investment horizon equals one year), it is a somewhat stronger assumption to compound this annual average over multiple periods (i.e., investment horizon equals *n* years); you are assuming that the estimate of the expected single-period return is accurate (in other words, that the estimate has no allowance for error). If you introduce measurement error and compound the estimated annual return over multiple periods, you will get a biased estimate of the true expected future value. This upward bias occurs even if the single-period arithmetic average itself is an unbiased estimate. The fact that you get an expected upward bias in future investment results if you project future returns using an arithmetic average is important if you are estimating the returns

[21] Booth, "Estimating the Equity Risk Premium and Equity Costs."
[22] Calculated as two standard errors around the average; 7.1% A+/– (2 × 2.2%).

REDACTED VERSION

[redacted]

Redacted Version

[redacted]

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Interest Rate Risk and Utility Risk Premia During 1982–93

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INTRODUCTION

The risk premium method of calculating a fair return on equity for a regulated utility is frequently used in regulatory proceedings. That method considers the relationship between a utility's bond yield and its required return on equity, and is especially useful when other methods, such as the capital asset pricing model and the discounted cash flow (DCF) model exhibit less reliability.[1] Although the discounted cash flow method is the favored method for estimating a utility's cost of equity in rate proceedings, the risk premium method provides a useful check on the DCF results. This is even more important in today's financial environment because of the difficulty of measuring investor-expected growth rates in the DCF method.

If bond yields and required returns on equity move up and down in lockstep, it is straightforward to calculate the appropriate cost of equity using the risk premium method. However, if they do not, estimation of the cost of equity is much more difficult. One explanation of this variability in risk premia is differences in 'interest rate risk'. In particular, arguments have been made in rate cases that utility bonds are riskier in the 1980s than they were earlier because of the significant increase in interest rate variability that occurred in the early 1980s (primarily caused by increased inflation rate variability).[2] In particular, when capital costs, and interest rates, increase, utility bondholders, who earlier 'locked-in' at lower interest rates, miss out on those higher interest rates. Bondholders who experience this will then prospectively require an 'interest rate risk' premium, and utility bond interest rates will be correspondingly greater. Furthermore, utility bonds of differing overall risk may exhibit differing sensitivities to that 'interest rate risk'.

In contrast, the argument goes, utility common stock returns have some protection from that risk. If capital costs increase, utilities can request a rate increase to increase the allowed return. Consequently, utility common shareholders can earn the higher capital costs, and do not necessarily require an 'interest rate risk' premium.[3] Thus, over time we would not necessarily expect to see utility bond yields and required equity returns move in one-to-one lockstep. Furthermore, to the extent that there is some substitutability between utility common stocks and utility bonds as interest rate risk associated with bonds increases, investors may increase their preferences for utility stocks. This should tend to decrease required returns on utility common stock.

Berry (1995) performed an analysis of the impact of interest rate (and capital cost) risk on interest rates and dividend yields. Those results indicate that interest rates are positively related to interest rate variability, but dividend yields are not affected by dividend yield variability. However, that study focused on *dividend yields*, which are easy to measure, and did not consider required equity returns which are much more difficult to measure. Furthermore, that study did not focus on risk premia, and the relationship between bond yields and required returns on equity, as does this paper. This paper utilizes required returns, as measured by Commission-allowed returns, in the risk premium analysis.

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Other studies have shown that there is an inverse relationship between interest rates and risk premia in recent years, but not in earlier years. Carleton *et al.* (1983) found that there was no relationship between electric utility risk premia and interest rates during the 1970s. Brigham *et al.* (1985) estimated a positive relationship between risk premia and interest rates for the 1966–79 period and a negative relationship between the variables during the 1980–84 period. They attributed this to increased inflation risk and its effect on interest rates. Similarly, Harris (1986) showed that there was a negative relationship between utility risk premia and interest rates during the 1982–84 period. Harris and Marston (1992) concluded that there was a negative relationship between the S&P 500 risk premia and interest rates for the 1982–91 period. However, none of these studies used Commission-allowed returns in the calculations of risk premia.

This paper considers two factors not previously considered in the literature. First, allowed returns are used as a proxy for required returns on equity, with appropriate consideration for partial adjustment. Second, explicit usage is made of measures of interest rate risk to gauge their impact on risk premia. Regression analyses is employed to estimate the effects of utility bond yields, interest rate variability, and time trends on required returns on equity and risk premia over the period 1982–93. In the second section, we present a simple regression model, which tests for an inverse relationship between required returns on equity and interest rates. This model, while not very sophisticated, has the inherent advantage that it can be easily used to estimate risk premia. In the third section, we consider a more complex model which explicitly considers various measures of interest rate variability, as well as interest rate levels.

REGRESSION RESULTS WITH INTEREST RATES

A common formulation of the risk premium is:

$$K = YD + RP \qquad (1)$$

where K is the required return on common equity, YD is the utility's current cost of long-term debt (yield) and RP is the risk premium. Since YD is directly measurable, and *if* RP can be properly measured, K can then be directly estimated.[4] However, there are two general problems with the implementation of a risk premium methodology:

1. The estimation of RP is often based on historical earned returns, which may or may not be indicative of *required* returns; and
2. The level of RP may not be constant through time. In particular, there may be an inverse relationship between interest rates and risk premia.[5]

To address the first problem we use Commission-allowed returns as a reasonable surrogate for required returns, with a partial adjustment feature, as will be discussed later. Commissions and their staff spend a significant amount of time in rate cases considering the determination of a utility's appropriate return on equity. As discussed earlier, the primary method employed is the DCF method, which, when performed properly, estimates the required return on equity.[6] Furthermore, Commission-allowed returns may represent better estimates of equity costs, than DCF methods using analysts' forecasts, since Commissions comprehend a wide variety of cost of capital methods.

For illustration we have arrayed risk premia by year in Table 1. For comparative purposes we also show the estimated risk premia using the long-term US Treasury bond yield. Note that there is a general upward trend in risk premia associated with Moody's utility bond yields, which occurs during a period of generally decreasing interest rates. Furthermore, the estimated risk premia are less than those reported in Harris and Marston (1992). This can be attributed to two factors. First, utilities are generally less risky than the S&P 500 which were used in the Harris and Marston study, with corresponding lower required returns. Second, Commission-allowed returns may incorporate lower DCF growth rates than the analysts' forecasts used by Harris and Marston.

Finally, risk premia for Treasury bonds, shown in Table 1, appear to be fairly stable, albeit with a slight upward drift over the 1982–93 period. Moody's yields fell by much more (777 basis points) over that period, than did Treasury yields (578 points). An explanation for this is provided in Berry (1995). As shown there, although there is a close one-to-one relationship between Moody's utility bond yields and Treasury yields, interest rate risk had a significant impact on Moody's

Table 1. Equity Risk Premia

Year (1)	US Treasury Bond Yields (2) (%)	Allowed Return on Equity (3) (%)	Equity Risk Premia on Treasury Yields [(3)-(2)] (4) (%)	Moody's Utility Bond Yields (5) (%)	Equity Risk Premia on Moody's Yields [(3)-(5)] (6) (%)
1982	12.23	15.46	3.23	15.33	0.13
1983	10.84	15.18	4.34	13.31	1.87
1984	11.99	15.25	3.26	14.03	1.22
1985	10.75	14.38	3.63	12.29	2.09
1986	8.14	13.2	5.06	9.46	3.74
1987	8.64	12.86	4.22	9.98	2.88
1988	8.98	12.82	3.84	10.45	2.37
1989	8.58	12.92	4.34	9.66	3.26
1990	8.74	12.63	3.89	9.76	2.87
1991	8.16	12.41	4.25	9.21	3.20
1992	7.52	11.84	4.32	8.57	3.27
1993	6.45	11.54	5.09	7.56	3.98
Change 1982–93	−5.78	−3.92	+1.86	−7.77	+3.85

Note: 1993 data are partial year.

yields. The decrease in interest rate risk during the 1980s, consequently, caused an incremental decrease in Moody's yields, in excess of that corresponding to the decrease in Treasury yields.[7] As will be discussed later, although the risk premia associated with Treasury bonds appear to be fairly stable during the 1982–93 period, there are specific reasons for that, which will not necessarily be repeated in the future.

In our regression analysis we use allowed returns and the corresponding bond yields for that utility's Moody's bond rating from 6 months earlier than the date of the Commission rate order.[8] This provides a better matching since the evidentiary record on the required return on equity is usually developed some months before the date of the rate order. The data on allowed returns was obtained from various editions of *Public Utilities Fortnightly* (1983–93).[9] The data on Moody's bond yields was obtained from various editions of *Moody's Public Utility Manual* (1982–93). This yielded a total of 1226 rate case observations over the period 1982–93. For each month we averaged the cross-sectional data to obtain 130 usable time series observations.[10]

Consistent with Equation (1), let K_t^* represent the required return on equity at time t such that

$$K_t^* = RP_t + YD_t \tag{2}$$

where RP_t and YD_t are the risk premium and current cost of debt at time t, respectively. To allow for a varying risk premium set

$$RP_t = \alpha + \beta YD_t. \tag{2a}$$

Postulate a regulator adjustment function of the form:

$$K_t - K_{t-1} = \gamma(K_t^* - K_{t-1}), \quad 0 < \gamma < 1 \tag{3}$$

where K_t is the allowed return at time t and γ is the adjustment factor. This equation implies an inertia on the part of regulators such that with a change in the required return on equity from the prior period's allowed return on equity, $K_t^* - K_{t-1}$, the regulator only moves part way to a new allowed return. The greater the value of γ, the greater the degree of regulator adjustment.[11]

Substitution of Equation (2) into Equation (3) yields

$$K_t = \gamma RP_t + \gamma YD_t + (1 - \gamma)K_{t-1} \tag{4}$$

or

$$K_t = \alpha\gamma + (1 + \beta)\gamma YD_t + (1 - \gamma)K_{t-1} \tag{4a}$$

For purposes here, we used the allowed return from 1 month earlier. Regulators are aware of recent allowed returns and will likely partially base their current allowed return awards on those recent historical allowed returns, consistent with Equation (3).[12] We then performed an ordinary least squares regression of the allowed returns on the corresponding bond yields and lagged allowed returns. This resulted in the following regression equation:

$$K_t = 0.03337 + \underset{(6.11)}{0.22301}\,YD + \underset{(8.58)}{0.56788}K_{t-1},$$
$$(\text{Durbin–Watson} = 2.41,\ R^2 = 0.905). \quad (5)$$

The t-statistics are shown in parentheses, and indicate significance for both independent variables at the 1% level. The implied value of γ, the adjustment factor, is $1 - 0.56788 = 0.43212$.

The implied risk premium equation, corresponding to Equation (2a), is

$$RP_t = 0.07722 - 0.48392\,YD_t. \quad (6)$$

Equation (6) indicates the presence of an inverse relationship between risk premia and interest rates. For every 100 basis point drop in interest rates, the risk premium *increases* by approximately 48 basis points and the cost of equity decreases by approximately 52 basis points. Conversely, for every 100 basis point increase in interest rates, the risk premium *decreases* by approximately 48 basis points and the cost of equity increases by approximately 52 basis points.

To the extent interest rate variability is a major factor in the level of capital costs, we would expect to empirically observe this inverse relationship between risk premia and interest rates.[13] That is, as interest rate variability increases, interest rate risk increases, interest rates increase, and risk premia fall since utility equity costs change very little, or decrease, for the reasons mentioned in the introduction. The converse would be true in the case of a decrease in interest rate variability.[14]

An alternative formulation of Equation (1) is

$$K_t^* = RP_t + GOV_t. \quad (7)$$

where GOV_t is the yield on long-term US Treasury bonds and RP_t is the corresponding risk premium. Performing a similar regression analysis with GOV instead of YD produces:

$$K_t = 0.1981 + \underset{(3.74)}{0.16016}GOV_t + \underset{(12.09)}{0.73703}K_{t-1},$$
$$(\text{Durbin–Watson} = 2.56,\ R^2 = 0.889). \quad (8)$$

The R^2 is statistically significant at the 1% level with both independent variables statistically significant.

The implied risk premium equation, corresponding to Equation (2a), is

$$K_t^* = 0.07533 - 0.39096\,GOV_t. \quad (9)$$

This formulation, too, indicates an inverse relationship between risk premia, measured relative to Treasury bonds, and Treasury bond yields. In particular, note that for a given 100 basis point increase in interest rates the risk premium decreases by 39 basis points. The relative change in risk premia is not as great, which is attributable to less interest rate variability and interest rate risk associated with Treasury bonds.[15] Over the 1982–93 period, while Treasury yields fell by 578 basis points, Moody's utility bond yields fell by 777 basis points.

REGRESSION RESULTS WITH BOND YIELD VARIABILITY

A factor that could directly and significantly affect risk premia is investor-perceived variability in utility bond yields. It is likely that historical variability in those bond yields would impact investor perceptions of interest rate risk and increase utility bond yields. Furthermore, to the extent that there is some substitutability between utility common stocks and utility bonds, as interest rate risk associated with bonds increases, investors may increase their preferences for utility stocks. This should tend to decrease required returns on utility common stock.[16] Both of these effects will tend to reduce the risk premium when utility bond interest rate risk increases.

While some of that interest rate variability may be picked up in the data on interest rate levels, those interest rate levels also reflect other factors, such as general tightness (or laxity) in capital market conditions, prevalence of call provisions, and differential tax wedges.[17] Thus, we performed a regression analysis that explicitly included a measure for interest rate variability. An obvious measure is the standard deviation (S.D.) in interest rates in the immediate past. If our hypothesis is correct, an increase in the S.D. should decrease RP.

We considered two different historical timeframes for estimating the S.D.: 3 years and 5 years (*SD3* and *SD5*, respectively). For example, with the 3 year time frame, the S.D. at month n is calculated using the 36 months prior to month n. With the 5-year time frame, the prior 60 months were used. Each of these measures was calculated separately for bond yields for Moody's *Aaa*, *Aa*, *A* and *Baa* utility bonds and then averaged across bond ratings to obtain the average *SD3* and *SD5* for each month.

Table 2. Regression Results With *YD*, Dependent Variable = *K*

Variable				
Constant	0.1077	0.0981	0.0790	0.1001
t	−0.0002** (−7.25)	−0.0002** (−6.16)	−0.0001** (−4.47)	−0.0002** (−6.09)
YD	0.2584** (7.55)	0.2032** (6.12)	0.1947** (5.57)	0.1950** (5.89)
SD3	−0.5087** (−5.31)			
RMSD3		−0.1695** (−3.91)		
SD5			−0.1282 (−1.43)	
RMSD5				−0.1307** (−3.83)
K_{t-1}	0.1302 (1.59)	0.2131* (2.60)	0.3312** (4.18)	0.2099* (2.53)
R^2	0.9332**	0.9270**	0.9194**	0.9267**
Durbin–Watson	2.06	2.08	2.15	2.07
N	130	130	130	130

Note: t-statistics in parentheses. * and** indicate significance at the 5% and 1% levels, respectively.

These are reasonable historical time frames for purposes of estimating forward-looking investor expectations of interest rate risk. Of course, if there has been little change in these S.D.s during the sample period, then none of this matters. However, as discussed in Berry (1995) there has been significant volatility in bond yields. This has led to sharp increases in S.D.s in the early 1980s (almost triple the level in the 1970s), with some decrease in the latter 1980s.

Another way of gauging this variability is to consider the deviation of the immediately preceding month's yield from the relevant prior months' yields. As in the case of S.D.s, 3- and 5-year lags were considered. For example, in the case of 3 years, the formula used to calculate the root mean square deviation (*RMSD*) in month n is

$$RMSD3(n) = \left(\left[\sum_{i=n-36}^{n-1} (YD_{n-1} - YD_i)^2\right]/36\right)^{1/2} \tag{10}$$

where YD_{n-1} is the yield in the immediately preceding month and YD_i, $i = 1, \ldots, n-1$, corresponds to the yields in the prior months. An analogous formula for *RMSD* (*RMSD5*) was used for the case of 5 years. As in the cases for *SD3* and *SD5*, different data series were calculated for the four Moody's bond ratings and then averaged across bond ratings.

The *RMSD* may be an appropriate measure of the risk perceived by an investor since it measures the potential interest rate swings (based on prior months' interest rates) relative to the immediately preceding month's yield. In contrast, the variable S.D. measures interest variability over a prior time frame relative to the mean over that same time frame. That mean does not necessarily equal a current yield, and hence may underestimate investor perceptions with regard to potential interest rate variability. Thus, usage of the *RMSD* assumes that, in month n, investors may look at month $n-1$'s yield relative to prior months' interest rates to gauge the full impact of any potential interest rate swing. Note that, as discussed in Berry (1995) the trends in *RMSD* are similar to those of S.D.To comprehend for the possibility of a time trend in risk premia we included a monthly trend variable, t. This type of variable was discussed in Morin (1994), pp. 291–292) and was statistically significant there.

Our more complete formulation using *SD3* is then:

$$K_t^* = RP_t + YD_t \tag{11}$$

where

$$RP_t = \alpha + \beta t + \delta YD_t + \theta SD3_t. \tag{11a}$$

Assuming a regulator adjustment function as shown in Equation (3) and substituting Equations (11) and (11a) into Equation (3) produces our regression equation:

$$K_t = \alpha\gamma + \beta\gamma t + (\delta + 1)\gamma YD_t + \theta\gamma SD3_t + (1 - \gamma)K_{t-1}. \tag{12}$$

Similar regression equations were used for *SD5*, *RMSD3* and *RMSD5*, where each of those variables were used in place of *SD3*. Our hypotheses are that the coefficient associated with t will be negative (consistent with Morin), the coefficient associated with *YD* will be positive, and that the coefficient associated with *SD3* (*SD5*, *RMSD3*, *RMSD5*) will be negative, as investors shift their relative preference to utility stock as interest rate risk on utility bonds increase.

Table 3. Implied Risk Premium Results, Dependent Variable = *RP*

Variable				
Constant	0.1238	0.1247	0.1181	0.1267
t	−0.0002	−0.0003	−0.0002	−0.0003
YD	−0.7029	−0.7418	−0.7089	−0.7532
SD3	−0.5849			
RMSD3		−0.2154		
SD5			−0.1917	
RMSD5				−0.1654

Table 5. Implied Risk Premium Results, Dependent Variable = *RP*

Variable				
Constant	0.1366	0.1390	0.1208	0.1408
t	−0.0004	−0.0003	−0.0002	−0.0003
GOV	−0.7906	−0.8169	−0.7399	−0.8215
SD3	−0.3357			
RMSD3		−0.1848		
SD5			0.1045	
RMSD5				−0.1655

The dependent variable, K, was then regressed on the three independent variables: time, yield and measures of variability in yields. Those four regression results are shown in Table 2.

Note that the regression slope coefficients are generally significant, although the coefficient for *SD5* was not. There is a statistically significant downward time trend, which is consistent with the result in Morin. The effects of *YD* on K are positive and significant. Three of the four coefficients associated with interest rate risk, *SD3*, *RMSD3* and *RMSD5* are significant and negative as was hypothesized. Finally, note that all of the slope coefficients associated with *YD* are significantly less than one, which supports the hypothesis that as interest rates decrease risk premia increase.

As can be seen in Table 2, the adjustment coefficients are in the range 67–87%, which are higher than the adjustment coefficient of 43% from Equation (5). This can be explained by noting that Equation (5) does not include the other factors shown in Table 2 (in particular, interest rate variability). Consequently, the adjustment coefficient measurement in Equation (5) is clouded by the effects of the other factors. It appears that regulators are not adjusting K to K^* very much (only 43%), simply because K is also reacting to other factors not captured in Equation (5). Table 2 properly captures those additional effects and isolates the larger adjustment coefficient effect.

The implied risk premium results, corresponding to Equation (11a), are shown in Table 3. As can be seen there, the coefficient associated with *YD* is between approximately −0.70 and −0.75. This indicates that each increase in utility bond yields of 100 basis points produces a decrease in the risk premium of 70 to 75 basis points. Increases in interest rates result in decreases in risk premia. Furthermore, the negative slope coefficients associated with interest rate risk, imply smaller risk premia as hypothesized. The trend variable in Table 3 has a negative slope, which is consistent with results reported in Morin (1994).[18]

To some extent the variable *YD* may include both the effects of general tightness or laxity in financial markets and interest rate risk. In order to better focus on the two separate factors, it would be appropriate to replace *YD* with *GOV* in

Table 4. Regression Results With *GOV*, Dependent Variable = *K*

Variable				
Constant	0.0781	0.0818	0.0639	0.0874
t	−0.0002** (−4.85)	−0.0002** (−5.10)	−0.0001** (−3.21)	−0.0002** (−5.44)
GOV	0.1197** (2.99)	0.1078** (2.66)	0.1376** (3.18)	0.1108** (2.80)
SD3	−0.1919 (−1.85)			
RMSD3		−0.1088* (−2.21)		
SD5			0.0553 (0.54)	
RMSD5				−0.1027** (−2.71)
K_{t-1}	0.4283** (5.30)	0.4113** (5.04)	0.4709** (6.01)	0.3794** (4.55)
R^2	0.9092**	0.9102**	0.9069**	0.9119**
Durbin-Watson	2.18	2.17	2.24	2.13
N	130	130	130	130

Note: t-statistics are in parentheses. * and ** indicate significance at the 5% and 1% levels, respectively.

Equations (11) and (11a), since GOV will more directly reflect changes in the supply and demand for loan funds, without the effect of utility bonds' interest rate risk. The corresponding equations with $SD3$ are:

$$K_t^* = RP_t + GOV_t \tag{13}$$

$$RP_t = \alpha + \beta t + \delta GOV_t + \theta SD3, \tag{13a}$$

These Equations focus on the relationship between utility stocks and government bonds. Assuming an adjustment mechanism as shown in Equation (3) a regression equation analogous to Equation (12) can be developed. Those regression results are shown in Table 4 and are similar to those from Table 2. However, note that the slope coefficients associated with GOV are smaller than those associated with YD in Table 2. This is consistent with the results in Berry (1995) wherein it was shown that GOV had a larger effect on utility bond yields than on utility common stock dividend yields. Given an imperfect, although positive, relationship between Treasury bonds and utility bonds, and an imperfect relationship between utility bonds and utility stocks, it naturally follows that there would be an even more imperfect relationship between Treasury bonds and utility stocks. This means that there is more substitutability between utility common stocks and utility bonds than between utility stocks and US Treasury bonds. A further point to note from Table 4 is that the slope coefficients associated with S.D. are statistically insignificant, while those associated with $RMSD$ are significant.

The implied risk premium results, corresponding to Equation (13a) are shown in Table 5. As can be seen there, the coefficient associated with GOV is between approximately -0.74 and -0.82 less than those associated with YD in Table 3. This is consistent with the point raised above concerning relative substitutability between stocks and bonds. An increase in Treasury yields of 100 basis points produces an increase of 18–26 basis points in the cost of equity, and a corresponding decrease in the risk premium of 74–82 basis points. In sharp contrast to the reported results in Table 1, controlling for other factors, risk premia relative to Treasury yields are not necessarily stable, but change as Treasury yields change. Increases in Treasury yields result in decreases in risk premia, and those decreases are greater than those associated with similar increases in utility bond yields. Furthermore, the negative slope coefficients associated with utility bond interest rate risk, imply smaller risk premia as hypothesized. The trend variable in Table 5 has a negative slope, which is consistent with results reported in Morin (1994), as well as in Table 3.

CONCLUSIONS

This paper examined, through regression analysis, the possibility that there is an inverse relationship between risk premia and both interest rates and interest rate risk in the utility industry. We demonstrated that that is the case over the 1982–93 time period. Furthermore, it was shown that there is a statistically significant basis for asserting that risk premia increase as interest rates decrease. Our analysis also indicated that there was a downward time trend in risk premia in that period. All of these phenomena occurred with either utility bond yields or long-term US Treasury bond yields. However, for an equivalent increase in either utility bond yields or Treasury yields, required equity returns increase by a slightly greater amount with regard to utility bond yields.

It was also shown that regulators may exhibit an inertia in their setting of allowed returns, such that they move partially to the new required return, in the event capital conditions warrant a change. The degree of movement is in the range of 50–80% relative to the prior month's allowed return.

There are several policy implications from the above analysis. First, when regulators use the risk premium method for setting the allowed return on equity, they should consider the degree of recent interest rate variability and consequent interest rate risk, in comparing utility common stocks and utility bonds. The appropriate risk premium will be narrower the greater the interest rate risk. As demonstrated here, the better measure of interest rate risk is $RMSD$, not S.D. Second, objective regulators who attempt to utilize the risk premium method should implicitly compensate for the indicated regulator inertia. For example, calculate the risk premium using K^*, rather than K. Third, while Table 1 implies that risk premia relative to Treasury bonds are more stable, that is not the case when consideration is made for other factors, as shown in Tables 4 and 5. There is not necessarily any gain in precision in using a risk premium method based on Treasury bonds.

Fourth, if the US enters a period of relative stability in interest rates, we are likely to see utility risk premia increase, a phenomenon utility executives nor regulators have any degree of control over. This widening will not occur because of increases in required equity returns, but because of relatively lower interest rates and less interest rate risk.

NOTES

1. See Bonbright *et al.*, 1988 (pp. 317–28) for a discussion of these methods.
2. Gordon and Halpern (1976) show that an increase in variable and uncertain inflation will theoretically decrease the spread between bond and share yields. This acts through the Fisher effect and the resultant increase in interest rate uncertainty. Examples of rate cases where this argument has been made are Arkansas Public Service Commission (1987), Docket No. 87-070-U, Federal Energy Regulatory Commission (1986), Docket Nos. EL86-58-000 and EL86-59-000, Hawaii Public Utility Commission, Docket No. 4156, Kentucky Public Service Commission, Case No. 8045, and Pennsylvania Public Utility Commission, Docket R-811510.
3. These points are noted in Brigham *et al.* (1985) and Taylor and Peake (1982).
4. See Ibbotson Associates (1993), Carleton *et al.* (1983), Brigham *et al.* (1985) and Harris (1986) for a discussion of risk premia.
5. See Brennan (1982), Brigham *et al.* (1985) and Harris (1986). Other sources are Harris and Marston (1992), Gordon and Halpern (1976) and Federal Energy Regulatory Commission Staff (1992).
6. This approach was also taken in the Federal Energy Regulatory Commission (1992) Staff study.
7. During the same period, any interest rate risk associated with Treasury bonds was not as large, nor did it exhibit as large a decrease.
8. Given the rate case process (testimony, hearing, order writing) a 6 month lag is reasonable. However, if the 6 month period is either too long or short, the analysis here would only result in a mis-estimate of the intercept term, not the slope coefficients. For example, in a period of increasing interest rates(non-accelerating), if the appropriate lag should have been only 3 months, the 6 month lag will result in an over-estimate of the intercept term, but no mis-estimate of the slope terms. With a non-decelerating decrease in interest rates, the intercept term will be under-estimated, with no mis-estimated slope terms. The focus of this paper is on the slope terms. Furthermore, regression analyses was also performed using (a) bond yields contemporaneous with the date of the allowed return and (b) bond yields from 12 months earlier. In both those cases, the Durbin–Watson statistics were worse and the corresponding R^2 were less than with the 6 month lag. Additionally, the slope coefficients for the *YD* and *GOV* variables were not as large, nor as significant as in the 6 month lag case. Consequently, the 6 month lag scenario was utilized here.
9. For the electric and gas rate cases the data was from *Public Utilities Fortnightly's* 'Annual Surveys', while the telecommunications data was from *Public Utilities Fortnightly's* 'Selected Utility Rate Filings'.
10. The data was aggregated into monthly data for three reasons. First, Durbin–Watson statistics can then be sensibly calculated. Second, this approach is consistent with prior studies. Third, this aggregation facilitates the partial adjustment feature. There were months when there were no reported allowed returns, which decreased our total sample size.
11. See Johnston, 1972 (pp. 300–301), for discussion of this technique.
12. This approach implicitly assumes that regulators focus on allowed returns in other jurisdictions in the prior month. This is reasonable for two reasons. First, there is a certain amount of 'peer pressure' amongst regulators wherein they generally do not want their own jurisdiction's allowed returns to be out of line with other jurisdictions, unless justified by general financial and economic circumstances (such as changes in interest rates). Second, the last allowed rate of return for a particular utility may be anywhere from 6 months to 3 years earlier. Modelling those differing periods adds unnecessary complexity to the analysis, in light of the first point raised.
13. See Berry (1995) for an empirical investigation of the impact of interest rate variability on the level of interest rates.
14. Other explanations for an inverse relationship between interest rates and risk premia have to do with call provisions and tax rates. In a high interest rate environment firms will include more call provisions in new bond issues, for which bond investors require even higher interest rate compensation. Additionally, with increasing interest rates, the tax wedge applied to interest on bonds grows relative to that on common stock due to the favorable tax treatment on the capital gains component of stock returns.
15. It could also be attributable to increased utility credit risk during that period.
16. This effect can be readily observed in the DCF method where K is calculated as $D/P+g$. D is the expected dividend, P is the stock's market price, and g is the investor-expected long-term growth rate in dividends. As P increases because of investors' relative preference for utility stocks, K will decrease.
17. As shown in Berry (1995), the impact of the tightness of capital markets has differential effects on interest rates and common stock dividend yields.
18. This negative slope coefficient associated with the time variable also provides an explanation as to why the positive interest rate slope coefficients are

smaller in Table 3 than that reflected in Equation (2). Throughout the 1982–93 period, interest rates were generally decreasing, which according to the results in Table 3, will lead to decreases in required equity returns. However, during that same period the trend variable t was increasing. This increasing trend variable implies an additional source for decreases in required equity returns over that time period. Since Equation (2) does not explicitly separate out the trend variable, the overall effect in Equation (2) includes both of these effects, which will make the Equation (2) slope coefficient larger.

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Using Analysts' Growth Forecasts to Estimate Shareholder Required Rates of Return

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I. Introduction

Shareholder required rates of return play key roles in establishing economic criteria for resource allocation in many corporate and regulatory decisions. Theory dictates that such returns should be forward-looking return requirements that take into account the risk of the specific equity investment.

Estimation of such returns, however, presents numerous and difficult problems. Although theory clearly calls for a forward-looking required return, investigators, lacking a superior alternative, often resort to averages of historical realizations. One primary example is the determination of equity required return as a "least risk" rate plus a risk premium where an equity risk premium is calculated as an average of past differences between equity returns and returns on debt instruments. The historical studies of Ibbotson *et al.* [9] have been used frequently to implement this approach.[1] Use of such historical risk premia assumes that past realizations are a good surrogate for future expectations and that risk premia are roughly constant over time. Additionally, the choice of a time period over which to average data under such a procedure is essentially arbitrary. Carleton and Lakonishok [3] demonstrate empirically some of the problems with such historical premia when they are disaggregated for different time periods or groups of firms.

Recently Brigham, Shome, and Vinson [2] surveyed work on developing *ex ante* equity risk premia with particular emphasis on regulated utilities. They presented their own risk premia estimates, which make use of financial analysts' forecasts as surrogates for investor expectations.

The current paper follows an approach similar to Brigham *et al.* and derives equity required returns and risk premia using publicly available expectational

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[1]Many leading texts in financial management use such historical risk premia to estimate a market return. See for example, Brealey and Myers [1]. Often a market risk premium is adjusted for the observed relative risk of a stock.

Exhibit 7. Changes in Equity Risk Premia Over Time — Entries are Coefficient (t-value)

Regression	Intercept	i_{20}	σ_g	$i_c - i_{20}$	R^2
A. SP500: Dependent Variable is Equity Risk Premium*					
1.	0.140	−0.632			0.43
	(8.15)†	(−4.95)†			
2.	0.118	−0.660	0.754		0.58
	(7.10)†	(−5.93)†	(3.32)†		
3.	0.069	−0.235		1.448	0.57
	(3.44)†	(−1.76)		(4.18)†	
4.	0.030	−0.177	0.855	1.645	0.79
	(2.17)†	(−2.07)†	(4.68)†	(7.63)†	
Regression	**Intercept**	**i_{20}**	**σ_g**	**$i_u - i_{20}$**	**R^2**
B. SPUT: Dependent Variable is Equity Risk Premium*					
1.	0.110	−0.510			0.37
	(7.35)†	(−4.41)†			
2.	0.101	−0.543	0.805		0.41
	(6.28)†	(−4.68)†	(1.42)		
3.	0.051	−0.259		1.432	0.80
	(5.54)†	(−4.05)†		(8.87)†	
4.	0.049	−0.287	0.387	1.391	0.80
	(5.15)†	(−3.87)†	(0.75)	(8.14)†	

*All variables are defined in Exhibit 1 and graphed in Exhibit 6. Regressions were estimated for the 36 month period January 1982–December 1984 and were corrected for serial correlation using the Prais-Winsten method. For purposes of this regression variables are expressed in decimal form, *e.g.*, 14% = 0.14.

†Significantly different from zero at 0.05 level using two-tailed test

cause of lower variability over time in the dispersion of FAF for utility stocks as compared to equities in general. The yield spread between utility and government bonds is significantly positively related to utility equity risk premia. And, as in the case of stocks in general, introduction of this spread substantially reduces the independent effect of interest rate levels on equity risk premia.

Given the short time series (36 months), tests for the stability of the relationships found in Exhibit 7 present difficulties. As a check, the relationships were reestimated dividing the data into two 18-month periods. For stocks in general (SP500), coefficients on σ_g and $(i_c - i_{20})$ were positive in all regressions and significantly so, except in the case of $(i_c - i_{20})$ for the second 18-month period. The coefficient of i_{20} was significantly negative in both periods. This confirms the general findings for the SP500 in Panel A of Exhibit 7. For utility stocks, results for the subperiods also matched the entire period results. The coefficients of $(i_u - i_{20})$ were significantly positive in both subperiods while those of σ_g were insignificantly different from zero. The level of interest rates (i_{20}) had a significant negative effect in both subperiods.

In summary, the estimated risk premia change over time and the patterns of such change are directly related to changes in proxies for the risks of equity investments. Risk premia for both stocks in general and utilities are inversely related to the level of government interest rates but positively related to the bond yield spreads which proxy for the incremental risk of investing in equities rather than government bonds. For stocks in general, risk premia also increase over time with increases in the general level of disagreement about future corporate performance.

VI. Conclusions

Notions of shareholder required rates of return and risk premia are based in theory on investors' expectations about the future. Research has demonstrated the usefulness of financial analysts' forecasts for such expectations. When such forecasts are used to derive equity risk premia, the results are quite encouraging. In addition to meeting the theoretical requirement of using expectational data, the procedure produces estimates of reasonable magnitude that behave as economic theory would predict. Both over time and across stocks, the risk premia vary directly with the perceived riskiness of equity investment.

The approach offers a straightforward and powerful aid in establishing required rates of return either for corporate investment decisions or in the regulatory arena. Since data are readily available on a wide range of equities, an investigator can analyze various proxy groups (*e.g.*, portfolios of utility stocks) appropriate for a particular decision. An additional advantage of the estimated risk premia is that they allow analysis of changes in equity return requirements over time. Tracking such changes is important for managers facing changing economic climates.

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COST OF EQUITY FOR ENERGY UTILITIES: BEYOND THE CAPM

STÉPHANE CHRÉTIEN & FRANK COGGINS

ABSTRACT

The Capital Asset Pricing Model (CAPM) is applied in regulatory cases to estimate the required rate of return, or cost of equity, for low-beta, value-style energy utilities, despite the model's well documented mispricing of investments with similar characteristics. This paper examines CAPM-based estimates for a sample of American and Canadian energy utilities to assess the risk premium error. We find that the CAPM significantly underestimates the risk premium for energy utilities compared to its historical value by an annualized average of more than 4%. Two CAPM extensions, the Fama-French model and an adjusted CAPM, provide econometric estimates of the risk premium that do not present a significant misevaluation.

JEL Classifications: G12, L51, L95, K23

Keywords: Cost of Capital, Rate of Returns, Energy Utilities

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1. INTRODUCTION

An important aspect of the regulatory process for energy utilities is the determination of their equity rate of return. This return, also known as the cost of equity capital, represents the expected remuneration of the shareholders of the utilities. It is a crucial component of their total cost of capital, which is central to their investment policy and serves as a basis for setting up the rates to their customers. The purpose of this paper is to highlight the problems of the most commonly used model to determine the equity rate of return for energy utilities and to propose two alternative models that empirically improve on the estimation. By providing new direct and focused evidence for energy utilities, our analysis contributes to the knowledge of energy, regulatory and financial economists, as well as regulators, who are concerned with rate determination.

Regulatory bodies, like the National Energy Board in Canada or the Federal Energy Regulatory Commission in the United States, have the mandate to set the equity rate of return so that it is fair and reasonable. Specifically, according to Bonbright, Danielsen and Kamerschen (1988, Chap. 10), the return should provide the ability to attract and retain capital (the capital-attraction criterion), encourage efficient managerial practice (the management-efficiency criterion), promote consumer rationing (the consumer-rationing criterion), give a reasonably stable and predictable rate level to ratepayers (the rate-level stability and predictability criterion) and ensure fairness to investors (the fairness to investors criterion). While the first four criteria are designed primarily in the interest of the consuming public, the last criterion acts as an equally-important protection for private owners against confiscatory regulation. Its requirement involves determining the return available from the application of the capital to other enterprises of like risk, which demands an understanding of the risk-return relationship in the equity market.

Traditionally, the regulated return has been set through hearings, where arguments on the issue of fairness could be debated. But since the 1990s, numerous boards have adopted an annual mechanism known as a "rate of return formula" or a "rate adjustment formula". This mechanism determines automatically the allowed rate of return through a calculation that explicitly accounts for the risk-return relationship in the equity market. The use of rate adjustment formulas is particularly prevalent in Canada since the landmark March 1995 decision by the National Energy Board (Decision RH-2-94), which sets the stage for the widespread adoption of closely related formulas by provincial regulators.

Most rate adjustment formulas use a method known as the Equity Risk Premium method.[1] This method can be summarized as calculating a utility's equity rate of return as the risk-free rate of return plus a premium that reflects its risk. The risk-free rate is usually related to the yield on a long-term government bond. The risk premium is obtained from the Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965), a classic model of capital market equilibrium. It is equal to the utility's beta, a measure of its systematic risk, multiplied by the market portfolio risk premium. The Equity Risk Premium method has a number of

[1] There exist other methods for estimating the rate of return, most notably the Comparable Earnings method and the Discounted Cash Flows method. See Morin (2006) for a description. These methods are generally not directly incorporated in the rate adjustment formulas.

advantages. First, it is supported by a solid theoretical foundation in the academic literature, thus providing a sound basis for understanding the risk-return relationship. Second, it can be estimated based on stock returns, thereby making it more objective than other methods, and relating it to current market conditions. Third, it is relatively simple to apply and requires data that can be obtained easily.

The Equity Risk Premium method is not, however, without shortcomings. Arguably its most criticized feature is the use of the CAPM as the basis to determine the risk premium. While the CAPM is one of the most important developments in finance, research over the last forty years has produced a large body of work critical of the model. On the theoretical side, Cochrane (1999) summarizes the current most prevalent academic view: "In retrospect, it is surprising that the CAPM worked so well for so long. The assumptions on which it is built are very stylized and simplified."[2] For example, at least since Merton (1973), it is recognized that factors, state variables or sources of priced risk beyond the movements in the market portfolio (the only risk factor in the CAPM) might be needed to explain why some risk premiums are higher than others. On the empirical side, the finance literature abounds with CAPM deficiencies (so-called "anomalies"). Fama and French (2004) review this literature to highlight that the CAPM is problematic in the estimation of the risk premium of low-beta firms, small-capitalisation firms and value (or low-growth) firms. While these problems have been well documented in the finance literature, their effects have not yet been fully explored for energy utilities, which may be part of the reasons why the CAPM is still widely used in rate adjustment formulas. In particular, as the CAPM does not empirically provide a valid risk-return relationship for the equity market, it might fall short of the requirement associated with the fairness to investors' criterion.

Considering the importance of the CAPM in determining the regulated equity rate of return, the objectives of this paper are two-folds. First, we re-examine the use of the model in the context of energy utilities to determine if it is problematic. As utilities are typically low-beta, value-oriented investments, the finance literature suggests that the model will have difficulties in estimating their risk premiums. We analyze the issue empirically by estimating the model and its resulting risk premiums for a sample of Canadian and American energy utilities mostly related to the gas distribution sector, and by testing for the presence of significant differences between the model's risk premium estimates and the historical ones.

Second, we implement two alternative models that are designed to circumvent some of the empirical problems of the CAPM. The first alternative is a three-factor model proposed by Fama and French (1993) (the Fama-French model hereafter). This model has been used to estimate the cost of equity by Fama and French (1997) for general industrial sectors and by Schink and Bower (1994) for the utilities sector in particular. The second alternative is a modified CAPM that includes the adjustments proposed by Blume (1975) and Litzenberger, Ramaswamy and Sosin (1980) (the Adjusted CAPM hereafter). The Fama-French model and the Adjusted CAPM provide useful comparisons with the CAPM on the estimation of the risk premiums of energy utilities.

Our empirical results can be summarized as follows. First, the CAPM significantly underestimates the risk premiums of energy utilities compared to their

[2] Cochrane (1999), p. 39.

historical values. The underestimations are economically important, with annualized averages of respectively 4.5% and 6.2% for the Canadian and American gas utilities we consider, and are consistent with the finance literature on the mispricing of low-beta, value-oriented stocks. Second, the Fama-French model and the Adjusted CAPM are both able to provide costs of equity that are not significantly different from the historical ones. Our results show that the value premium, in the case of the Fama-French model, and a bias correction, in the case of the Adjusted CAPM, are important in eliminating the CAPM underestimations. Both models suggest average risk premiums between 4% and 8% for gas utilities portfolios, and are relevant at the individual utility level as well as at the utilities sector level.

Overall, we conclude that the CAPM is problematic in estimating econometrically the cost of equity of energy utilities. The Fama-French model and the Adjusted CAPM are well specified for this purpose as they reduce considerably the estimation errors. These models could thus be considered as alternatives to the CAPM in the Equity Risk Premium method employed by regulatory bodies to obtain the risk-return relationship for the fairness to investors' criterion.

The CAPM dates back to the mid-1960s. While the model is tremendously important, there has been a lot of progress over the last 45 years in the understanding of the cross-section of equity returns. It should be clear that the goals of this paper are not to implement full tests of asset pricing models or examine comprehensively the numerous models in the equity literature. Focusing on energy utilities, this paper is an application of the CAPM and two reasonable and relevant alternatives to the problem of cost of equity estimation, using a standard methodology. Our findings show that it is potentially important to go beyond the CAPM for energy utilities. They represent an invitation to further use the advances in the literature on the cross-section of returns to better understand their equity rate of return.

The rest of the paper is divided as follows. The next section presents our sample of energy utilities and reference portfolios. The third, fourth and fifth sections examine the risk premium estimates with the CAPM, the Fama-French model and the Adjusted CAPM, respectively. Each section provides an overview of the model, presents its empirical estimation and results, and discusses the implications of our findings. The last section concludes.

2. Sample Selection and Descriptive Statistics

This section examines the sample of firms and portfolios for our estimation of the cost of equity of energy utilities. We focus on the gas distribution sector to present complete sector-level and firm-level results, but we also consider utilities indexes to ensure the robustness to other utilities. We provide Canadian and American results for comparison, as both energy markets are relatively integrated and investors might expect similar returns. We first discuss sample selection issues and then present descriptive statistics.

2.1. Sample Selection

Two important choices guide our sample selection process. First, we use monthly historical data in order to have sufficient data for estimating the parameters and test statistics, while avoiding the microstructure problems of the stock markets (low liquidity for numerous securities, non-synchronization of transactions, etc.) in higher frequency data.[3] We then annualized our results for convenience. Second, we emphasize reference portfolios (such as sector indexes) over individual firms. Reference portfolios reduce the potentially large noise (or diversifiable risk) in the stock market returns of individual firms. They allow for an increased statistical accuracy of the estimates, an advantage recognized since (at least) Fama and MacBeth (1973), and alleviate the problem that we do not observe the returns on utilities directly and must rely on utility holding companies.

To represent the gas distribution sector in Canada and the U.S., we use a published index and a constructed portfolio for each market. The independently-calculated published indexes are widely available and consider the entire history of firms having belonged to the gas distribution sector. The constructed portfolios use the most relevant firms at present in the gas distribution or energy utility sector. The data collection also allows an examination of the robustness of our results at the firm level. The resulting four gas distribution reference portfolios are described below:

- *DJ_GasDi*: A Canadian gas distribution index published by Dow Jones, i.e. the "Dow Jones Canada Gas Distribution Index." The firms in the index are weighted by their market value. Monthly returns (180) are available from January 1992 to December 2006;
- *CAindex*: An equally-weighted constructed portfolio formed of 13 Canadian energy utilities, most with activities that are related to the gas distribution sector, i.e. ATCO Ltd., Algonquin Power Income Fund, Canadian Utilities Limited, EPCOR Power, Emera Incorporated, Enbridge Inc., Fort Chicago Energy Partners, Fortis Inc., Gaz Métro Limited Partnership, Northland Power Income Fund, Pacific Northern Gas, TransAlta Corporation and TransCanada Pipelines.[4] Monthly returns (263) are available from February 1985 to December 2006;
- *DJ_GasUS*: A U.S. gas distribution index published by Dow Jones, i.e. the "Dow Jones US Gas Distribution Index." The firms in the index are weighted by their market value. Monthly returns (180) are available from January 1992 to December 2006;
- *USindex*: An equally-weighted constructed portfolio formed of nine U.S. firms whose activities are heavily concentrated in local gas distribution, i.e. AGL Resources Inc., Atmos Energy Corp., Laclede Group, New Jersey Resources Corp., Northwest Natural Gas Co., Piedmont Natural Gas Co., South Jersey Industries, Southwest Gas Corp. and WGL Holdings Inc. Monthly returns (407) are available from February 1973 to December 2006.

[3] See Fowler, Rorke and Jog (1979, 1980) for an analysis of these problems in the Canadian stock markets.

[4] We also considered AltaGas Utility Group, Enbridge Income Fund, Westcoast Energy, Nova Scotia Power and Energy Savings Income Fund. We did not retain the first four because they had a returns history of less than 60 months. We eliminated the last one because it is a gas broker and its average monthly return of more than 3% was a statistical outlier. Our results are robust to variations in the formation of the CAindex portfolio, like the inclusion of these five firms or the exclusion of income funds and limited partnerships.

To confirm the validity of our analysis to other energy utilities, we also consider four utilities reference portfolios, which consist of the utilities sector indexes described below:

- *DJ_Util*: A Canadian utilities index published by Dow Jones, i.e. the "Dow Jones Canada Utilities Index." The firms in the index are weighted by their market value. Monthly returns (180) are available from January 1992 to December 2006;
- *TSX_Util*: A Canadian utilities index published by S&P/TSX, i.e. the "S&P/TSX Utilities Index." The firms in the index are weighted by their market value. Monthly returns (228) are available from January 1988 to December 2006;
- *DJ_UtiUS*: A U.S. utilities index published by Dow Jones, i.e. the "Dow Jones US Utilities Index." The firms in the index are weighted by their market value. Monthly returns (180) are available from January 1992 to December 2006;
- *FF_Util*: A U.S. utilities index formed by Profs. Fama and French, or the University of Chicago and Dartmouth College, respectively. The firms in the index are weighted by their market value. Monthly returns (407) are available from February 1973 to December 2006.

Depending on their availability, the reference portfolio series have different starting dates. In our econometric estimation, we keep the maximum number of observations for each series. Fama and French (1997) find that such a choice results in costs of equity more precisely estimated and with more predictive ability than costs of equity obtained from rolling five-year estimation windows, a common choice in practice. The data are collected from the Canadian Financial Markets Research Center (CFMRC), Datastream and the web sites of Prof. French[5] and Dow Jones Indexes[6].

2.2. Descriptive Statistics

Descriptive statistics for the monthly returns are presented in Table 1. Panel A shows the results for the 13 Canadian energy utilities and their equally-weighted portfolio (CAindex). Panel B shows the results for nine U.S. gas distribution utilities and their equally-weighted portfolio (USindex). Panel C shows the statistics for Canadian and U.S. indexes for the utilities sector (DJ_Util, DJ_UtilUS, TSX_Util and FF_Util) and the gas distribution sub-sector (DJ_GasDi and DJ_GasUS).[7]

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[5] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

[6] http://www.djindexes.com/mdsidx/index.cfm?event=showtotalMarketIndexData&perf=Historical%20Values

[7] The returns from August to November 2001 of the Dow Jones U.S. indexes are strongly influenced by the Enron debacle, which started with the resignation of its CEO, Jeffrey Skilling, on August 14, 2001 and ended with the bankruptcy of the company on December 2, 2001. During those four months, the DJ_GasUS and DJ_UtiUS indices lost 68.9% and 16.2% of their value, respectively. By comparison, the equally-weighted portfolio of U.S. gas distributors (USindex) gained 1.2% and the Fama-French utilities index (FF_Util) lost 6.2 %. In order to soften the impact of that statistical aberration (caused by an unprecedented fraud) on the estimation of the risk premium, the returns from August to November 2001 of DJ_GasUS and DJ_UtilUS are replaced by those of USindex and FF_Util, respectively.

TABLE 1
Descriptive Statistics of Monthly Returns

Variable	N	Mean	St Dev	Min	Max	Brief Description
Panel A: Canadian Energy Utilities						
ATCO	263	0.013	0.067	-0.301	0.279	ATCO Ltd.
Algonqui	108	0.009	0.054	-0.163	0.166	Algonquin Power Income Fund
CanUtili	263	0.012	0.043	-0.107	0.159	Canadian Utilities Limited
EPCOR	114	0.008	0.046	-0.201	0.108	EPCOR Power
Emera	143	0.009	0.043	-0.137	0.115	Emera Incorporated
Enbridge	263	0.011	0.054	-0.365	0.205	Enbridge Inc.
FortChic	107	0.009	0.054	-0.119	0.210	Fort Chicago Energy Partners
Fortis	228	0.013	0.041	-0.134	0.146	Fortis Inc.
GazMetro	166	0.010	0.037	-0.134	0.084	Gaz Métro Limited Partnerships
NorthPow	104	0.011	0.063	-0.202	0.205	Northland Power Income Fund
PacNorth	263	0.010	0.070	-0.400	0.507	Pacific Northern Gas
TransAlt	263	0.009	0.048	-0.217	0.188	TransAlta Corporation
TransCan	258	0.008	0.054	-0.214	0.254	TransCanada Pipelines
CAindex	263	0.010	0.031	-0.130	0.087	Equally-weighted portfolio
Panel B: U.S. Gas Distribution Utilities						
AGL_Res	407	0.013	0.052	-0.138	0.253	AGL Resources Inc.
Atmos	277	0.013	0.063	-0.302	0.269	Atmos Energy Corp.
Laclede	407	0.012	0.056	-0.148	0.374	Laclede Group
NJ_Res	407	0.013	0.063	-0.171	0.577	New Jersey Resources Corp.
Northwes	407	0.012	0.060	-0.236	0.274	Northwest Natural Gas Co.
Piedmont	407	0.013	0.059	-0.188	0.315	Piedmont Natural Gas Co.
SouthJer	407	0.012	0.058	-0.194	0.486	South Jersey Industries
Southwes	407	0.011	0.070	-0.304	0.234	Southwest Gas Corp.
WGL_Hold	407	0.012	0.071	-0.232	0.807	WGL Holdings Inc.
USindex	407	0.012	0.041	-0.121	0.338	Equally-weighted portfolio
Panel C: Sector Indexes						
TSX_Util	228	0.010	0.037	-0.101	0.114	S&P/TSX Utilities Index
DJ_GasDi	180	0.012	0.043	-0.139	0.137	Dow Jones Canada Gas Distribution Index
DJ_Util	180	0.007	0.036	-0.139	0.101	Dow Jones Canada Utilities Index
DJ_GasUS	180	0.012	0.039	-0.120	0.143	Dow Jones US Gas Distribution Index
DJ_UtiUS	180	0.009	0.042	-0.127	0.136	Dow Jones US Utilities Index
FF_Util	407	0.010	0.041	-0.123	0.188	Fama-French US Utilities Index

NOTES: This table presents descriptive statistics on the monthly returns of 13 Canadian utilities and their equally-weighted portfolio (CAindex) in Panel A, of nine U.S. gas distribution utilities and their equally-weighted portfolio (USindex) in Panel B, and on selected utilities sector indexes in Panel C. The columns labelled N, Mean, St Dev, Min and Max correspond respectively to the number of observations, the mean, the standard deviation, the minimum value and the maximum value. The column labelled Brief Description gives the full name of the utility holding companies or the utilities sector indexes.

For the Canadian energy utilities, the monthly average return of all 13 firms is 1.0% with a standard deviation of 3.1%. The Dow Jones Canada Gas Distribution Index, the Dow Jones Canada Utilities Index and the S&P/TSX Utilities Index have mean returns of 1.2%, 0.7% and 1.0%, respectively. The monthly average return of the nine U.S. gas distribution utilities is 1.2% with a standard deviation of 4.1%. The Dow Jones US Gas Distribution Index, the Dow Jones US Utilities Index and the Fama-French U.S. Utilities Index show mean returns of 1.2%, 0.9% and 1.0%, respectively. Correlations between the four gas distribution reference portfolios (not tabulated) are between 0.29 and 0.80. These correlations indicate that the portfolios show some commonality, but are not perfect substitutes. We next start our analysis of the equity risk premium models.

3. Equity Risk Premium with the CAPM

This section examines the use of the Capital Asset Pricing Model (CAPM) for estimating the rate of return for energy utilities. The CAPM is the model the most often associated with the Equity Risk Premium method that is the basis of the rate adjustment formulas of regulatory bodies. We first present the model and its relevant literature. Then we estimate the model for our sample of energy utilities. Finally, we discuss the implications of our findings.

3.1. Model and Literature

The CAPM is a model proposed by Sharpe (1964) and Lintner (1965) in which the expected equity return or cost of equity for a gas utility is given by

$$E(R_{GAS}) = R_f + \beta \times \lambda_m ,$$

where R_f is the risk-free rate, β is the firm's beta or sensitivity to the market returns and λ_m is the market risk premium. In this model, a higher beta results in a higher risk premium.

The CAPM is the best known model of expected return. In spite of its undeniable importance in the field of finance, it has long been rejected by numerous empirical tests in the academic literature. The empirical rejections start with the first tests (Black, Jensen and Scholes, 1972, Fama and MacBeth, 1973, and Blume and Friend, 1973) that find that the relation between beta and average return is flatter than predicted by the model. They continue with the discovery of numerous "anomalies" (like the price-to-earnings effect of Basu, 1977, the size effect of Banz, 1981, etc.). Finally, in the 1990s, based on high-impact articles, including Fama and French (1992, 1993, 1996a and 1996b), Jegadeesh and Titman (1993) and Jagannathan and Wang (1996), the academic profession reaches a relative consensus that the CAPM is not valid empirically. In Canada, like elsewhere in the world, the literature reaches similar conclusions (see Morin, 1980, Bartholdy, 1993, Bourgeois and Lussier, 1994, Elfakhani, Lockwood and Zaher, 1998, L'Her, Masmoudi and Suret, 2002, 2004.).

A complete review of the literature on the problems of the CAPM is beyond the scope of this paper. It is nevertheless important to point out the two characteristics of energy utilities that suggest the CAPM might be problematic in estimating their equity return. First, energy utilities have typically low betas, significantly below one. Second, they are known as value investments, in the sense that they have high earnings-to-price, book-to-market, cash flows-to-price or dividend-to-price ratios. In a summary article requested for a symposium on the 40th anniversary of the CAPM, Fama and French (2004) highlight the result of using the model to estimate the cost of equity capital for firms with these two characteristics:

> "As a result, CAPM estimates of the cost of equity for high beta stocks are too high (relative to historical average returns) and estimates for low beta stocks are too low (Friend and Blume, 1970). Similarly, if the high average returns on value stocks (with

high book-to-market ratios) imply high expected returns, CAPM cost of equity estimates for such stocks are too low."[8]

As Fama and French (2004) indicate, the low-beta and value characteristics of energy utilities will probably lead the CAPM to estimate a rate of return that is too low. We next examine whether this undervaluation in fact exists in our sample of reference portfolios and utilities.

3.2. Risk Premium Estimates

This section empirically estimates the risk premium with the CAPM using the previously described Canadian and U.S. monthly data.[9] More specifically, we estimate the model using the time-series regression approach pioneered by Black, Jensen and Scholes (1972) with the following equation:

$$R_{GAS,t} - R_{f,t} = \alpha_{GAS} + \beta \times \lambda_{m,t} + \varepsilon_{GAS,t},$$

where $\lambda_{m,t} = R_{m,t} - R_{f,t}$ is the return on the market portfolio in excess of the risk-free return and $\varepsilon_{GAS,t}$ is the mean-zero regression error, at time *t*. In this equation, the CAPM predicts that the alpha (or intercept) is zero ($\alpha_{GAS} = 0$) and the risk premium is $E(R_{GAS,t} - R_{f,t}) = \beta \times E(\lambda_{m,t})$. An alpha different from zero can be interpreted as the risk premium error of the CAPM (see Pastor and Stambaugh, 1999). A positive alpha indicates the CAPM does not prescribe a large enough risk premium compared to its historical value (an underestimation), whereas a negative alpha indicates the CAPM prescribes a risk premium that is too large (an overestimation). It is therefore possible to determine the CAPM risk premium error for energy utilities based on the estimates of the alpha.[10]

We use Hansen's (1982) Generalized Method of Moments technique in order to estimate jointly the parameters α_{GAS} and β of the model and the market risk premium $E(\lambda_{m,t})$. As Cochrane (2001, Section 12.1) shows, this method has the necessary flexibility to correct the results for possible econometric problems in the

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[8] Fama and French (2004), p. 43-44.

[9] Our focus is on the estimation of the equity risk premium for energy utilities. To obtain their full cost of equity, we would need to add an appropriate risk-free rate, which could depend on the circumstances. For example, one common choice advocates adding to their equity risk premium the yield on a long-term government bond. But other choices for an appropriate risk-free rate are possible.

[10] The time series regression approach is commonly used when the model factors are returns. Cochrane (2001, Chapter 12) emphasizes that the approach implicitly imposes the restriction that the factors (chosen to fully represent the cross section of returns in the modeling) should be priced correctly in the estimation. While there are other ways to estimate a model like the CAPM, one advantage of the times series regression approach is that it can be easily applied to a restricted set of assets (like energy utilities) as the cross-sectional variations in asset returns are already captured by the correct pricing of the traded factors. Cochrane (2001, Chapter 12) also shows that the approach is identical to a Generalized Least Square cross-sectional regression approach.

data.[11] We take the monthly returns on portfolios of all listed securities weighted by their market value for the market portfolio returns and on the Treasury bills for the risk-free returns.[12] The annualized mean market risk premiums are 5.2% for Canada from February 1985 to December 2006 and 6.0% for the U.S. from February 1973 to December 2006.

Table 2 shows the results of the regressions using each of the four gas distribution reference portfolios. The estimates of the annualized risk premium error (or annualized α_{GAS}), the beta β and the risk premium $\beta \times E(\lambda_{m,t})$ are presented in Panels A, B and C, respectively. For each estimate, the table also shows its standard error, t-statistic and associated p-value.

TABLE 2
CAPM Risk Premium Estimates for the Gas Distribution Reference Portfolios

Portfolio	Estimate	SE	t-stat	Prob > |t|
Panel A: Risk Premium Error (Alpha)				
DJ_GasDi	8.43	3.79	2.22	0.028
CAindex	4.52	2.33	1.94	0.053
DJ_GasUS	7.39	3.34	2.21	0.028
USindex	6.23	1.95	3.19	0.002
Panel B: Beta				
DJ_GasDi	0.21	0.11	1.95	0.053
CAindex	0.34	0.07	4.60	<.0001
DJ_GasUS	0.37	0.09	4.16	<.0001
USindex	0.46	0.06	7.37	<.0001
Panel C: Risk Premium				
DJ_GasDi	1.66	1.28	1.30	0.195
CAindex	1.76	1.11	1.58	0.116
DJ_GasUS	2.74	1.46	1.87	0.063
USindex	2.72	1.33	2.04	0.042

NOTES: This table reports the results of the estimation of the CAPM for the gas distribution reference portfolios. Panels A to C look at the annualized risk premium error or alpha (in percent), the market beta and the annualized risk premium (in percent), respectively. The columns labelled Estimate, SE, t-stat and Prob > |t| give respectively the estimates, their standard errors, their t-statistics and their p-values. The four gas distribution reference portfolios and their sample are described in section 2 and table 1. The annualized mean market risk premiums for their corresponding sample period are 8.1% for DJ_GasDi, 5.2% for CAindex, 7.5% for DJ_GasUS and 6.0% for USindex.

The estimates in Panel A of Table 2 indicate that the risk premium errors are positive. Hence, the CAPM underestimates the risk premium for the gas distribution reference portfolios. The underestimation is not small – a minimum of 4.52% (for CAindex) and a maximum of 8.43% (for DJ_GasDi) – and is statistically greater than zero for all portfolios. Also, as expected, the underestimation comes with low

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[11] All standard errors and statistical tests have been estimated using the Newey and West (1987) method, which takes account of the potential heteroscedasticity and autocorrelation in the errors of the statistical models.

[12] The data sources are CFMRC (until 2004) and Datastream (thereafter) for the Canadian returns and the web site of Prof. French for U.S. returns.

beta estimates, with values between 0.21 and 0.46 in Panel B. For example, for CAindex, the beta is 0.34 and the annualized risk premium predicted by the CAPM is 1.76%, an underestimation of the historical risk premium $\alpha_{GAS} = 4.52\%$.

To verify the underestimation is not an artifact of the utilization of the reference portfolios and is robust to other energy utilities, Figure 1 shows the risk premium errors for the utilities that make up the CAindex portfolio (Figure 1a), the gas distributors in the USindex portfolios (Figure 1b) and the four utilities reference portfolios (Figure 1c). Once again, the alphas are always positive, with values between 2.1% and 8.9% for the Canadian utilities, between 3.5% and 8.4% for the U.S. gas distributors, and between 2.1% and 5.0% for the utilities reference portfolios. The constantly positive and often significant errors support the notion that the CAPM might not be appropriate for determining the risk premium in the utilities sector.

FIGURE 1
Risk Premium Errors with the CAPM for Various Utilities

Figure 1a: Firms in the CAindex Portfolio

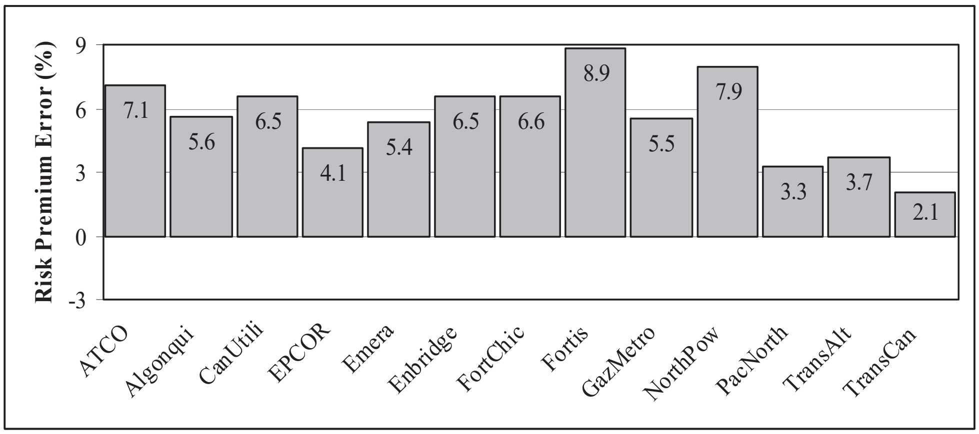


Figure 1b: Firms in the USindex Portfolio

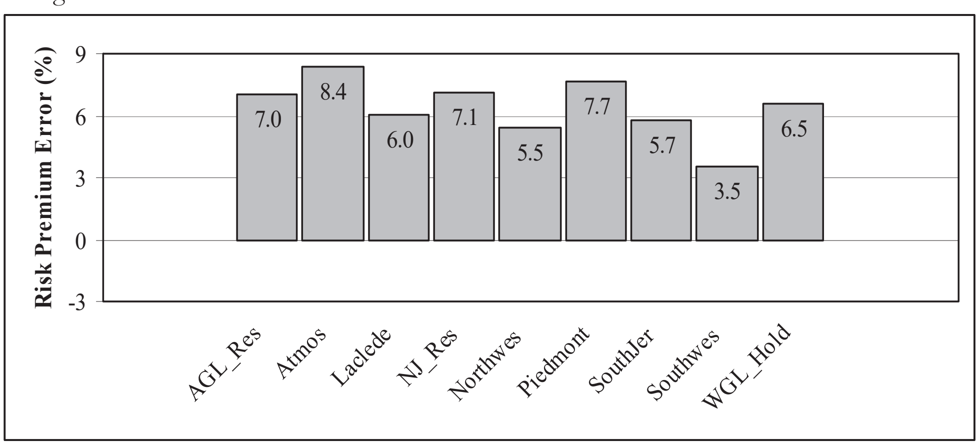
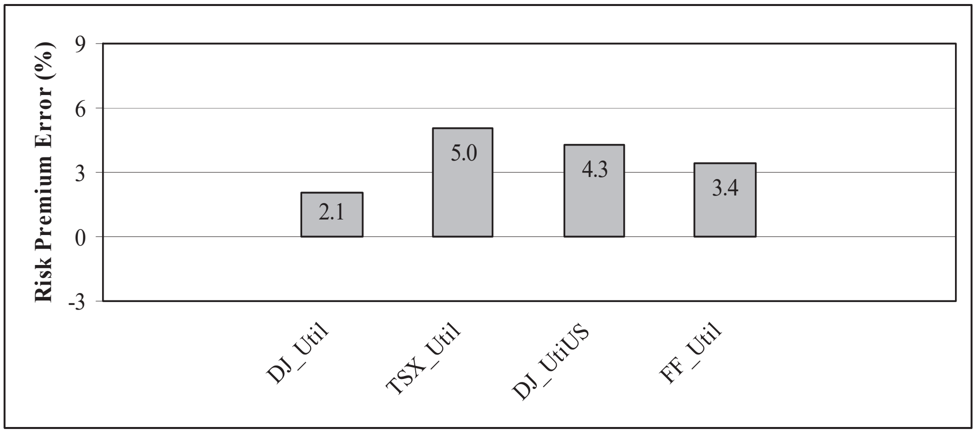


Figure 1c: Utilities Reference Portfolios



NOTES: This figure shows the annualized risk premium errors (or alphas) with the CAPM for the Canadian utilities in the CAindex portfolio (Figure 1a), the U.S. gas distributors in the USindex portfolio (Figure 1b) and the utilities reference portfolios (Figure 1c).

3.3. Discussion

Our results show that the CAPM underestimates the risk premium for the gas distribution sub-sector in particular and for the utilities sector in general. This finding is consistent with the empirical literature that finds that the CAPM tends to underestimate the risk premium of securities or sectors associated with low-beta, value and small-cap investments. In the terminology of asset pricing, the returns on energy utilities are "anomalous" with respect to the CAPM. As the application of the model would not be sensible in evaluating the performance of value-type mutual funds, given the related anomaly, it could be unwarranted in evaluating the cost of equity for energy utilities.

While the magnitude of the underestimation for the utilities is large, it is not unexpected. Fama and French (2004) review the evidence on the large CAPM literature for the *full cross-section* of equity returns. Their figures 2 and 3, in particular, illustrate well the findings for portfolios of stocks formed on their beta and their book-to-market ratio value indicator, respectively. In the cross-section of all stock returns, their figure 2 show visually that the CAPM underestimation is about 3% for the lowest beta portfolio (a beta of about 0.6), while its overestimation is about 3% for the highest beta portfolio (a beta of about 1.8). Their figure 3 indicates that the CAPM underestimation is about 5% for the highest book-to-market ratio portfolio, while its overestimation is about 2% for the lowest book-to-market ratio portfolio. As energy utilities are low-beta and value-oriented stocks, our estimates of the CAPM underestimation for this segment are consistent with the evidence from the full cross-section of equity returns.

Our results are related to numerous studies documenting that the CAPM alphas are different from zero. As a consequence of these rejections, finance researchers have considered various models that generalized the CAPM as well as various empirical improvements to the estimates of the CAPM. Based on this literature, we explore two alternative ways of estimating the risk premium of energy utilities in the next two sections.

4. Equity Risk Premium with the Fama-French model

The CAPM claims that a single factor, the market portfolio return, can explain expected returns. The most natural extension is to take multiple factors into account. Clearly, if factors other than the market return have positive risk premiums that contribute to explaining expected returns, then the inclusion of those factors should provide a better estimate of the risk premium and potentially eliminate the CAPM errors (see Merton, 1973, and Ross, 1976, for formal theoretical justifications). This section considers one of the most common generalization of the CAPM, a multifactor model by Fama and French (1993). We first describe the model and then use it to estimate the risk premium of energy utilities. We finally discuss the interpretation of our findings.

4.1. Model and Literature

The Fama-French model is a three-factor model developed to capture the anomalous returns associated with small-cap, value and growth portfolios by including risk premiums for size and value. For a gas utility, the expected equity return is given by

$$E(R_{GAS}) = R_f + \beta \times \lambda_m + \beta_{SIZE} \times \lambda_{SIZE} + \beta_{VALUE} \times \lambda_{VALUE},$$

where R_f is the risk-free rate, β, β_{SIZE} and β_{VALUE} are respectively the firm's market, size and value betas, and λ_m, λ_{SIZE} and λ_{VALUE} are respectively the market, size and value risk premiums. The three betas represent sensitivities to the three sources of risk, and the higher are their values, the higher is a firm's risk premium. In cases when the size and value risk factors are not relevant, then the Fama-French model reduces to the CAPM. Theoretical justifications for the size and value premiums are provided by Berk, Green and Naik (1999), Gomez, Kogan and Zhang (2003), and Carlson, Fisher and Giammarino (2004). Fama and French (1993, 1996a) are the two of the most influential empirical tests of the model.

Like the CAPM, the Fama-French model has been used in applications ranging from performance measurement to abnormal return estimation and asset valuation. For the calculation of the cost of equity capital, the model is studied by, among others, Schink and Bower (1994), Fama and French (1997), and Pastor and Stambaugh (1999). It has also proven to be relevant for explaining stock market returns in most countries where it has been examined. For example, in Canada, the model is validated by Elfakhani, Lockwood and Zaher (1998) and L'Her, Masmoudi and Suret (2002). Given that energy utilities are associated with value investments, the Fama-French model has the potential to improve the estimation of their rates of returns. We next assess this possibility for our sample of reference portfolios and utilities.

4.2. Risk Premium Estimates

The risk premium with the Fama-French model is estimated with a methodology that is similar to the one followed for the CAPM using the following equation:

$$R_{GAS,t} - R_{f,t} = \alpha_{GAS}^{FF} + \beta \times \lambda_{m,t} + \beta_{SIZE} \times \lambda_{SIZE,t} + \beta_{VALUE} \times \lambda_{VALUE,t} + \upsilon_{GAS,t} \,,$$

where $\lambda_{m,t} = R_{m,t} - R_{f,t}$ is the return on the market portfolio in excess of the risk-free return, $\lambda_{SIZE,t} = R_{SMALL,t} - R_{LARGE,t}$ is the return on a small-cap portfolio in excess of the return on a large-cap portfolio, $\lambda_{VALUE,t} = R_{VALUE,t} - R_{GROWTH,t}$ is the return on a value portfolio in excess of the return on a growth portfolio and $\upsilon_{GAS,t}$ is the mean-zero regression error, at time *t*. The alpha α_{GAS}^{FF} is still interpreted as the risk premium error. The three beta parameters give the sensitivities to the market, size and value factors. Finally, $\beta \times E(\lambda_{m,t}) + \beta_{SIZE} \times E(\lambda_{SIZE,t}) + \beta_{VALUE} \times E(\lambda_{VALUE,t})$ represents the risk premium from the Fama-French model.

The data for the market portfolio returns and the risk-free returns are the same used in the CAPM estimation. For the Canadian regressions, the small-cap portfolio returns are from a portfolio of all listed securities weighted equally whereas the large-cap portfolio returns are from a portfolio of all listed securities weighted by their market value.[13] The value and growth portfolios are determined from the earnings-to-price ratio. Specifically, the value (growth) portfolio contains firms having an earnings/price ratio in the highest (lowest) 30%.[14] For U.S. regressions, the size and value premiums are the Fama and French (1993, 1996a) SMB and HML variables, which are computed from market capitalization (size) and book-to-market ratio (value).[15] The annualized mean size and value risk premiums are respectively 8.9% and 6.4% for Canada from February 1985 to December 2006 and 2.7% and 6.0% for the U.S. from February 1973 to December 2006.

Table 3 presents the results of the estimates of the coefficients and the risk premium with the Fama-French model for the four gas distribution reference portfolios previously described. Panel A shows that the annualized risk premium errors are still positive for the four portfolios, ranging from 0.31% (for USindex) to 4.45% (for DJ_GasDi), but the underestimation is now statistically negligible. Panel D confirms that the inclusion of the value risk premium is instrumental in the reduction of the errors. The value betas are highly significant, with values between 0.30 and 0.71. The size betas (Panel C) are low and often not statistically different from zero, whereas the market betas (Panel B) are 0.54 on average. The estimated risk premiums vary between 4.23% and 8.83%.

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13 These indexes are taken from CFMRC for returns up to 2004 and then completed by the returns of the S&P/TSX Composite Index and the MSCI Barra Smallcap Index, respectively.

14 Data come from the web site of Prof. French, who also provides specific instructions on the composition of the portfolios. The site gives returns for value and growth portfolios based on four indicators – earnings-to-price, book-to-market, cash flows-to-price and dividend-to-price. Fama and French (1996a) show that these indicators contain the same information about expected returns. Fama and French (1998) confirm the relevance of these indicators in explaining the returns in 12 major international financial markets and emerging financial markets. We chose the earnings-to-price indicator because it is more effective in capturing the premium of value securities compared to growth securities in Canada (see Bartholdy, 1993, and Bourgeois and Lussier, 1994). The indicator book-to-market is less effective in Canada because the value effect is mainly concentrated in more extreme portfolios (highest and lowest 10%) than in those available on the site (see L'Her, Masmoudi and Suret, 2002).

15 Data again come from the web site of Prof. French. Detailed instructions on the composition of the SMB and HML variables are also provided.

TABLE 3
Fama-French Risk Premium Estimates for the Gas Distribution Reference Portfolios

Portfolio	Estimate	SE	t-stat	Prob > |t|
Panel A: Risk Premium Error (Alpha)				
DJ_GasDi	4.45	3.11	1.43	0.155
CAindex	2.04	1.85	1.11	0.270
DJ_GasUS	1.31	3.01	0.43	0.665
USindex	0.31	1.80	0.17	0.863
Panel B: Beta				
DJ_GasDi	0.41	0.08	5.06	<.0001
CAindex	0.48	0.05	10.38	<.0001
DJ_GasUS	0.63	0.07	9.64	<.0001
USindex	0.64	0.06	11.18	<.0001
Panel C: Size Beta				
DJ_GasDi	-0.01	0.08	-0.11	0.912
CAindex	-0.02	0.05	-0.51	0.613
DJ_GasUS	0.00	0.09	0.04	0.971
USindex	0.20	0.07	2.9	0.004
Panel D: Value Beta				
DJ_GasDi	0.33	0.06	5.12	<.0001
CAindex	0.30	0.04	7.64	<.0001
DJ_GasUS	0.59	0.13	4.41	<.0001
USindex	0.71	0.10	7.21	<.0001
Panel E: Risk Premium				
DJ_GasDi	5.64	1.78	3.17	0.002
CAindex	4.23	1.52	2.78	0.006
DJ_GasUS	8.83	2.32	3.81	0.000
USindex	8.64	2.16	4	<.0001

NOTES: This table reports the results of the estimation of the Fama-French model for the gas distribution reference portfolios. Panels A to E look at the annualized risk premium error or alpha (in percent), the market beta, the size beta, the value beta and the annualized risk premium (in percent), respectively. The columns labelled Estimate, SE, t-stat and Prob > |t| give respectively the estimates, their standard errors, their t-statistics and their p-values. The four gas distribution reference portfolios and their sample are described in section 2 and table 1. The annualized mean market risk premiums for their corresponding sample period are 8.1% for DJ_GasDi, 5.2% for CAindex, 7.5% for DJ_GasUS and 6.0% for USindex. The annualized mean size risk premiums for their corresponding sample period are 12.4% for DJ_GasDi, 8.9% for CAindex, 2.7% for DJ_GasUS and 2.7% for USindex. The annualized mean value risk premiums for their corresponding sample period are 7.4% for DJ_GasDi, 6.4% for CAindex, 6.9% for DJ_GasUS and 6.0% for USindex.

Figure 2 compares the Fama-French and CAPM results. Figure 2a illustrates the risk premium errors of the two models, while Figure 2b shows their explanatory power given by the adjusted R^2. The errors have substantially fallen with the Fama-French model for all reference portfolios. Furthermore, the Fama-French model explains a much larger proportion of the variation in the reference portfolio returns.

FIGURE 2
Comparison of the Fama-French and CAPM Results

Figure 2a: Risk Premium Errors

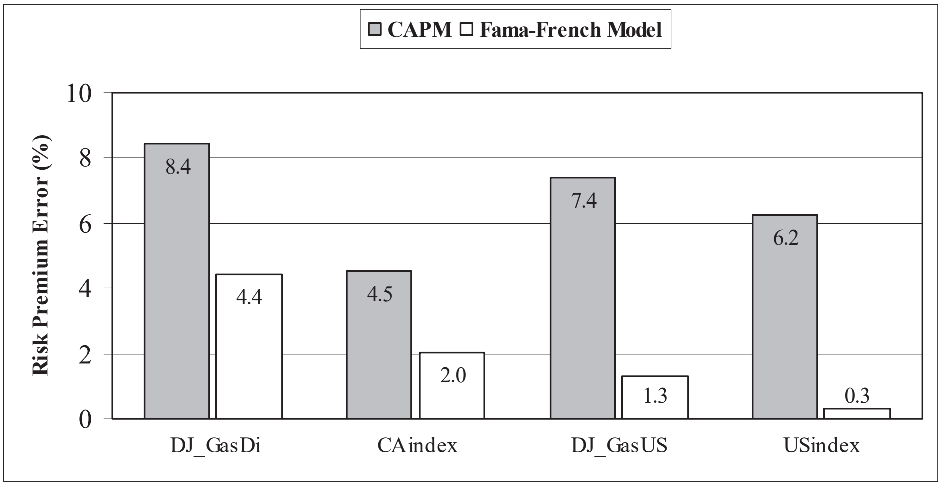
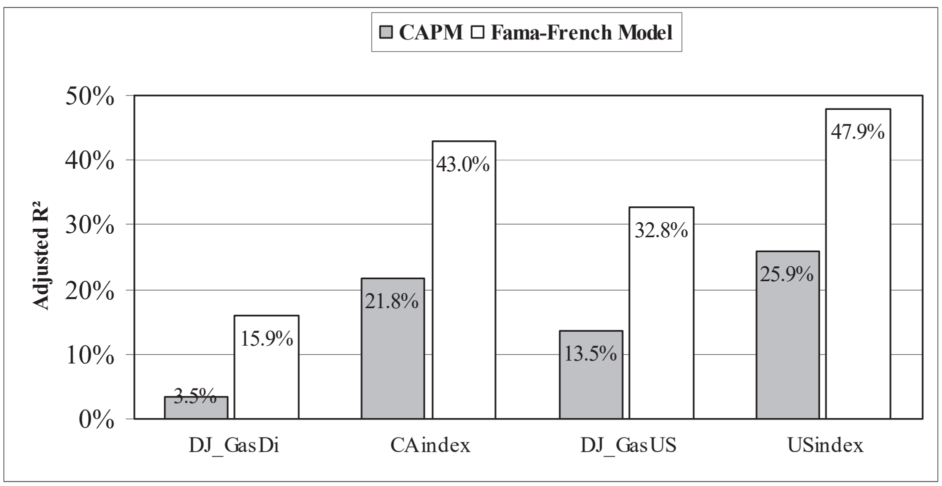


Figure 2b: Adjusted R²s



NOTES: This figure compares the results of the CAPM (gray bars) and the Fama-French model (white bars) in terms of annualized risk premium errors (or alphas) (Figure 2a) and adjusted R^2 (Figure 2b) for the gas distribution reference portfolios.

Figures 3 and 4 present the risk premium errors and the value betas, respectively, for the utilities that make up the CAindex portfolios (Figures 3a and 4a), the gas distributors in the USindex portfolios (Figures 3b and 4b) and the four utilities reference portfolios (Figures 3c and 4c). A comparison of Figure 3 with Figure 1 shows that the risk premium errors have decreased in all cases. None of the errors are now significantly different from zero. Figure 4 confirms that the reductions in the risk premium errors are caused by the inclusion of the value risk premium. All value betas are greater than 0.23 and statistically significant. For example, the TSX_Util portfolio has a value beta of 0.41 that contributes to reduce its risk premium error from 5.0% with the CAPM to 0.7% with the Fama-French model.

FIGURE 3
Risk Premium Errors with the Fama-French Model for Various Utilities

Figure 3a: Firms in the CAindex Portfolio

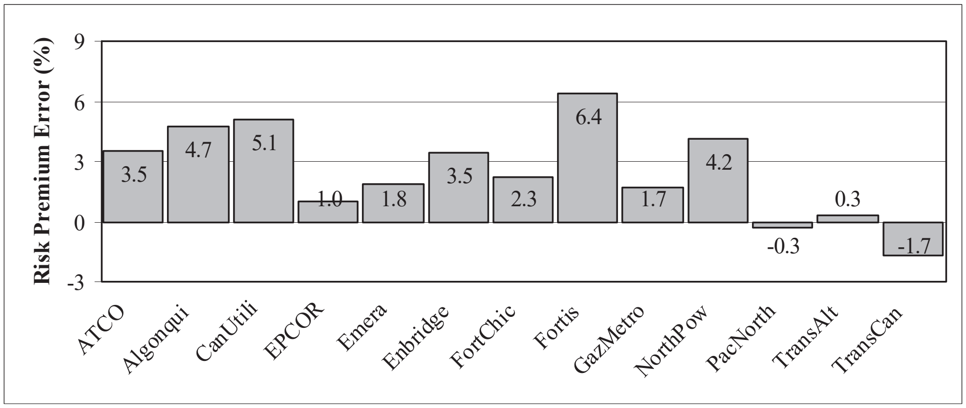


Figure 3b: Firms in the USindex Portfolio

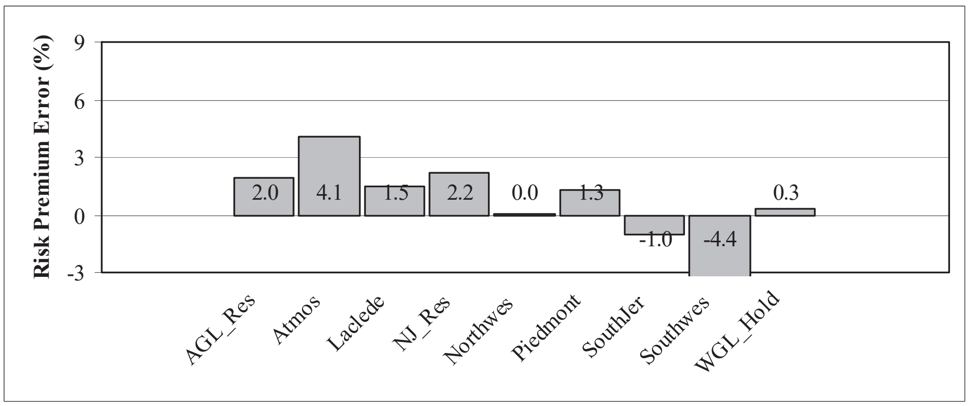
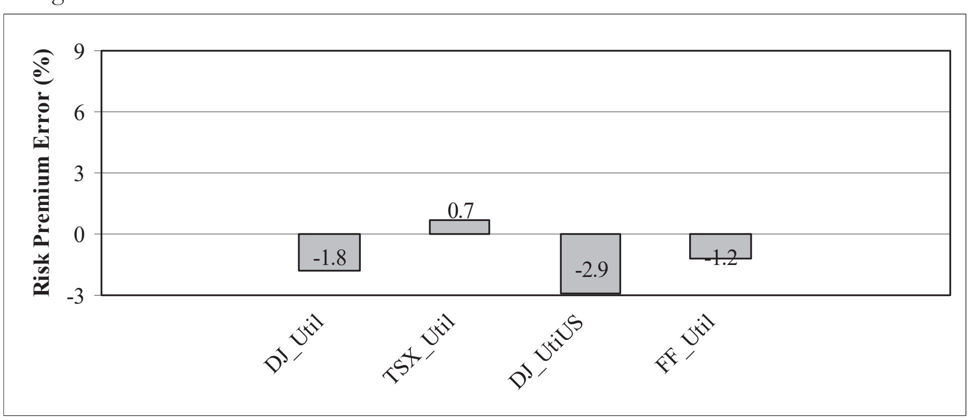


Figure 3c: Utilities Reference Portfolios



NOTES: This figure shows the annualized risk premium errors (or alphas) with the Fama-French model for the Canadian utilities in the CAindex portfolio (Figure 3a), the U.S. gas distributors in the USindex portfolio (Figure 3b) and the utilities reference portfolios (Figure 3c).

FIGURE 4
Value Betas for Various Utilities

Figure 4a: Firms in the CAindex Portfolio

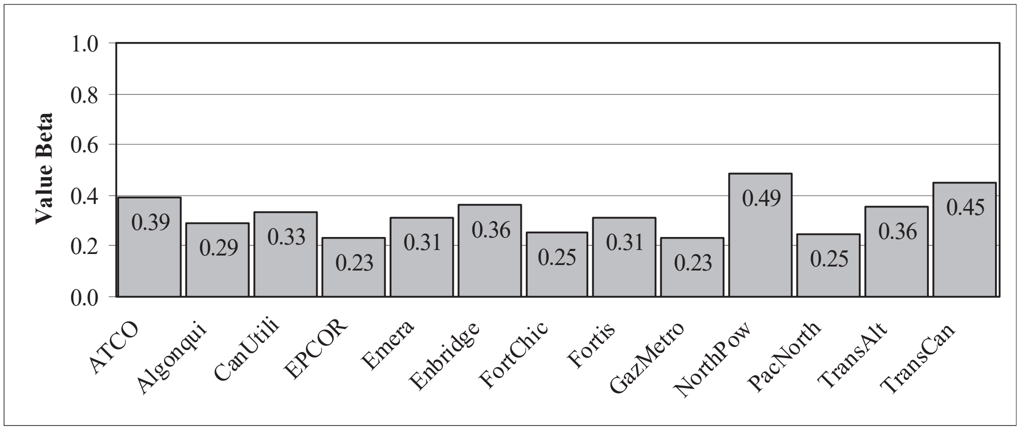


Figure 4b: Firms in the USindex Portfolio

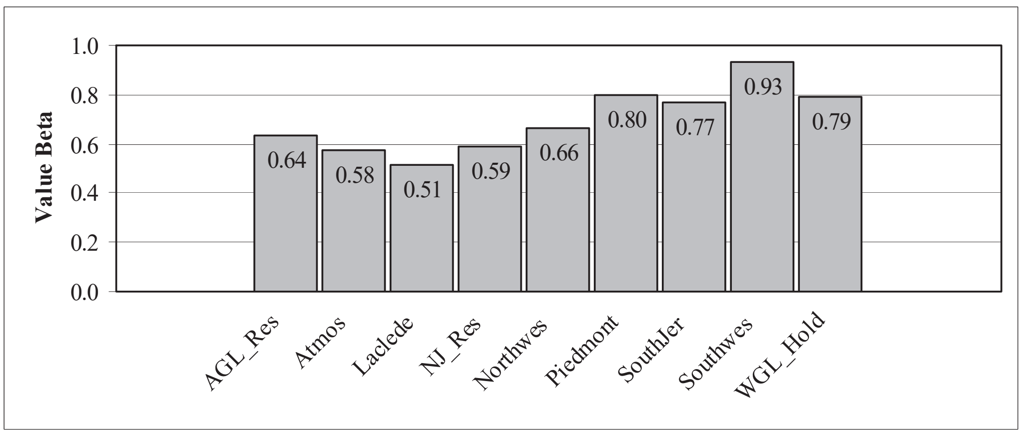
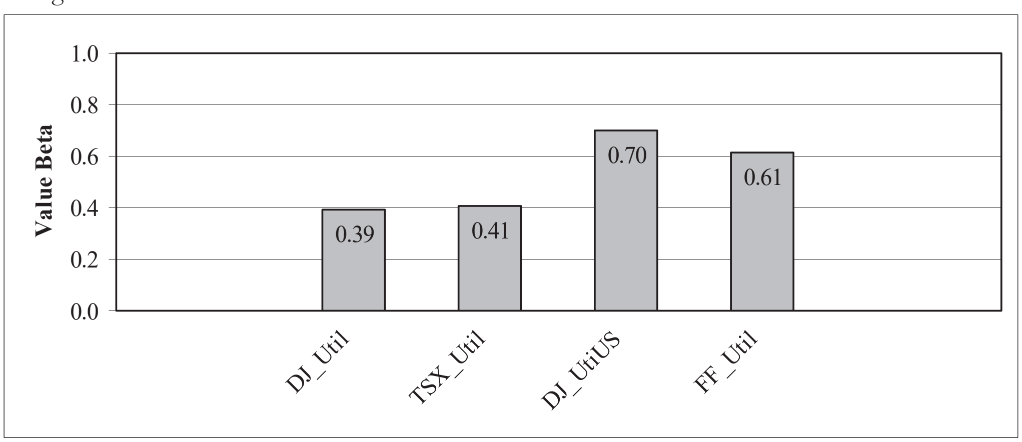


Figure 4c: Utilities Reference Portfolios



NOTES: This figure shows the value betas in the Fama-French model for the Canadian utilities in the CAindex portfolio (Figure 4a), the U.S. gas distributors in the USindex portfolio (Figure 4b) and the utilities reference portfolios (Figure 4c).

4.3. Discussion

Our results support the notion that the Fama-French model is well suited to estimate the risk premium for energy utilities, consistent with the findings of Schink and Bower (1994). We obtain lower risk premium errors with the Fama-French model than with the CAPM and significant value betas, similar to the results reported by Schink and Bower (1994), Fama and French (1997) and Pastor and Stambaugh (1999).

While the model is being increasingly considered in practice, an often mentioned limitation is that the economic interpretation of the size and value premiums is still under debate. On one side, starting with Fama and French (1993), the size and value factors are presented as part of a rational asset pricing model, where they reflect either state variables that predict investment opportunities following the theory of Merton (1973), or statistically useful variables to explain the returns following the theory of Ross (1976). On the other side, as first advocated by Lakonishok, Shleifer and Vishny (1994), the size and value factors are thought to be related to investors' irrationality in the sense that large-cap and growth stocks tend to be glamorized whereas small-cap and value stocks tend to be neglected. There is a vast literature on both sides of this debate.[16]

While the debate is important to improve our understanding of capital markets, Stein (1996) demonstrates that the theoretical interpretation of the model is not relevant to its application to determine the cost of capital. On one side, if the Fama-French model is rational, then the size and value factors capture true risks and should be accounted for in the risk premiums of energy utilities. On the other side, if the size and value factors are irrational, then the significant value betas of energy utilities indicate that they are neglected or undervalued firms. In this case, Stein (1996) shows that rational firms should not undertake a project that provides an expected return lower than the return estimated by the potentially irrational Fama-French model. They are better off in rejecting the project and simply buying back their own shares for which they expect an inflated future return because of the undervaluation. Thus, the potentially irrational Fama-French estimates serve as the appropriate hurdle rate for project investments. Hence, for both interpretations, the equity cost of capital of energy utilities generated by the Fama-French model is a useful guideline of a fair rate of return for regulators.

Arguably, the Fama-French model is one of the most widely used models of expected returns in the academic finance literature (Davis, 2006). Nevertheless, the literature on the cross-section of equity returns has identified numerous other factors that could be relevant in the multifactor approach. For examples, other influential factors include the labor income factor of Jagannathan and Wang (1996), the momentum factor of Jegadeesh and Titman (1993) and Carhart (1997), the liquidity factor of Pastor and Stambaugh (2003) and the idiosyncratic volatility factor of Ang *et al.* (2006, 2009). These advances in the literature on the cross-section of returns could eventually lead to a better understanding of the equity risk premium

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[16] A third interpretation, following Lo and MacKinlay (1990) and Kothari, Shanken and Sloan (1995), is that the results of the Fama-French model are spurious, due to biases like data snooping or survivorship. However, the fact that similar size and value premiums have been found in countries outside the U.S. has rendered this explanation less appealing.

for energy utilities.[17] The next section looks at a second approach that goes beyond the CAPM to estimate the equity risk premium.

5. Equity Risk Premium with the Adjusted CAPM

This section considers two empirical adjustments to the CAPM estimates proposed in the academic literature to account for their deficiencies. We call the CAPM with the addition of the two modifications the "Adjusted CAPM". Unlike the CAPM and the Fama-French model, the Adjusted CAPM is not an equilibrium model of expected returns. It contains adjustments to the CAPM that are empirically justified in a context where the known difficulties of a theoretical model need to be lessened for improved estimation. We first introduce the Adjusted CAPM. Then we implement it to estimate the risk premium of energy utilities. We finally offer a brief discussion of our findings.

5.1. Model and Literature

The Adjusted CAPM is based on the CAPM but provides more realistic estimates of the rate of return by considering the empirical problems of the CAPM. More specifically, the Adjusted CAPM is a model in which the expected equity return of a gas utility is arrived at by

$$E(R_{GAS}) = R_f + \alpha_{GAS} \times \left(1 - \beta^{Adj}\right) + \beta^{Adj} \times \lambda_m .$$

Compared to the CAPM, this equation incorporates a modification to take into account that estimated betas can be adjusted for better predictive power and a modification to take account of the fact the alpha (risk premium error) is high for low-beta value-oriented firms in the CAPM.

The first modification originates from the works of Blume (1971, 1975). Blume (1971) examines historical portfolio betas over two consecutive periods and finds that the historical betas, from one period to another, regress towards one, the average of the market. He also shows that the historical betas adjusted towards one predict future betas better than unadjusted betas. Blume (1975) builds a historical beta adjustment model to capture the tendency to regress towards one. He discovers that the best adjustment is to use a beta equal to $0.343 + 0.677 \times \beta^{His}$, a finding that led to the concept of "adjusted beta". Merrill Lynch, which popularized the use of adjusted betas based on Blume (1975)'s results, advocates the adjustment $\beta^{Adj} = 0.333 + 0.667 \times \beta^{His}$. Merrill Lynch's adjusted beta, now widely used in practice, represents a weighted-average between the beta of the market and the historical beta, with a two-thirds weighting on the historical beta.

The second adjustment is initially proposed by Litzenberger, Ramaswamy and Sosin (1980), who consider solutions to the problem that the CAPM gives a cost of equity capital with a downward bias for low beta firms, as discussed in section 3.1. They note that one way of remedying the problem is to add a bias correction to the CAPM risk premium. To be effective, the correction must take account of the

[17] Some of the documented effects, like momentum, are short-lived. Hence, their related factor might be irrelevant for estimates of the cost of equity capital.

importance of the risk premium error and the level of the firm's beta because these two elements influence the magnitude of the problem. To do this for low beta securities, Litzenberger, Ramaswamy and Sosin (1980) propose the bias correction $\alpha_{GAS} \times (1-\beta)$. As desired, the correction increases with the risk premium error of the CAPM, and decreases with the beta. The correction is nil for a firm for which the CAPM already works well (when $\alpha_{GAS} = 0$) or for a firm having a beta of one, two cases where the CAPM produces a fair rate of return on average. Morin (2006, Section 6.3) presents an application of this adjustment in regulatory finance through a model he calls the empirical CAPM.

In summary, the two modifications incorporated in the Adjusted CAPM involve first using the adjusted beta instead of the historical beta and second including the bias correction in the risk premium calculation. Considering the documented usefulness of the two adjustments, the Adjusted CAPM has the potential to estimate a reasonable risk premium for the energy utilities.

5.2. Risk Premium Estimates

To compute the Adjusted CAPM estimates for our utilities, the starting point is the estimates of the CAPM of Section 3.2, given in Table 2. The beta estimates are now understood as the unadjusted historical betas β^{His}. The gas utility risk premium with the Adjusted CAPM can then be expressed as

$$\alpha_{GAS} \times \left(1-\beta^{Adj}\right) + \beta^{Adj} \times E\left(\lambda_{m,t}\right),$$

where $\beta^{Adj} = 0.333 + 0.667 \times \beta^{His}$. The Adjusted CAPM risk premium error is arrived at by

$$\alpha_{GAS}^{Adj} = E\left(R_{GAS,t} - R_{f,t}\right) - \left[\alpha_{GAS} \times \left(1-\beta^{Adj}\right) + \beta^{Adj} \times E\left(\lambda_{m,t}\right)\right].$$

Table 4 shows the Adjusted CAPM estimates using the four gas distribution reference portfolios. The estimates of the risk premium error α_{GAS}^{Adj}, the adjusted beta β^{Adj}, the bias correction $\alpha_{GAS} \times \left(1-\beta^{Adj}\right)$ and the risk premium are shown in Panels A, B, C and D, respectively. The risk premium errors are still positive for the four portfolios, with values ranging from 1.39% (for CAindex) to 2.89% (for USindex), but the underestimation is only significant for USindex. The reduction in errors comes from the use of adjusted betas, which are 0.56 on average, and the bias corrections, which are 2.96% on average. Lastly, the risk premiums vary between 4.88% and 8.27%, findings comparable to the estimates obtained with the Fama-French model.

TABLE 4
Adjusted CAPM Risk Premium Estimates
for the Gas Distribution Reference Portfolios

Portfolio	Estimate	SE	t-stat	Prob > |t|
Panel A: Risk Premium Error (Alpha)				
DJ_GasDi	1.82	2.00	0.91	0.365
CAindex	1.39	1.54	0.9	0.366
DJ_GasUS	2.68	1.97	1.36	0.176
USindex	2.89	1.37	2.11	0.035
Panel B: Adjusted Beta				
DJ_GasDi	0.47	0.07	6.69	<.0001
CAindex	0.56	0.05	11.38	<.0001
DJ_GasUS	0.58	0.06	9.84	<.0001
USindex	0.64	0.04	15.44	<.0001
Panel C: Bias Correction				
DJ_GasDi	4.46	2.28	1.96	0.052
CAindex	1.99	1.10	1.81	0.071
DJ_GasUS	3.12	1.61	1.94	0.054
USindex	2.26	0.77	2.94	0.004
Panel D: Risk Premium				
DJ_GasDi	8.27	2.71	3.05	0.003
CAindex	4.88	2.11	2.31	0.021
DJ_GasUS	7.45	2.52	2.96	0.004
USindex	6.05	1.89	3.21	0.002

NOTES: This table reports the results of the estimation of the Adjusted CAPM for the gas distribution reference portfolios. Panels A to D look at the annualized risk premium error or alpha (in percent), the adjusted market beta, the bias correction and the annualized risk premium (in percent), respectively. The columns labelled Estimate, SE, t-stat and Prob > |t| give respectively the estimates, their standard errors, their t-statistics and their p-values. The four gas distribution reference portfolios and their sample are described in section 2 and table 1. The annualized mean market risk premiums for their corresponding sample period are 8.1% for DJ_GasDi, 5.2% for CAindex, 7.5% for DJ_GasUS and 6.0% for USindex.

Figure 5 shows the risk premium errors for the utilities that make up the CAindex portfolios (Figure 5a), the gas distributors in the USindex portfolios (Figure 5b) and the four utilities reference portfolios (Figure 5c). The errors are generally insignificant and a comparison with Figure 1 indicates that they have decreased considerably for all portfolios. For example, for the TSX_Util portfolio, the error is down from 5.0% with the CAPM to 0.9% with the Adjusted CAPM.

FIGURE 5
Risk Premium Errors with the Adjusted CAPM for Various Utilities

Figure 5a: Firms in the CAindex Portfolio

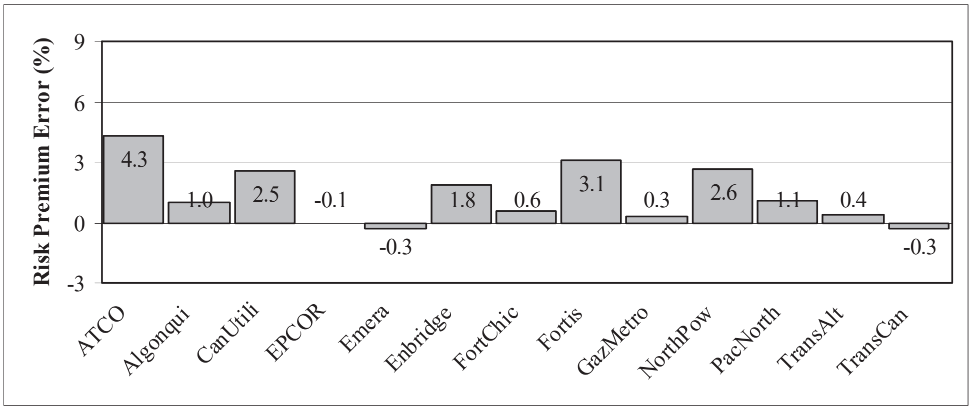


Figure 5b: Firms in the USindex Portfolio

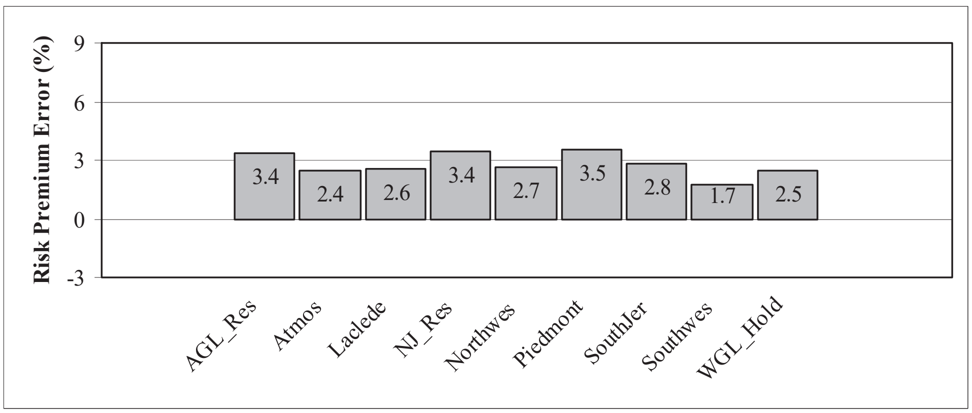
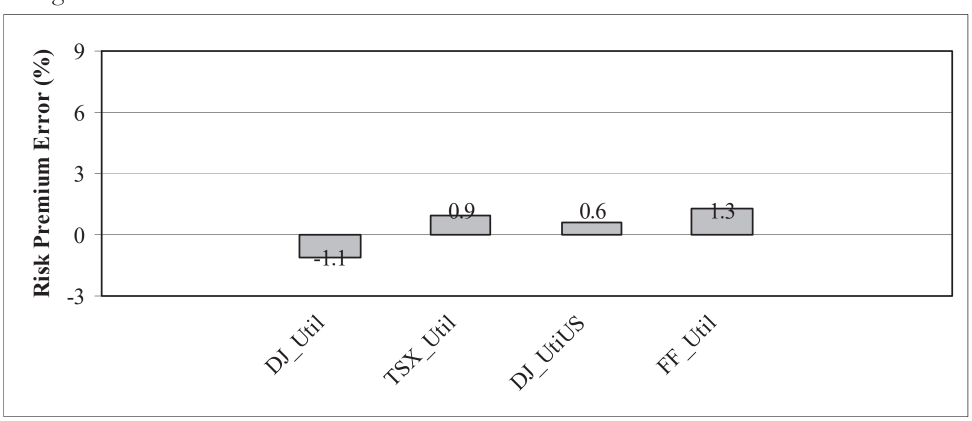


Figure 5c: Utilities Reference Portfolios



NOTES: This figure shows the annualized risk premium errors (or alphas) with the Adjusted CAPM for the Canadian utilities in the CAindex portfolio (Figure 5a), the U.S. gas distributors in the USindex portfolio (Figure 5b) and the utilities reference portfolios (Figure 5c).

5.3. Discussion

Our results support the validity of the Adjusted CAPM for determining the rate of return on energy utilities. While its risk premium estimates are in the same range as the Fama-French estimates, it arrives at its results from a different perspective. The Fama-French model advocates the use of additional risk factors to reduce the CAPM risk premium errors. The Adjusted CAPM, through its bias correction, effectively estimates the risk premium as a weighted-average of the CAPM risk premium and the realized historical risk premium, with a weighting of beta on the former.

The Adjusted CAPM thus recognizes that the CAPM is an imperfect model that can be improved with the information contained in the historical returns. Pastor and Stambaugh (1999) propose a similar strategy by demonstrating how to estimate the cost of equity by using Bayesian econometrics to incorporate the CAPM risk premium error (or alpha) in an optimal manner based on the priors of the evaluator. Consistent with our results, they also show evidence of higher costs of equity for energy utilities using their technique than using the CAPM alone.[18] As the Adjusted CAPM does not require additional risk factors like size and value, the model might be easier to interpret for regulators already familiar with the standard CAPM in their decisions.

6. Conclusion

It is difficult to overstate the importance of the evaluation of the expected rate of return in finance. For a firm's management group, the expected rate of return on equity (or the equity cost of capital) is central to its overall cost of capital, i.e. the rate used to determine which projects will be undertaken. For portfolio managers, the expected rate of return on equity is an essential ingredient in portfolio decisions. For regulatory bodies, the expected return on equity is the basis for determining the fair and reasonable rate of return of a regulated enterprise. This paper is interested in evaluating the rate of return in the context of regulated energy utilities.

The academic literature contains numerous theories for determining the expected rate of return on equity. As those theories are based on simplified assumptions of the complex world in which we live, they cannot be perfect. Even if the theoretical merit of the different models can be debated, the determination of the most valid approach to explain the financial markets really becomes an empirical question – it is necessary to answer the question "which theory best explains the information about actual returns?" This paper empirically examines the validity of the model the most often used in the rate adjustment formula of regulatory bodies, the CAPM, one of the most prominent academic alternatives, the Fama-French model, and a version of the CAPM modified to account for some of its empirical deficiencies, the Adjusted CAPM.

Our empirical results show that the risk premiums for energy utilities estimated with the CAPM are rejected as too low compared to the historical risk premiums.

[18] Pastor and Stambaugh (1999) obtain risk premiums that vary between the CAPM estimates, when they assume that there is zero prior uncertainty on the CAPM, and the historical estimates, when they assume that there is infinite prior uncertainty on the CAPM. Our bias correction corresponds approximately to a prior uncertainty on the CAPM between 3% and 6% in their setup.

The rejections are related to the well-documented CAPM underestimation of the average returns of low-beta firms and value firms. The Fama-French model and the Adjusted CAPM appear statistically better specified, as we cannot reject the hypothesis that their risk premium errors are equal to zero. They suggest equity risk premiums for gas distribution utilities between 4% and 8%. Overall, our findings demonstrate that models that go beyond the CAPM have the potential to improve the estimation of the cost of equity capital of energy utilities. They are thus interesting avenues for regulators looking to set fair and reasonable equity rates of return.

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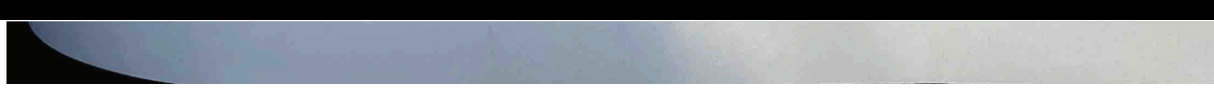

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May 21, 2024

Trisha Osborne
Assistant Commission Secretary
Public Utilities Commission of Nevada
1150 E. William Street
Carson City, NV 89701

Re: Docket No. 24-02026 – Application of Sierra Pacific Power Company d/b/a NV Energy for authority to adjust its annual revenue requirement for general rates charged to all classes of electric customers and for relief properly related thereto.

Dear Ms. Osborne:

Please find enclosed for filing, the Prepared Direct Testimony of Lance D. Kaufman on behalf of Smart Energy Alliance, Peppermill Casinos Inc., and Caesars Enterprise Services, LLC.

Certain information provided with Lance D. Kaufman's direct testimony is sensitive and is subject to protection pursuant to NRS 703.190. Specifically, page 43, line 7 contains confidential equity ratio information.

Pursuant to NAC 703.5274(1), one unredacted copy of the confidential information will be filed with the Commission's Secretary in a separate envelope stamped "confidential." Redacted versions of confidential information will be submitted for processing and posting onto the Commission's public website.

Pursuant to NAC 703.5274(2), Smart Energy Alliance, Peppermill Casinos Inc., and Caesars Enterprise Services, LLC request that this information remain confidential for a period of five years after which the information may be destroyed or returned.

If you have any questions regarding this filing, please do not hesitate to contact me.

Very truly yours,

/s/Laura K. Granier
Laura K. Granier
Partner
of Holland & Hart LLP

Very truly yours,

/s/Curt R. Ledford
Curt R. Ledford
Attorney, Davison Van Cleve, PC

Very truly yours,

/s/Lucas M. Foletta
Lucas M. Foletta
McDonald Carano, LLP

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BEFORE THE PUBLIC UTILITIES COMMISSION OF NEVADA

Application of Sierra Pacific Power Company d/b/a NV Energy for authority to adjust its annual revenue requirement for general rates charged to all classes of electric customers and for relief properly related thereto.)	Docket No. 24-02026

PREPARED DIRECT TESTIMONY OF LANCE D. KAUFMAN

ON BEHALF OF

SMART ENERGY ALLIANCE, PEPPERMILL CASINOS INC., and

CAESARS ENTERPRISE SERVICES, LLC

May 21, 2024

TABLE OF CONTENTS TO THE
PREPARED DIRECT TESTIMONY OF LANCE D. KAUFMAN

EXHIBIT LIST

I. INTRODUCTION AND SUMMARY

Q.1 PLEASE STATE YOUR NAME AND OCCUPATION.

A.1 My name is Lance D. Kaufman. I am a consultant representing utility customers before state public utility commissions in the Northwest, Southwest, and Intermountain West. My witness qualification statement can be found at Exhibit Kaufman-Direct-1.

Q.2 PLEASE IDENTIFY THE PARTY ON WHOSE BEHALF YOU ARE TESTIFYING.

A.2 I am testifying on behalf of the Smart Energy Alliance ("SEA"), Peppermill Casinos Inc. ("Peppermill"), and Caesars Enterprise Services, LLC ("Caesars"). SEA is a Nevada nonprofit trade association dedicated to advocating for the energy interests of its members. SEA members include large energy users and retail customers of Sierra Pacific Power Company ("SPPC" or "Company") who will be directly affected by the rates established in this proceeding. Peppermill and Caesars are some of the largest energy users in Nevada.

Q.3 WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A.3 I am providing testimony on SPPC's cost of capital application.

Q.4 PLEASE SUMMARIZE YOUR RECOMMENDATIONS.

A.4 I make the following recommendations:

- The Commission should adopt: (i) a 9.25 percent cost of equity; (ii) a 4.89 percent cost of debt; (iii) a 50 percent equity hypothetical capital structure; and (iv) a 7.07 percent weighted average cost of capital.

Q.5 WOULD THE COMMISSION'S ADOPTION OF SPPC'S PROPOSED INCREASE IN ROE IMPOSE SIGNIFICANT AND UNREASONABLE COSTS ON CUSTOMERS?

A.5 Yes. SPPC's current authorized rate of return is 6.95% and SPPC has requested this be increased to 7.93% in its certification filing.[1] SPPC's requested change increases revenue requirement by **$25 million**.[2] SPPC's request increases its authorized return on equity ("ROE") from 9.5% to 10.4%. My analysis shows that SPPC's cost of equity should be decreased to 9.25, but that SPPC's weighted average cost of capital be increased to 7.07 percent.

Q.6 WHY DO YOU RECOMMEND A COST OF EQUITY OF 9.25 PERCENT?

A.6 This recommendation is based on the application of the Discounted Cash Flow ("DCF") model, the Capital Asset Pricing Model ("CAPM"), and the Empirical CAPM ("ECAPM"). I found that after updating SPPC's assumptions to reflect current data and modern finance literature, these models support a reasonable ROE range from 8.5 to 9.5. I recommend 9.25 as the authorized ROE because it is the midpoint of three of four financial models, and because will provide a smooth transition from SPPC's current excessive ROE to a more reasonable ROE of 9 percent in future rate proceedings.

Q.7 WHY DO YOU RECOMMEND A DECREASE IN THE COST OF EQUITY?

A.7 The primary consideration in determining whether an authorized ROE is sufficient to meet investor expectations for investments of equivalent risk should be whether it is sufficient to assure the financial integrity of the utility, to maintain credit, and to attract capital.[3] It is

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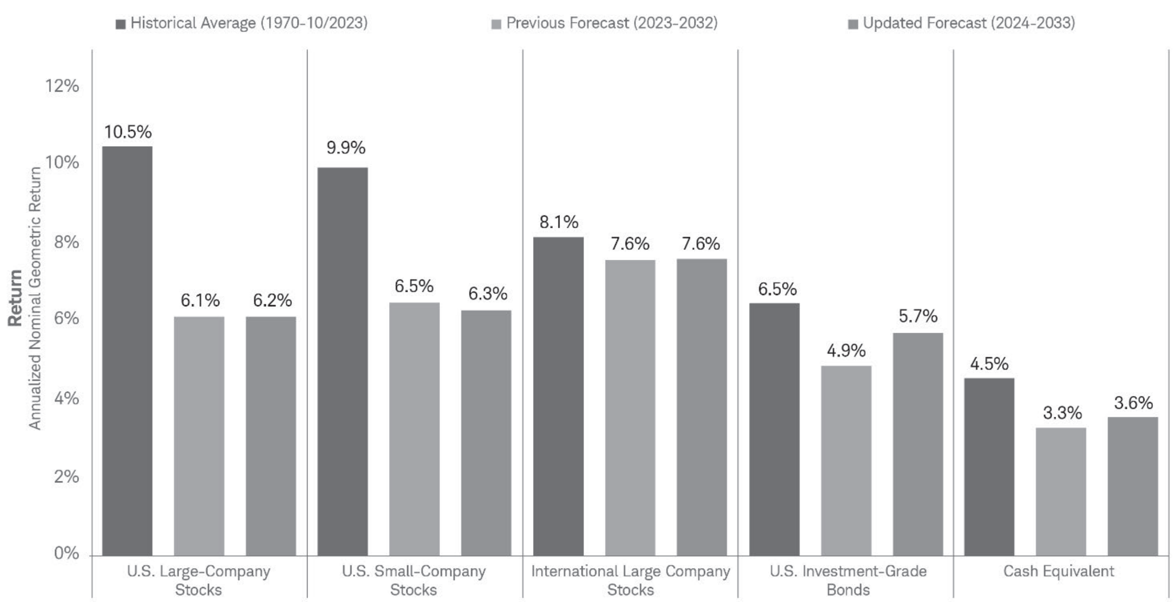
[1] Table Behrens CERTIFICATION - 1.

[2] This change only includes return on rate base and tax impacts. I have not calculated the impact on other revenue-sensitive factors.

[3] *Federal Power Commission v. Hope Natural Gas Co.*, 320 US 591, 602 (1944).

generally agreed that utilities are less risky equity investments relative to the average publicly traded company. The returns for equity markets are expected to be lower in the future than they have been historically. Charles Schwab forecasts the total returns for US large and small company stocks to be 6.2 and 6.3 percent on average over the next ten years.[4] This is well below the 10.5% average historic returns for US stocks. Given that the 10-year market returns for US stocks are expected to average 6.2-6.3 percent, and that utility companies are less risky than average, it is highly likely that the returns investors expect are less than 6.2 percent on average from utility stocks. The Figure below reproduces Charles Schwab's current market return forecast.[5]

Figure LK-1: Return on Equity Summary



[4] Emre Erdogan & Seth McMoore, Schwab's 2024 Long-Term Capital Market Expectations Schwab (2024). Available at, https://www.schwab.com/learn/story/schwabs-long-term-capital-market-expectations.

[5] *Id.*

My cost of equity analysis, which includes assumptions that lead to conservatively high ROE estimates, and which relies on current market conditions, demonstrates that in the near-term investors expect returns in the range of 8.5 to 9.5 percent. This is well above expected market returns. The current authorized ROE of 9.5 percent is at the top of this range. However, maintaining ROE at the current level is inconsistent with investor expectations about long run returns. The Commission should begin moving returns towards long run expectations now to smooth the transition to lower expected equity returns. This will signal to investors that they should not rely on Commission benevolence to foster excess returns in the face of declining capital costs.

In addition to the importance of providing proper signals to investors, my recommendation considers the relationship between the equity ratio of the proxy group and the equity ratio recommended in my testimony. The average equity ratio of the proxy group used in my cost of capital models is 42 percent.[6] I recommend a 50 percent equity ratio. My recommended equity ratio is materially higher than the average equity ratio of the proxy group. The cost of equity decreases by 0.8 to 1.4 percent per 10 percent increase in equity ratio.[7] While 9.5 percent may be on the edge of reasonable for firms with 42 percent equity, it is too high for a utility with a 50 percent equity share. This means the authorized ROE should not be set at 9.5 percent if the Commission approves an equity ratio of 50 percent. Furthermore, if the Commission approves SPPC's requested equity ratio of 55.19 percent, the Commission should pair this with an ROE of 8.85 percent, which reflects the lower risk associated with SPPC's excessive equity ratio.

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[6] SPPC's requested equity ratio is 55.19 percent.

[7] Morin, R. A. (2006). *New Regulatory Finance*. Austria: Public Utilities Reports, p. 469.

An independent test of whether a 9.25 percent ROE can continue to attract capital is demonstrated by Consolidated Edison Company of New York. This company has authorized ROE of 9.25 percent. However, the price-to-book ratio for this company has averaged 1.5. This means that when the market is willing to pay $1.5 dollars for per dollar of equity recorded in the Company's books. As a result, Consolidated Edison can attract equity capital on favorable terms.

Q.8 WHY IS IT IMPORTANT TO PROVIDE A SMOOTH TRANSITION TO LOWER COSTS OF EQUITY?

A.8 Investors understand that the profits of regulated utilities are impacted by Commission authorized ROEs. A utility stock's current market price reflects investor expectations about future Commission decisions. When investors expect Commission authorized ROE to exceed the ROE necessary to attract capital, investors will purchase the company's stock until the realized ROE equals the necessary ROE. For example, consider a company with equity share of rate base equal to book value of equity. If the authorized ROE equals the necessary ROE, the price of the stock will adjust until the market value of the stock equals the book value of the stock. If the necessary ROE declines over time, but the authorized ROE does not follow suit, the stock price of the company will increase. As the stock price increases, the realized ROE from holding the stock will decline below the authorized ROE, until the realized ROE equals the necessary ROE. Investors who held the stock before the price increase will experience excess returns, or windfall profits. However, if, after some time, the Commission revises its authorized ROE to reflect the necessary ROE, the stock price will decrease back to its original level. Investors who purchased stock at the elevated prices will feel "short-changed" because they valued the stock under incorrect expectations.

I recommend that the Commission gradually reduce the Company's ROE to prevent investors from holding ill-conceived forecasts about authorized ROEs exceeding necessary ROEs and receiving shocks when such forecasts are shown to be incorrect.

Q.9 IF INVESTORS EXPERIENCE SUCH A SHOCK WHEN AUTHORIZED ROE IS LOWERED, AND COMPLAIN ABOUT UNFAIR TREATMENT BY REGULATORS, IS THIS A SIGN THAT REGULATORS MADE AN UNFAIR DECISION?

A.9 No. It is important to distinguish between investor forecasts of regulatory treatment and investor expectations about returns on equivalent investments. As long as the ROE authorized by the regulator is consistent with the expected returns indicated by overall market conditions, it is not unfair for the Commission to deviate from investor forecasts about regulatory treatment. The Company points to the ICC's recent treatment of Ameren Illinois Co. and ComEd (publicly traded as Ameren Corp. and Exelon Corp. respectively) as evidence that deviating from expected regulatory treatment is problematic, noting that such treatment caused the stock prices to decline 11 to 15 percent.[8]

Such stock declines are certainly shocking and may be disappointing for investors holding the stock. However, these shocks occurred not because the ICC authorized an insufficient ROE, but because investors had inaccurate expectations about regulatory treatment. Ameren Corp. and Exelon Corp. both remain financially stable with stock prices well above book value. Both companies were in the peer group used in my models and the ROE approved for Ameren and ComEd are within the range that I find reasonable for the peer group that includes them. There is no indication that Ameren Illinois Co. or ComEd are having difficulty attracting capital. Thus, while the authorized ROEs were lower than average, and the

[8] Bulkley-DIRECT, p. 137 at l. 5-12.

decision upset shareholders, the decrease in stock price is simply evidence that the stock was overvalued, and not evidence that the authorized ROE was too low.

Q.10 SHOULD THE COMMISSION BE CONCERNED THAT YOUR RECOMMENDED ROE IS LOWER THAN AVERAGE AUTHORIZED ROES?

A.10 No. My recommended ROE is well above the authorized ROEs for Amaren and ComEd, and consistent with the authorized ROE for many financially sound utilities. This recommendation is even conservatively high to allow for a smooth transition from SPPC's current excessive ROE to a more reasonable ROE of 9 percent in future rate proceedings. It is consistent with investor expectations about the average direction for US equities while still providing SPPC's investors with returns in excess of that necessary for investments of comparable risk.

Q.11 WHAT ARE THE IMPACTS OF YOUR RECOMMENDATIONS ON SPPC'S REVENUE REQUIREMENT?

A.11 My ROE recommendation reduces SPPC's revenue requirement by $17.6 million relative to the certification filing. My capital structure recommendation reduces SPPC's revenue requirement by $7.8 million relative to the certification filing. Together these recommendations reduce SPPC's revenue requirement by $25.3 million relative to the certification filing.[9]

II. COST OF EQUITY

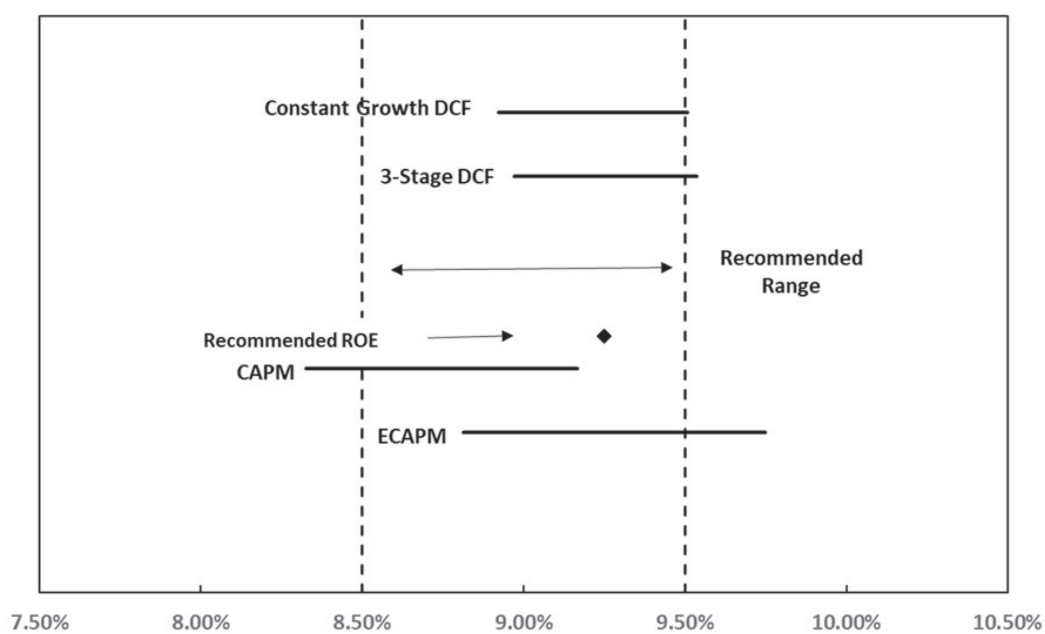
Q.12 PLEASE SUMMARIZE YOUR COST OF EQUITY TESTIMONY.

A.12 I analyzed SPPC's cost of capital using constant growth discounted cash flow models, three stage discounted cash flow models, capital asset pricing models, and empirical capital asset pricing models. These models employ similar methodologies as those found in SPPC's direct

[9] This change is approximate and may not include all revenue sensitive factors.

testimony. However, for each model, I use more appropriate input parameters than SPPC. For each model I examined a range of inputs, and I used this variation to establish that a reasonable range for SPPC's ROE is 8.5 percent to 9.5 percent. This range captures one or more variants of each ROE model that I evaluated. I recommend SPPC's authorized ROE be set at slightly above the midpoint of this range, at 9.25 percent. This recommendation reflects the midpoint of three models. It is also consistent with my recommended 50-50 capital structure. If the Commission approves SPPC's requested equity ratio of 55 percent, I recommend reducing the authorized ROE 8.85 percent to account for reduced investment risk associated with higher equity ratios. The figure below provides an update to Ms. Ann Bulkley's ROE estimations to illustrate my estimates, recommended range, and recommended ROE.

Figure LK-2: Return on Equity Summary



Q.13 WHAT PROXY GROUP DO YOU USE FOR YOUR ANALYSIS?

A.13 I use SPPC's proxy group for combination utilities. This provides an ROE estimate that can be appropriately applied to both SPPC's gas and electric operations, and is consistent with SPPC's request for consolidated capital treatment.[10]

Q.14 SHOULD THE COMMISSION CONTINUE TO CONSIDER THE BOND YIELD PLUS PREMIUM MODEL?

A.14 No. The Commission has recently issued findings relying on the bond yield plus premium model.[11] This model has critical flaws and should not be used for estimating investor expectations. The primary reason for this is that the model does not leverage any market information about the cost of equity. Bond yields do not reflect equity costs. Authorized ROEs reflect prior Commission decisions across the US. These decisions are not direct measures of investor expectations and are not forward looking. This is distinctly different from DCF and CAPM models because these models are self-correcting in that market prices adjust to account for deviations between commission authorized ROEs and investor expectations for ROEs.

A second major concern with the Bond Yield model is that its error is serially correlated. The bond yield model is an ordinary least squares ("OLS") regression model. One of the key assumptions of OLS models is that errors are independently distributed. However, there is a very high correlation between the error in time t and time t-1 of the bond yield model.[12] The average error for 2023 is substantial, and the model over-forecasted ROE in the last quarter of 2023 by 82 basis points. If SPPC's bond-yield model is adjusted to account for this the estimate, it reduces from a range of 10.55 to 10.26 percent to a range of 9.73 to 9.44

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[10] Behrens-DIRECT, p. 14 at l. 15-24.
[11] Docket 22-06007 ¶90.
[12] Correlation coefficient of .5.

percent. Regardless, because this model does not directly rely on investor expectations, the results of this model should be discarded.

Q.15 WHAT DRIVES THE DIFFERENCES BETWEEN YOUR ROE RESULTS AND SPPC'S?

A.15 The primary difference between SPPC's approach to ROE and my approach to ROE is that I account for both short and long-term growth rates and I use betas that have substantially lower forecast error compared to those of SPPC. I also limit my analysis to cost of capital models that have sound theoretical basis and are supported by finance research.

SPPC's models rely heavily on analyst forecasts from Value Line, Yahoo, and Zachs. These forecasts are used for SPPC's DCF, CAPM, and ECAPM models to represent growth indefinitely into the future. Even if these forecasts are found not to be biased,[13] the forecasts reflect short run expectations and are inappropriate for modeling growth beyond 5 years. SPPC's models apply these short run forecasts to growth indefinitely into the future. This is the primary reason why SPPC anticipates market returns of 12.55 percent while more reputable sources, such as Kroll[14] and Charls Schwab[15] anticipate market returns from 6 to 9 percent.

SPPC's use of analyst forecasts, and SPPC's other cost of capital inputs, bias cost of equity estimates higher than that expected or required to attract capital. I have identified the following issues with SPPC's models:

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[13] Analyst forecasts have been found to be overly optimistic and statistically biased. Szakmary, Andrew; Conover, C. Mitchell; and Lancaster, Carol, "An Examination of Value Line's Long-term Projection" (2008). *Finance Faculty Publications*, p. 30. Available at: https://scholarship.richmond.edu/finance-faculty-publications, p.30.

[14] https://www.kroll.com/en/insights/publications/cost-of-capital/recommended-us-equity-risk-premium-and-corresponding-risk-free-rates

[15] Emre Erdogan & Seth McMoore, Schwab's 2024 Long-Term Capital Market Expectations Schwab (2024). Available at: https://www.schwab.com/learn/story/schwabs-long-term-capital-market-expectations

1. Constant growth DCF model relies on short term growth forecast rather than a rate that represents both short and long-term growth.
2. No three stage DCF model contemplated.
3. Risk Premium in CAPM and ECAPM model greatly exceed investor consensus.
4. Risk Premium derived by relying on short term growth forecasts only without considering long term expectations.
5. Risk Premium derived using asymmetric filter of analyst forecasts.
6. Beta forecasts in CAPM and ECAPM are biased towards 1, and have very high forecast error.

Q.16 HOW DO YOU AVOID THE RISK OF BIASED ESTIMATES?

A.16 I reduce bias by validating the results of my models with independent estimates. My estimates are consistent with the Kroll's estimated market return.[16] My estimate also greatly exceeds Charles Schwab's current 10-year projection for market returns.[17] While I reduce bias, some bias remains. In an abundance of caution, I intentionally retain some biased model inputs that lead to over-estimation of ROE.[18] This allows for a margin of error and to smooth the transition from the currently excessive ROE to a fair ROE.

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[16] https://www.kroll.com/en/insights/publications/cost-of-capital/recommended-us-equity-risk-premium-and-corresponding-risk-free-rates

[17] Emre Erdogan & Seth McMoore, Schwab's 2024 Long-Term Capital Market Expectations Schwab (2024), https://www.schwab.com/learn/story/schwabs-long-term-capital-market-expectations

[18] Specifically, in the DCF model I use the US 30 year treasury bond yield to reflect long term growth rates even though it is 30 percent higher than the expected growth rate for US GDP. In the CAPM and ECAPM models, I use SPPC's short term forecast without accounting for long run growth rates. I also adjust betas towards a conservatively high industry average beta rather than towards a historically accurate industry average beta.

Q.17 HOW IS THIS SECTION ORGANIZED?

A.17 I present the results of the Constant Growth DCF, Three Stage DCF, CAPM, and ECAPM models in sequence. The discussion of each model includes a description of the differences between my method and SPPC's method.

a. Discounted Cash Flows

Q.18 WHAT ARE THE RESULTS OF YOUR DISCOUNTED CASH FLOW ANALYSIS?

A.18 My discounted cash flow models estimate an ROE range from 8.92 percent to 9.54 percent. This result is derived from SPPC's combination proxy group and a growth rate that reflects average growth over the short and long run.

Q.19 HOW ARE SPPC'S DCF MODELS MATHEMATICAL IMPLAUSIBLE & ACCORDING TO FERC PRECEDENT UNRELIABLE?

A.19 SPPC's constant growth model assumes that analyst's short term (1-5 year) growth forecasts continue indefinitely. This assumption is mathematically implausible because these growth rates exceed the long term forecasted growth rate for the US economy. Under SPPC's assumption, every proxy firm's earnings will eventually exceed the US GDP, which is clearly implausible. The FERC has found that "performing a DCF analysis a projection of growth rates limited to five years, with no evidence of what is anticipated beyond that point, is inconsistent with the DCF model and cannot be relied on in a DCF analysis."[19] I assume that short term forecasts are valid for 5 years, and that growth rates converge on a linear path to a long term economic growth rate within 25 years. This growth profile is identical to that recommended in

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[19] Northwest Pipeline Corp., 79 F.E.R.C. P 61,309, 62,385 (1997). *See also,* Transcontinental Gas Pipe Line Corp., 84 F.E.R.C. P 61,084, 61,423 (1998).

the standard text New Regulatory Finance.[20] The constant growth rate is assumed to equal the average growth rate from years 1 through 30. This results in a constant growth rate assumption that reasonably balances near term and long-term expectations.

I model two long term growth scenarios, one based on the US Congressional Budget Office long term forecast for US GDP,[21] and one based on 30-year treasury bill yields. I also model the cost of equity using a three-stage DCF model. This model uses identical growth rate assumptions, but uses the variable yearly growth rates rather than a constant growth rate based on the 30 year average. The table below summarizes the results of these models:

Table LK-3: Discounted Cash Flow ROE Estimates

Constant Growth DCF		
30-Day Average	8.92%	9.51%
90-Day Average	8.99%	9.48%
180-Day Average	8.95%	9.51%
Average	8.95%	9.50%
Three Stage DCF		
30-Day Average	9.21%	9.54%
90-Day Average	9.17%	9.50%
180-Day Average	8.97%	9.30%
Average	9.12%	9.45%

Q.20 WHY DO YOU USE THE US CBO GDP GROWTH RATE?

A.20 The long-term GDP growth rate is typically used to represent the terminal growth rate in DCF models.[22] The standard three stage DCF model relies on a long run economic growth forecast

[20] Morin, R. A. (2006). *New Regulatory Finance*. Austria: Public Utilities Reports, p. 311.
[21] https://www.cbo.gov/publication/59711
[22] Morin, R. A. (2006). *New Regulatory Finance*. Austria: Public Utilities Reports, p. 311. *See also*, Northwest Pipeline Corp., 79 F.E.R.C. P 61,309, 62,385 (1997) and Transcontinental Gas Pipe Line Corp., 84 F.E.R.C. P 61,084, 61,423 (1998).

for the final stage.[23] The US CBO GDP forecast is a reliable, unbiased, and highly vetted forecast for US GDP.[24] The average GDP growth from 2035 to 2054 is 3.64 percent per year.

Q.21 WHY DO YOU USE THE 30-YEAR TREASURY YIELD?

A.21 The 30-year treasury rate yield was 4.77 at the date of analysis.[25] This provides a conservative estimate of the long-term earnings growth potential.

Q.22 ARE THE RESULTS OF YOUR CONSTRANT GROWTH DCF MODEL CONSISTENT WITH INVESTOR EXPECTATIONS?

A.22 Yes. My DCF model results in ROE estimates from 8.92 to 9.54. This is higher than investor expectations of returns over the next ten years of approximately 6 percent per year. However, the estimate is consistent with shorter term expected returns. For example, Kroll anticipates market returns of 9 percent.[26]

b. <u>Capital Asset Pricing Model</u>

Q.23 WHAT ARE THE RESULTS OF YOUR CAPITAL ASSET PRICING MODEL ANALYSIS?

A.23 My CAPM models estimate an ROE range from 8.32 percent to 9.17 percent.

Q.24 HOW DO YOUR CAPM MODELS DIFFER FROM SPPC'S CAPM MODELS?

A.24 I make the following two changes:

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[23] The FERC supports the use of long run GDP growth rate to model long term growth. Northwest Pipeline Corp., 79 F.E.R.C. P 61,309, 62,385 (1997). *See also*, Transcontinental Gas Pipe Line Corp., 84 F.E.R.C. P 61,084, 61,423 (1998).

[24] The Long-Term Budget Outlook: 2024 to 2054, Congressional Budget Office March 20, 2024. Available at: https://www.cbo.gov/publication/59711

[25] For consistency I use the same data relied on by SPPC, thus the treasury yield reflects yields at the time of SPPC's analysis.

[26] https://www.kroll.com/en/insights/publications/cost-of-capital/recommended-us-equity-risk-premium-and-corresponding-risk-free-rates

1. SPPC relies on betas that have been adjusted towards 1. These betas are biased and grossly misrepresent reasonable forecasts for utility stock betas. I use raw betas and betas adjusted to the industry average, as suggested in finance literature.[27]
2. SPPC's risk premium is abnormally high and relies on a biased selection of market forecasts. I use two alternatives that are less susceptible to bias and more consistent with investor expectations and finance literature.[28]

Beta Estimation

Q.25 HOW DO SPPC'S ESTIMATES OF BETA GROSSLY EXCESSIVE FORECAST BIAS?

A.25 SPPC uses betas that have been adjusted closer to 1. According to SPPC witness Ann Bulkley, "[t]he use of adjusted betas in the CAPM is important because if beta trends towards 1.00, as Blume noted, then the adjusted beta will be more reflective of the beta that can be expected over the near term."[29] This rationale is flawed in the utility cost of capital context because utility betas do not trend towards 1.[30] As I show later in this testimony SPPC's betas have grossly excessive forecast bias in both the near term and the long term. Raw betas and betas adjusted to the industry average are substantially less biased.

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[27] *Investments*, 2d ed., Prentice-Hall, Inc., Englewood Cliffs, 1981, p. 344. As quoted in OPUC Docket Nos. UT 125/UT 80, Order No. 00-191 at ¶ 3, 2000 Ore. PUC LEXIS 401 at *67-*68 (Apr. 14, 2000). Michelfelder, R. A., & Theodossiou, P. (2013). Public utility beta adjustment and biased costs of capital in public utility rate proceedings. *The Electricity Journal*, 26(9), 60-68.

[28] Damodaran, Aswath, Equity Risk Premiums (ERP): Determinants, Estimation, and Implications – The 2022 Edition (March 23, 2022). Available at SSRN: https://ssrn.com/abstract=4066060 or http://dx.doi.org/10.2139/ssrn.4066060.

[29] Prepared Rebuttal Testimony of Ann E. Bulkley, Docket No. 23-06007, p. 68 l. 2-5.

[30] Michelfelder, R. A., & Theodossiou, P. (2013). Public utility beta adjustment and biased costs of capital in public utility rate proceedings. *The Electricity Journal*, 26(9), 60-68.

SPPC selects beta from Bloomberg and Value Line. Bloomberg's adjusted beta weights the historic raw beta by 67 percent of the raw beta and 33 percent of the market average beta, which is assumed to be 1. Value Line beta is poorly documented and cannot be reproduced.[31]

I conduct the CAPM model using two types of betas. Bloomberg's unadjusted, or raw beta, which actually has greater predictive power than Bloomberg's adjusted beta, and the raw beta adjusted to the average of the peer group, which represents movement towards the industry beta rather than the market average.

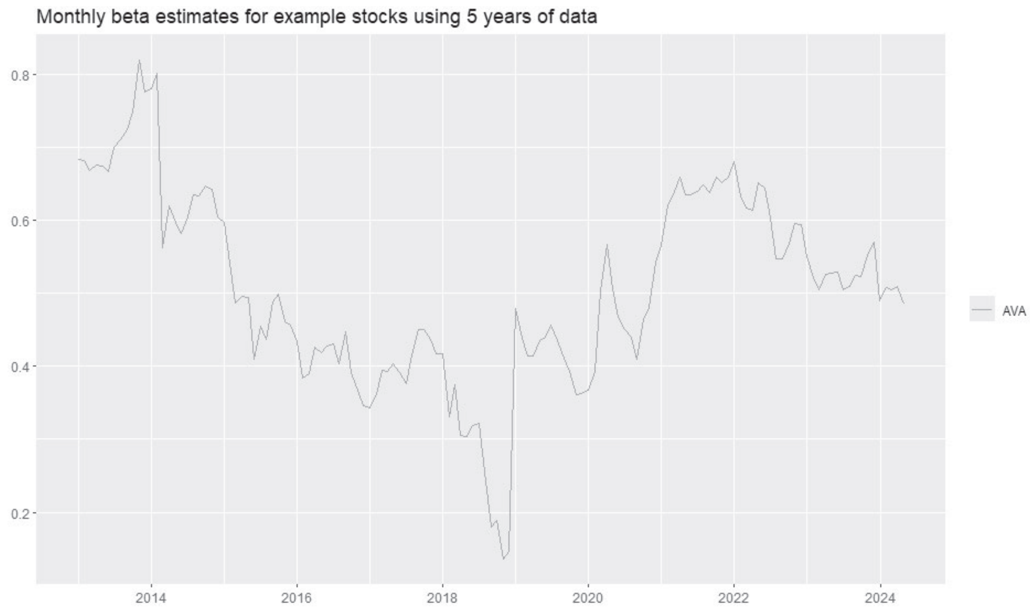
Q.26 WHY DO SOME ANALYSTS ADJUST BETAS?

A.26 Beta is typically estimated using a fixed historic period for data, such as the five prior years. Stock beta varies over time because the historic period rolls forward through different periods. It is generally agreed that betas follow an autoregressive time series process. Under this type of process, ordinary least squares (OLS) model assumptions are violated, and OLS beta assumptions can be incorrect. A more appropriate approach is to model beta as time dependent, where beta converges to an underlying value over time, as historic perturbations (such as covid or other firm specific events) have diminishing impacts.

The figure below illustrates the variation in beta for the utility company Avista when calculated with OLS regression on a rolling window of 5 years of monthly returns.

[31] Value Line betas are rounded to multiples of five, are significantly higher than Bloomberg's raw and adjusted beta, and in some cases are adjusted to be *above* 1 even when raw betas are below 1. This is inconsistent with the flawed assumption that betas move towards 1 because movement towards 1 would not move a raw beta from below 1 to above 1.

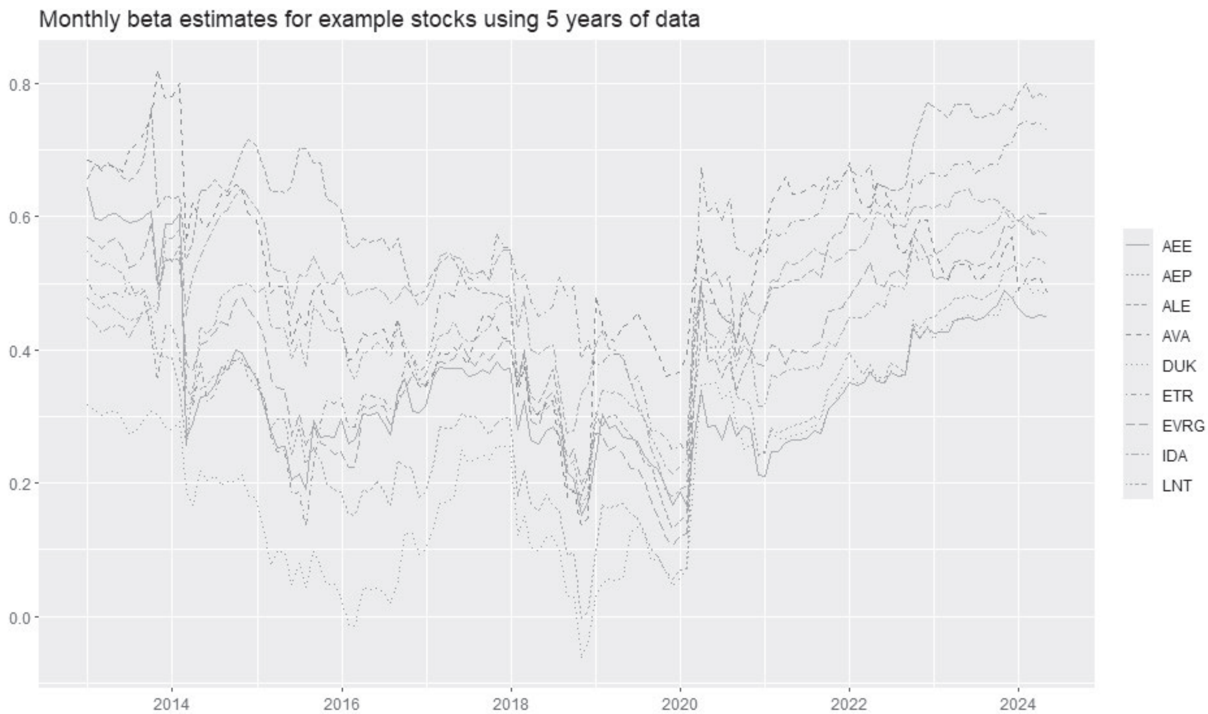
Figure LK-4: Return on Equity Summary



There are several factors of note in this figure. The estimate varies substantially over time, ranging from 0.1 to 0.8 over less than five years. If the raw beta were used to forecast future betas, and were selected at the peak of 0.8, it would clearly result in forecast error. Adjusting a beta estimate of 0.8 towards the average of approximately 0.5 would increase the accuracy of the forecast. Adjusting the beta towards 1, as done by the Company, would decrease the accuracy of the forecast.

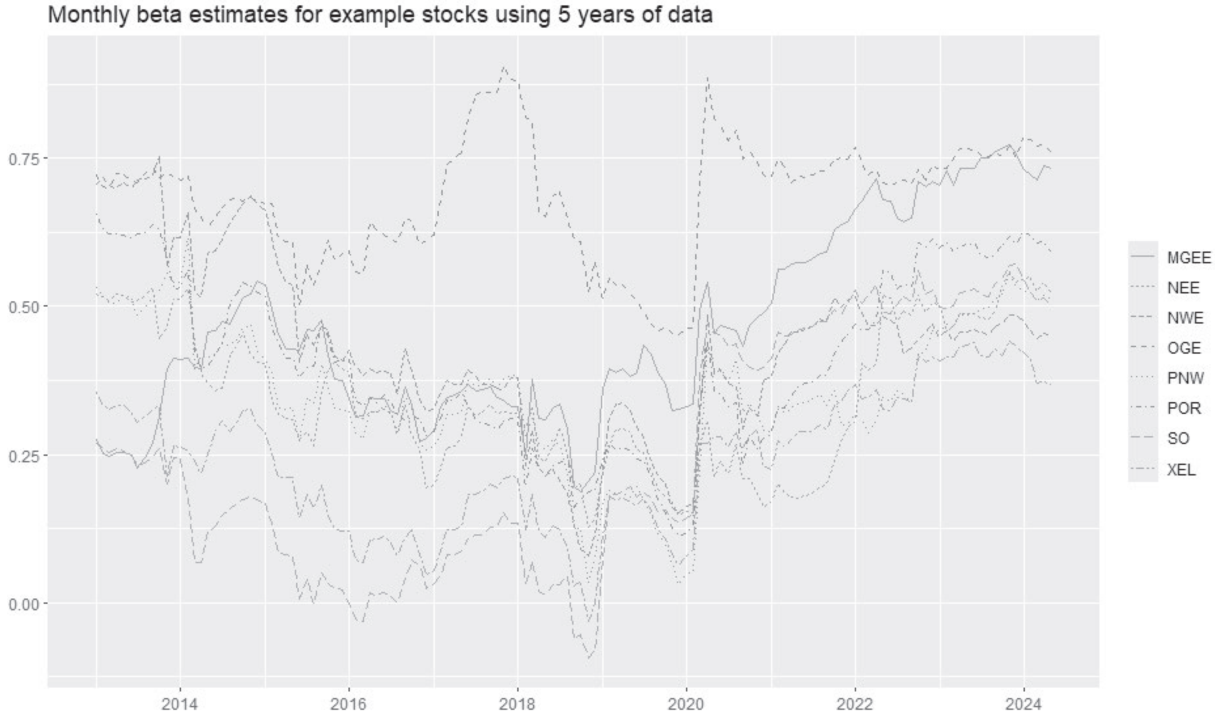
The figures below show that these patterns hold for all firms in SPPC's proxy group. Note that there is not consistent movement towards 1 over time.

Figure LK-5: Return on Equity Summary



Prepared Direct Testimony of
Lance D. Kaufman
Docket No. 24-02026

Figure LK-6: Return on Equity Summary



The following patterns are apparent when examining the proxy group betas. First, utility betas vary over time, but do not systematically converge towards 1. Second, beta rarely exceeds 0.7 and, on average, remains well below 0.7. Third, the OLS beta both increases and decreases over time, and because of this, the OLS beta provides a reasonable approximation of beta over the following year. Fourth, while there appears to be some trend over time, the trend is short lived, in that it does not push industry average beta outside of the range of approximately .3 to .6. Finally, the betas from 2022 to present do not trend up or down, suggesting that currently the OLS beta is a very reasonable approximation of near-term future beta.

Q.27 DOES SPPC'S ADJUSTMENT OF UTILITY BETAS TO THE MARKET AVERAGE INSTEAD OF INDUSTRY AVERAGE YIELD UNREASOANBLE RESULTS?

A.27 Yes. This adjustment is not appropriate because it increases forecast error and bias. While it is correct that beta changes over time, adjusting betas for utility stocks towards the market average will overrepresent the risk of the utility industry. It is well known that utility stocks, after addressing diversifiable risk, are less risky than the market, on average. If anything, adjustment should be made to the industry average, not the market average. This position is supported by Nobel Laureate William F. Sharpe:

> Information of the type shown in Table 13-4 [industry average betas] can be used to "adjust" historic beta values. For example, the knowledge that a corporation is in the air transport [*68] industry suggests that a reasonable estimate of the beta value of its stock is greater than 1.0. It thus makes more sense to adjust a historic beta value toward a value above 1.0 than to the average for all stocks.[32]

In the context of this case, the "industry" is the group of proxy utilities, and moving the beta of individual companies in the group towards the group average would not materially change the results. This is because the ROE that is used to develop the CAPM models ROE ranges are averages already.

Q.28 DOES SPPC'S ADJUSTMENT OF BETAS TOWARDS ONE OVER-INFLATE UTILITY COST OF CAPITAL?

A.28 Yes. The practice of adjusting beta towards 1 overinflates utility cost of capital. As can be seen in the figures above, utility stocks rarely exceed a beta of 0.7. However, SPPC's proposed betas are well above this threshold. Peer-reviewed research supports my assertion that this is

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[32] *Investments*, 2d ed., Prentice-Hall, Inc., Englewood Cliffs, 1981, p. 344. As quoted in OPUC Docket Nos. UT 125/UT 80, Order No. 00-191 at ¶ 3, 2000 Ore. PUC LEXIS 401 at *67-*68 (Apr. 14, 2000).

not appropriate and inflates utility cost of capital, finding that "an empirical analysis suggests that the commonly used Blume CAPM beta adjustment is not appropriate for electric and electric and gas public utility betas, and may bias the cost of common equity capital in public utility rate proceedings."[33] This research suggests that "adjustment to beta should be based upon the likely future trend in peer group or public utility betas, or the specific utility's beta, not the trend in betas for all stocks in general."[34]

Recall that since 2022, utility betas have been relatively flat.[35] Thus, if this advice is followed, it is appropriate to make no adjustment to beta, or adjust to the current peer group average without trending the average up or down.

Q.29 WHAT HAVE OTHER COMMISSIONS DETERMINED REGARDING THE USE OF ADJUSTED BETAS?

A.29 The Oregon Public Utility Commission ("OPUC") has ruled against adjusting betas to the market average.[36]

Q.30 HOW DO NEAR-TERM FORECASTS USING SPPC'S BETAS COMPARE TO FORECASTS USING YOUR BETAS?

A.30 Near term (1-3 year) forecasts using SPPC's betas are substantially more biased than forecasts using my proposed beta measures. I generated forecast betas for SPPC's two methods, Value Line and Bloomberg's adjustment, and for the two methods I use, unadjusted beta and adjusted to industry average. I performed annual forecasts from 2013 to 2023 and compared the

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[33] Michelfelder, R. A., & Theodossiou, P. (2013). Public utility beta adjustment and biased costs of capital in public utility rate proceedings. *The Electricity Journal*, 26(9), 60-68.

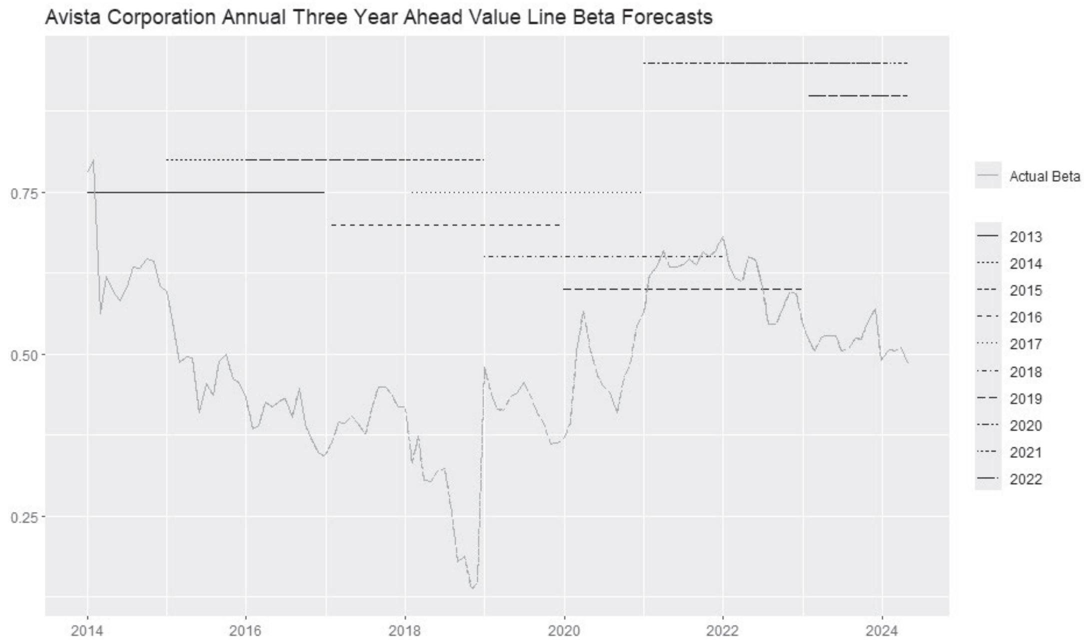
[34] *Id.*

[35] Figures LK-5 and LK-6.

[36] OPUC Docket Nos. UT 125/UT 80, Order No. 00-191, 2000 Ore. PUC LEXIS 401 (Apr. 14, 2000). The use of adjusted betas was disputed in this case. The Commission noted that "Thus, if any adjustment to the raw beta is appropriate, it should be toward the industry average rather than toward a generic average of all stocks."

forecasted values to actual values for the three years following the forecast. The four figures below compare these forecasts to actual betas. Note that the Value Line and Bloomberg[37] forecast betas are above actual betas for nearly every forecast. This is a clear indication that, at least for Avista, there is substantial forecast bias for both of SPPC's methods.

Figure LK-7: Return on Equity Summary



[37] The Bloomberg forecast uses the same adjustment formula as Bloomberg. However, I do not have access to historical Bloomberg beta estimates, so the adjustment is applied to my independent OLS beta estimate.

Figure LK-8: Return on Equity Summary

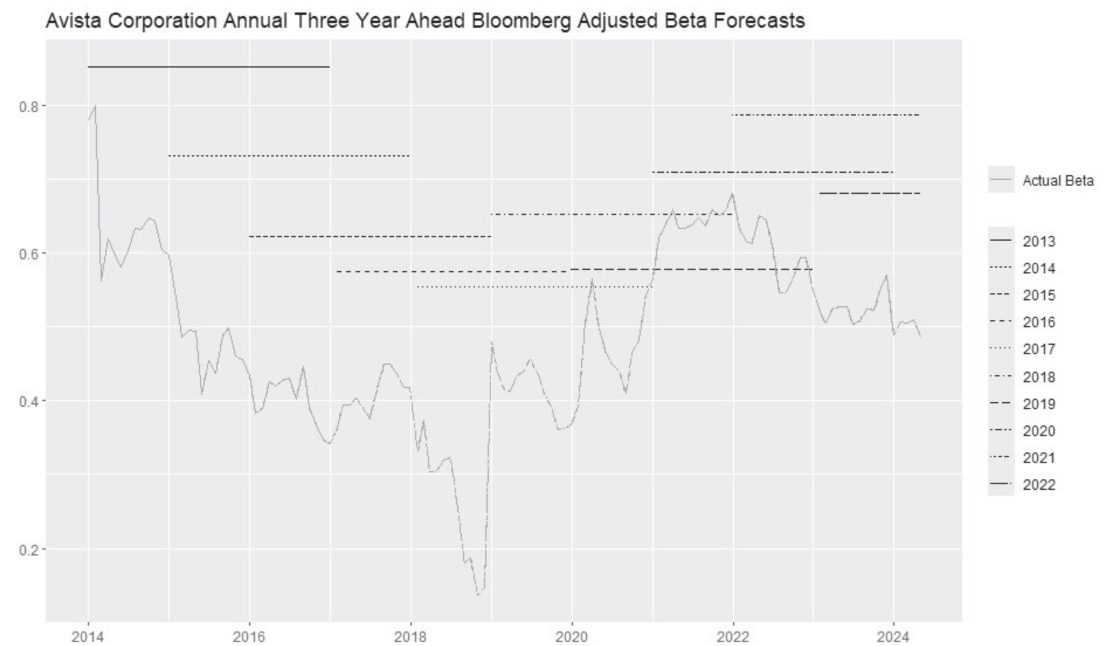


Figure LK-9: Return on Equity Summary

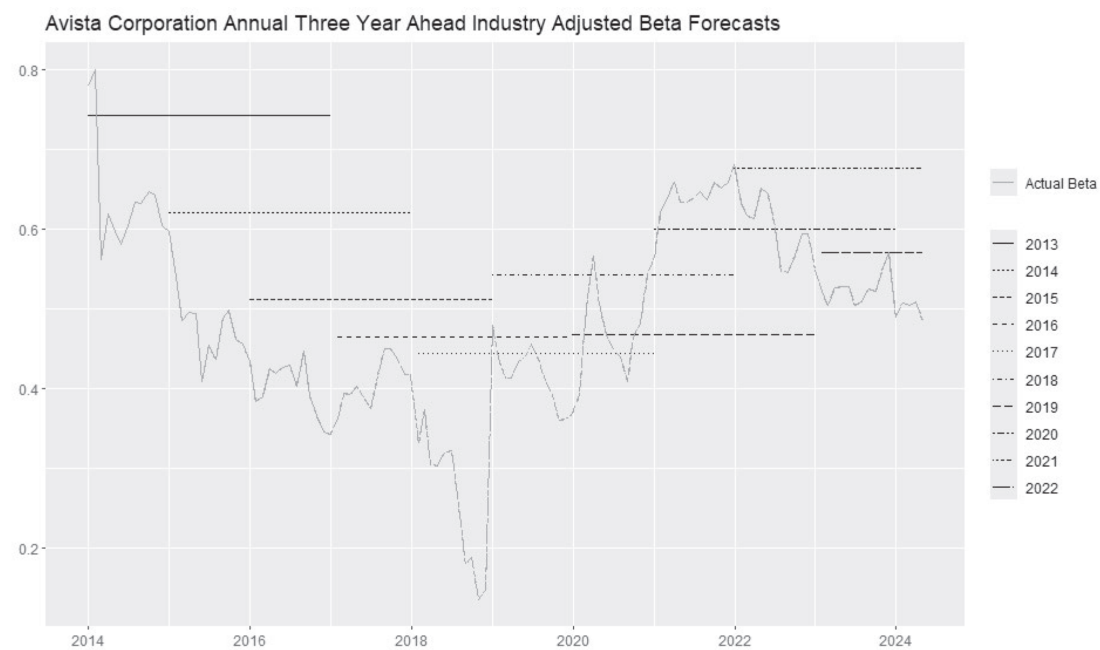
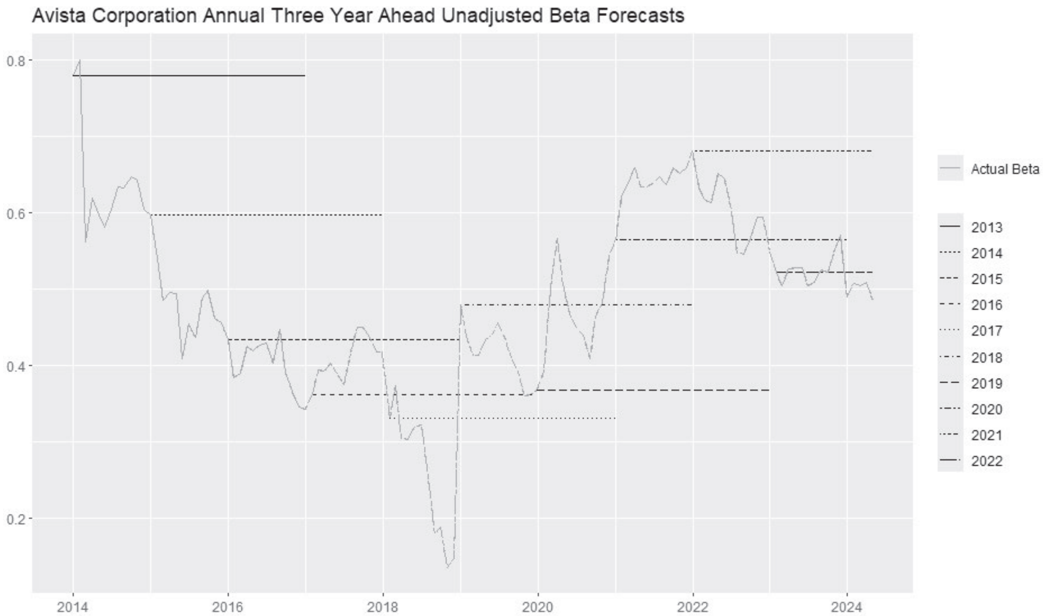


Figure LK-10: Return on Equity Summary



The forecasts for unadjusted beta and adjustment to industry average are clearly closer to the actual beta and fall both above and below actuals in a more even manner.

The pattern demonstrated for Avista is consistent for all utilities in SPPC's proxy group. I used the following formula to calculate a normalized forecast metric (NFM) that identifies forecast bias:

$$NFM = \frac{(Forecast - Actual)}{(Forecast + Actual)}$$

A value below zero indicates consistent under forecasting, while a value above zero indicates consistent over forecasting. The table below reports the average NFM for each year and forecast method. The Bloomberg and Value Line forecasts over forecast beta in every forecast year.[38] The absolute value of NFM for both methods exceed the NFM of industry adjusted beta forecasts for every forecast year, and they exceed that of the unadjusted beta forecast in every year except 2019. On average, the unadjusted betas have the smallest and least biased forecast. The industry adjusted forecast has some bias forecasts before 2019, but little to no bias following 2019.

Figure LK-11: Return on Equity Summary

Forecast Date	Unadjusted	Industry Adj.	Bloomberg	Value Line
12/31/2013	0.18	0.25	0.34	0.38
12/31/2014	0.20	0.28	0.36	0.42
12/31/2015	0.02	0.28	0.38	0.48
12/31/2016	0.03	0.29	0.38	0.47
12/31/2017	0.00	0.26	0.37	0.48
12/31/2018	-0.16	0.12	0.24	0.31
12/31/2019	-0.44	-0.06	0.08	0.19
12/31/2020	-0.19	-0.02	0.09	0.30
12/31/2021	-0.06	0.02	0.11	0.26
12/31/2022	-0.02	0.03	0.12	0.22
Average	-0.04	0.15	0.25	0.35

Q.31 HOW DO YOU CALCULATE BETA FOR YOUR CAPM AND ECAPM MODELS?

A.31 I use two alternative measures for beta, unadjusted beta and adjustment to industry average. To maintain consistency with SPPC's calculations and market inputs, I use SPPC's reported Bloomberg betas as a starting point. I revert these beta estimates to raw beta by reversing the Blume adjustment.[39] I calculate the industry average by averaging beta for SPPC's gas and

[38] Values are greater than zero in every year.

[39] This results in raw betas that are higher than the 5-year monthly return OLS betas I independently estimated, as well as the raw beta estimated by Zach's.

electric combined peer group. The industry average beta is .672.[40] I then adjust betas towards the industry average by weighting raw betas by 67 percent and average beta by 33 percent.

Q.32 WHAT IS THE IMPACT OF YOUR LOWER ESTIMATE OF BETA ON ROE?

A.32 All else equal, a lower beta estimate for a company lowers the forecasted return for the company. My recommended betas reduce the estimation of SPPC's cost of capital relative to the Company's estimate.

Equity Risk Premium

Q.33 HOW DO BETAS RELATE TO COST OF CAPTIAL?

A.33 The CAPM model calculates cost of equity as the risk-free rate of return plus beta times the equity risk premium. The risk-free rate is typically modeled using low risk bonds, such as 30-year treasury bond yields. The equity risk premium is the difference between expected market returns and the risk-free rate.

Q.34 HOW DOES SPPC FORECAST A RISK PREMIUM SUBSTANTIALLY HIGHER THAN ALL OTHER AVAILABLE ESTIMATES OF THE EQUITY RISK PREMIUM?

A.34 SPPC estimates market return based on a DCF model of S&P 500 growth forecasts. This model is identical to the one presented by SPPC's witness Ann Bulkley in Docket 23-06007.[41] In Nevada Power Company's rate case filed just last year, the Commission rejected the market risk premium resulting from Ms. Bulkley's model as being higher than current market expectations.[42] SPPC limits the analysis to S&P firms with growth forecasts between 0 and 20 percent. These limits are arbitrary and clearly biased because they are not symmetric around

[40] I base the industry average on the average raw Bloomberg beta. Note that this is substantially higher than that suggested by my 5-year OLS estimates indicate, and therefore remains conservatively high.

[41] Exhibit AEB-7 of Docket 23-06007 has the same structure and assumptions as Exhibit AEB-7 of the current Docket.

[42] Docket 23-06007, Modified Final Order ¶88.

zero. A less biased approach would be to include firms with growth forecasts between -20 and 20 percent. I refer to this symmetric filter as the “Corrected SPPC Method”. While the filter is symmetric, it continues to forecast a risk premium substantially higher than all other available estimates of the equity risk premium.

Q.35 IS SPPC’S ESTIMATE FOR THE EQUITY RISK PREMIUM EXTRAORDINARILY HIGH?

A.35 Yes. The table below summarizes estimates for the equity using a variety of methods. The SPPC method, and a corrected version with unbiased bounds, are in the first two rows of the table. SPPC’s method is 60 percent higher than average of the other estimates.

Table LK-12: Recent Equity Risk Premium Estimates

Approach Used	*ERP*	*Additional information*
SPPC Method	7.77%	S&P Weighted Growth Forecast Between 0 and 20%
Corrected SPPC Method	6.71%	S&P Weighted Growth Forecast Between -20% and 20%
Kroll ERP	5.50%	Kroll's April 2024 Recommended US Equity Risk Premium
Survey: CFOs	4.42%	Campbell and Harvey survey of CFOs (2018); Average estimate. Median was 3.63%.
Survey: Global Fund Managers	4.60%	Merrill Lynch (January 2020) survey of global managers
Historical - US	5.06%	Geometric average - Stocks minus T.Bonds: 1928-2022
Historical - Multiple Equity Markets	5.00%	Average premium across 20 markets from 1900-2022: Dimson, Marsh and Staunton (2022)
Current Implied premium	4.60%	From S&P 500 - January 1, 2024
Average Implied premium (1960-2022)	4.21%	Average of implied equity risk premium
Average Implied premium (2012-2022)	5.37%	Average of implied equity risk premium
Default spread based premium	4.24%	Baa Default Spread on 1/1/23 * Median value of (ERP/ Default Spread)
Survey: Gobal Finance	5.60%	Finance and economics professors, analysts and managers of companies (2023)
Average (Excluding SPPC Methods)	4.86%	

Q.36 DO YOU HAVE ANY CONCERNS ABOUT THE SPPC METHOD OTHER THAN ITS ABNORMAL VALUE?

A.36 Yes, this methodology is subject to the same optimism and subsequent bias as the Value Line EPS forecasts used in the DCF models. SPPC’s filters exclude firms with growth above 20 percent. However, even indefinite growth of 20 percent per year is highly unlikely for firms of this size. SPPC's model assumes that Caterpillar Inc. grows indefinitely at 20 percent per year. If Caterpillar grows at this rate for 50 years, Caterpillar's net income would equal the current US GDP. This is clearly an unsustainably high level of growth and cannot be assumed to persist indefinitely.

Q.37 WHAT MEASURES DO YOU USE FOR THE EQUITY RISK PREMIUM?

A.37 I use two measures. The first is a revised version of SPPC's model using unbiased bounds of -20 to 20 percent rather than 0 to 20 percent.[43] The second is the Kroll April 2024 Recommended US Equity Risk Premium of 5.5 percent. These two measures remain higher than all other ERP measures reported in Table LK-12, and thus result in conservatively high ROE estimates.

Q.38 THE AVERAGE THAT YOU PROPOSE REMAINS SIGNIFICANTLY HIGHER THAN THE OTHER RISK PREMIUMS IN TABLE LK-8. CAN YOU PROVIDE MORE DETAIL ON THE VARIOUS METHODS OF ESTIMATING THE EQUITY RISK PREMIUM?

A.38 There are three broad approaches to estimating the equity risk premium:

1) Survey of investors or other experts regarding expectations for future returns;
2) Historical premium of equities over riskless investments; and
3) Forward looking premiums based on current market prices.[44]

Q.39 DO MARKET SURVEYS OF INVESTORS OR OTHER EXPERTS REVEAL SPPC'S PROPOSED EQUITY RISK PREMIUM IS UNREASONABLY HIGH?

A.39 Yes. Market surveys show that the average risk premium required by investors is materially lower than the forecast produced by SPPC. Recent survey-based estimates of the equity risk

[43] I keep this measure in the interests of gradualism and conservatism. Even this symmetric filter retains the inherently incorrect assumption that short term forecast can model long term growth.

[44] Damodaran, Aswath, Equity Risk Premiums (ERP): Determinants, Estimation, and Implications – The 2022 Edition (March 23, 2022). Available at: https://ssrn.com/abstract=4066060 or http://dx.doi.org/10.2139/ssrn.4066060.

premium are available from institutional investors, corporate management, and academics. The table below summarizes these data.

Table LK-13: Summary of Investor and Finance Professional Surveys

Date	Survey	Estimate
Feb-2007	Merryll Lynch survey of institutional investors[45]	3.5
Mar-2007	Merryll Lynch survey of institutional investors[46]	4.1
2010	Merryll Lynch survey of institutional investors[47]	3.76 to 3.9
Jan-2012	Merryll Lynch survey of institutional investors[48]	4.08
Feb-2014	Merryll Lynch survey of institutional investors[49]	4.6
June 2020	Merryll Lynch survey of institutional investors[50]	2.5
Dec-2017	Graham and Harvey survey of CFOs[51]	3.63
Jan-2016	Graham and Harvey survey of CFOs[52]	3.55
2000 to 2017	Graham and Harvey survey of CFOs[53]	2.42 to 4.56, 3.63 average
2011	Fernandes et al. survey of Academics[54]	5.6
2022	IESE Business School survey of Academics, investors, and executives[55]	5.5
2021	CFA Institute Research Foundation[56]	3 to 6

Q.40 WHAT RISK PREMIUM EXISTS IN HISTORIC MARKET DATA?

A.40 The historical risk premium depends on the time period studied, method of averaging, and basis for risk free rate. Damodaran, a widely published and well-respected finance researcher,

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45 Global Fund Manager Survey, cited in Damodaran (2022).
46 *Id.*
47 *Id.*
48 *Id.*
49 *Id.*
50 Global Fund Manager Survey, Bank of America Merrill Lynch, January 2022. Cited in Damodaran (2022).
51 Graham, J.R. and C.R. Harvey, 2018, *The Equity Risk Premium in 2018*, Working paper, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3151162. Cited in Damodaran (2022).
52 *Id.*
53 *Id.*
54 Fernandez, P., J. Aguirreamalloa and L. Corres, 2011, Equity Premium used in 2011 for the USA by Analysts, Companies and Professors: A Survey, Working Paper, Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1805852&rec=1&srcabs=1822182. Cited in Damodaran (2022).
55 *Id.*
56 Laurence B. Siegel and Paul McCaffrey, Editors (2023) Revisiting the Equity Risk Premium. https://www.cfainstitute.org/-/media/documents/article/rf-brief/Revisiting-the-Equity-Risk-Premium.pdf.

provides persuasive rationale for using an extended time horizon, geometric averaging, and US Treasury bills as the risk-free rate.[57] This results in an equity risk premium of 4.47 to 5.13 percent.[58] Historic risk premiums have an advantage over surveys in that they are market-driven, and thus are not subjective or exposed to other drawbacks of surveys. However, unlike surveys, historic risk premiums are not forward looking. Implied risk premiums provide a market-based approach to estimating a forward-looking risk premium.

Q.41 WHAT FORWARD RISK PREMIUMS CAN BE IMPLIED FROM MARKET DATA?

A.41 A forward-looking risk premium can be implied from current market prices and expected cash flows. The risk premium is implied by current market value for a representative index and the expected cash flows from that index. Damodaran finds that the implied equity premium of the trailing 12 months is the best predictor of the actual implied premium.[59] The January 2024 trailing 12-month implied equity risk premium is 4.6 percent.[60]

Q.42 DOES THE RANGE OF SURVEY RESULTS FOR THE EQUITY RISK PREMIUM SHOW SPPC'S FORECAST IS UNREASONABLY HIGH AT 7.7 PERCENT COMPARED TO THE CURRENT IMPLIED RISK PREMIUM OF 4.6 PERCENT?

A.42 Yes. The surveys of investors and finance professionals report that the equity risk premium is between 3 and 6 percent. This is consistent with the current implied risk premium of 4.6 percent, but substantially less than the SPPC forecast of 7.7 percent. The surveys are also consistent with historical risk premium when geometric averaging is used, but are well

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[57] Damodaran, Aswath, Equity Risk Premiums (ERP): Determinants, Estimation, and Implications – The 2022 Edition (March 23, 2022). Available at: https://ssrn.com/abstract=4066060 or http://dx.doi.org/10.2139/ssrn.4066060.
[58] Damodaran (2022), p. 38.
[59] Damodaran (2022).
[60] https://pages.stern.nyu.edu/~adamodar/New_Home_Page/home.htm Trailing 12-month cash yield for September 1, 2022.

below historical risk premium when arithmetic averaging is used. This confirms that geometric averaging should be used when evaluating investor expectations.

Q.43 WHAT MEASURE OF THE EQUITY RISK PREMIUM IS RECOMMENDED FOR USE IN SETTING RATES?

A.43 There is no one approach to estimating equity risk premiums that is appropriate for all analyses. However, generally, the current trailing 12-month implied equity risk premium is more appropriate when equity markets are assumed to be functioning efficiently, when predictive power is important, or when current equity needs of investors are being considered. A historical risk premium or a long-term average of implied premiums is appropriate when evaluating long-term capital investment decisions or when there is reason to believe that current markets are over- or under-valued. Survey results are appropriate when markets are assumed to be functioning poorly over an extended time.

In setting utility rates, the primary function of estimating the cost of equity is to provide a fair return to equity investors that is sufficient to attract capital. However, utilities also use approved cost of capital in long-term planning and when making capital investment decisions. In an environment of well-functioning capital markets, greatest weight should be placed on the current implied equity risk premium. However, it is also appropriate to consider long-term average implied risk premium and the historic risk premium and current survey results due to unstable equity market conditions and the capital planning functions of the authorized cost of equity.

c. Empirical CAPM

Q.44 PLEASE SUMMARIZE THE RESULTS OF YOUR EMPIRICAL CAPM MODELS.

A.44 My ECAPM models estimate an ROE range from 8.81 percent to 9.75 percent. I recommend against placing material weight on this model because it contains questionable assumptions.

Q.45 HOW DO YOUR ESTIMATES OF BETA DIFFER FROM SPPC'S?

A.45 I apply the same updates to betas and equity risk premium performed for the CAPM model above.

Q.46 WHY DO YOU CHARACTERIZE THE ECAPM AS HAVING QUESTIONABLE ASSUMPTIONS?

A.46 The formula Ms. Bulkley uses, and which I adopt, for the ECAPM relies on statistical analysis performed in 1989, 35 years ago.[61] It is not clear that this relationship persists in the markets today. Furthermore, the analysis underlying the ECAPM model relies on industry averages, rather than utility averages. Thus, it is likely that the adjustment does not reflect any real characteristics of the utility industry. While I report ECAPM for informational purposes, I do not recommend giving the model results material weight or consideration because it over-represents the risk of utility companies. I also do not apply the excessive Value Line risk premium forecasts to this model because that would exacerbate the problems with the model.

d. Market Analysis

Q.47 GIVEN CURRENT MARKET CONDITIONS, WHY DO YOU RECOMMEND A DECREASE IN THE COST OF EQUITY?

A.47 The only market conditions that are relevant to evaluating cost of equity are those that are inputs to the ROE estimation models. Outside of these, SPPC's arguments about the condition

[61] Morin, R. A. (2006). *New Regulatory Finance*. Austria: Public Utilities Reports, p. 190, fn 12.

of the market are speculative and irrelevant, in that the arguments are not theoretically or empirically linked to the models used to estimate ROE.

Furthermore, speculation about current market conditions does not directly address whether the currently approved ROE is too high or too low. The primary consideration in determining cost of equity is that it be commensurate with the returns on investments for other firms with similar risks and that it be sufficient to assure the financial integrity of the utility, to maintain credit, and to attract capital.[62] My recommendations are supported by various mathematical models that can be used to estimate a return on equity that meets these criteria. However, the judgement applied in evaluating these models is grounded in observing utility and investor behavior.

SPPC has not faced any difficulties in attracting capital, and SPPC is not aware of any other utilities that have been unable to.[63] In fact, not only has SPPC been able to attract capital, SPPC has, in planning dockets such as the recent Fifth Amendment to its IRP, been proposing and supporting substantially increased capital spending and here is seeking to increase its equity ratio above its historic levels. This indicates an investor appetite for SPPC's existing ROE. This investor appetite occurs when an investor's expected ROE exceeds that required by the investor, and the tendency for regulated utilities to over-capitalize is known academically as the Averch–Johnson effect, and informally, as "gold-plating." The Averch–Johnson effect is the tendency of regulated companies to engage in excessive capitalization in order to increase net income.

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[62] *Federal Power Commission v. Hope Natural Gas Co.*, 320 US 591, 602 (1944).

[63] Response to SEA Data Request No. 11, Exhibit Kaufman-Direct-2. The Company also fails to deny that equity could be raised in traditional equity markets should BHE decline to invest additional equity in SPPC. Response to SEA Information Request 7.

The cause of the Averch-Johnson effect is excessive ROE, and the symptoms of the Averch–Johnson effect are: 1) actions that increase equity, and 2) market valuations of equity above the book value of equity. Examples of increasing equity include requesting an equity-heavy capital structure, discouraging competitive energy service, and acquiring owned generation rather than power purchase agreements. In most proceedings that I have participated in across the U.S., I have observed a utility actively arguing against actions that would decrease the utility's opportunity for increased investment.

The second key factor indicating that current return on equity is excessive is that utilities are experiencing excessive market-to-book ratios. If return on equity for the utility industry is sufficient but not excessive, the market to book ratio for the utility industry should be at or near 1.[64] A market-to-book ratio above 1 indicates that return on equity exceeds that which is necessary for an investment of comparable risk.[65] The table below presents the market-to-book ratio for the proxy utilities. The only two utilities with reasonable market to book ratios are Avista (AVA) and NorthWestern (NEW). The average market-to-book ratios are well above 1. These data indicate that the proxy group, on average, have authorized ROEs that are substantially higher than necessary to attract capital.

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[64] Morin, R. A. (2006). *New Regulatory Finance*. Austria: Public Utilities Reports, p. 360.
[65] *Id*.

Figure LK-14: Market-to-Book Ratio

	Current	3/31/2024	12/31/2023	9/30/2023	6/30/2023	3/31/2023
NI	1.64	1.59	1.96	1.67	1.84	1.92
AEE	1.75	1.74	1.74	1.84	2.02	2.16
AVA	1.19	1.1	1.16	1.04	1.26	1.38
CMS	2.41	2.46	2.46	2.24	2.5	2.64
MGEE	2.54	2.5	2.3	2.23	2.6	2.6
NWE	1.12	1.12	1.14	1.1	1.26	1.3
SO	2.7	2.49	2.44	2.3	2.51	2.5
WEC	2.2	2.21	2.26	2.18	2.39	2.63
XEL	1.73	1.69	1.98	1.87	2.04	2.23
Average	1.92	1.88	1.94	1.83	2.05	2.15

Q.48 OTHER THAN GENERAL INDUSTRY OBSERVATIONS, WHAT SPECIFIC BEHAVIOR OF SPPC INDICATES THAT THE CURRENT AUTHORIZED ROE OF 9.5 PERCENT IS EXCESSIVE?

A.48 My exposure to SPPC's behavior is limited to reviewing its cost of capital and its rate design. SPPC's effort to increase its equity ratio indicates the current ROE is excessive. SPPC also mistreated partial requirements customers by attempting to use biased methodologies to unfairly shift costs to these customers.[66] Additionally, in its recent application to update its 2021 Integrated Resource Plan, the company specifically asks that $1.5 billion in new generation be company owned, rather than be contracted through a third party.[67] This indicates a preference for owned generation, which is consistent with the Averch-Johnson effect.[68] I also understand that in the 2021 Nevada legislative session, the utility advocated in support of a bill

[66] Dockets 22-06014 and 23-06007 (Rate Design).

[67] Docket No. 23-08015, Joint Application of Nevada Power Company d/b/a NV Energy and Sierra Pacific Power Company d/b/a NV Energy for approval of the Fifth Amendment to the 2021 Joint Integrated Resource Plan, Transmittal Letter at 1 and Application Ex. A at 97.

[68] *See,* Docket 23-08015, rebuttal testimony of Doug Cannon, wherein the Company is seeking to rate-base over $1.5 billion in new renewable generation, instead of choosing a PPA to meet the RPS which, as the Company acknowledged, would not require capital expenditures.

requiring it to construct the Greenlink West and Greenlink North transmission lines with CEO Doug Cannon testifying to the Nevada legislature that the utility would bring over $2 billion of private money to the state for these projects.[69]

Q.49 HOW DO CURRENT MARKET CONDITIONS FACTOR INTO ROE ESTIMATES?

A.49 Current market conditions and future expectations are inputs to the DCF and CAPM models. These models automatically account for the impact of current and expected market conditions. It is unnecessary to make further adjustments.

Sierra Solar

Q.50 HOW DOES THE RECENT COMMISSION ORDER REGARDING SIERRA SOLAR AFFECT YOUR RECOMMENDATION?

A.50 The Company argues that the Commission's treatment of Sierra Solar should be considered when establishing cost of capital in this case.[70] This is incorrect for several reasons. First, the Company could have secured a solar PPA without exposing its own equity to risk by virtue of investing in the $1.5 billion project. The Company's decision to invest equity in the project is a manifestation of the Averch-Johnson effect, incentivizing the utility to over-capitalize. To the extent that the Sierra Solar project increases the Company's financial risk, that increase is self-imposed, and considering such an increase to SPPC's Cost of Capital would lead to inappropriate incentives. Namely, increasing returns when the company intentionally increases financial risk would reward the company for risk seeking behavior. This would cause an upward spiral in ROE and unfair and unnecessary cost increases to customers.

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[69] Testimony of Doug Cannon, Assm. Cmte. on Growth & Infrastructure Hearing on S.B. 448 (May 25, 2021), at 9-10. Available at: https://www.leg.state.nv.us/App/NELIS/REL/81st2021/Bill/8201/Meetings. It is worth noting that a similarly situated resource procured through a PPA would have the same economic impact.

[70] Behrens-CERTIFICATION p. 6, l. 11-14.

Second, all of the proxy groups included in the cost of capital analysis face similar regulatory risk. The Commission's order is simply a single manifestation of risk, which is present for all regulated utilities. Because the proxy group faces similar risks, there is no need for *ad hoc* adjustments to the results of the cost of capital models.

Third, the Company's premise that the Solar Project increases its risk may be incorrect. Moody's argues that the investment will actually decrease the company's risk.[71]

Finally, any impact that the decision has on the cost of debt will occur in the future, after additional debt is issued. At that future time, the Commission should consider whether the Company acted prudently by insisting on massive capital spending in the face of marginal credit or if it was acting in a speculative and risky manner. Regardless of future outcomes, the decision will not impact cost of debt in this case.

Q.51 DOES SPPC'S UNREASONABLY HIGH COST OF EQUITY ANALYSIS AND RECOMMENDATION CREATE SIGNIFICANT AND UNNECESSARY CUSTOMER COST INCREASES?

A.51 Yes, the DCF, CAPM, and ECAPM models result in a broad range of ROE estimates. However, all models overlap with some portion of the range of 8.5 to 9.5, which I recommend as a reasonable ROE range. I recommend an ROE of 9.25 percent. This provides a return on equity sufficient to attract capital given the risk and returns of the SPPC and the Proxy group. My ROE recommendation reduces SPPC's revenue requirement by $17.6 million relative to the certification filing.

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71 "In the long run, the large renewable energy project and associated spending could eventually improve Sierra Pacific's business risk and financial stability." Rating Action: Moody's downgrades Sierra Pacific Power to Baa2, outlook stable, May 6, 2024.

III. CAPITAL STRUCTURE

Q.52 PLEASE SUMMARIZE YOUR CAPITAL STRUCTURE TESTIMONY.

A.52 I recommend the use of a hypothetical capital structure with 50 percent common equity, 50 percent debt. This structure is based on a midpoint between Berkshire Hathaway Energy's ("BHE") capital structure and SPPC's certification capital structure.

Q.53 DO YOU RECOMMEND USING A HYPOTHETICAL CAPITAL STRUCTURE TO AVOID SPPC EXCEEDING ITS AUTHORIZED RATE OF RETURN?

A.53 Yes. I recommend a hypothetical capital structure for two reasons. First, the cost of equity is negatively related to share of equity in capital structure. My COE analysis above reflects a peer group with an actual capital structure of 42 percent equity. SPPC's certification equity ratio of 55 percent greatly exceeds this and is inconsistent with the results of the ROE analysis. A hypothetical capital structure of 50 percent equity is more consistent with the recommended ROE.

Second, SPPC's parent company, BHE, has a capital structure of 47% equity. This indicates that SPPC's investors are more leveraged than suggested by SPPC's certification filing. If this additional leverage is not accounted for, the return earned by BHE will actually exceed the authorized rate of return.

Q.54 DOES SPPC MISREPRESENT THE CAPITAL STRUCTURE OF THE PROXY GROUP?

A.54 Yes, the table below compares the equity ratio of the proxy group with that calculated by SPPC. Note that SPPC's equity ratio is more than 10 percent higher than the average actual equity ratio. There are two reasons for this. First, SPPC relies on evaluating capital structure of subsidiary operating companies rather than the overall capital structure of the stock being analyzed. The inputs to cost of capital models are not the operating entity's inputs, but rather the holding company's inputs. That means that the ROE results are only valid for equity ratios of the holding company, not the equity ratios of the operating company.

Figure LK-15: Return on Equity Summary

	12/31/2023	12/31/2022	12/31/2021	Average	SPPC Calc.
NI	36.9%	40.1%	41.0%	39.3%	58.0%
AEE	40.7%	41.0%	41.6%	41.1%	52.2%
AVA	45.0%	44.5%	45.3%	44.9%	61.3%
CMS	32.5%	32.9%	34.7%	33.4%	51.3%
MGEE	59.4%	59.8%	61.5%	60.2%	59.7%
NWE	49.9%	50.3%	47.8%	49.3%	49.3%
SO	33.1%	34.0%	33.7%	33.6%	54.5%
WEC	38.5%	39.7%	41.2%	39.8%	54.6%
XEL	39.0%	39.0%	38.7%	38.9%	54.0%
Average	41.7%	42.4%	42.8%	42.3%	55.0%

The second reason SPPC's calculations are lower is due to error. For example, SPPC represents that Avista's (AVA) operating company equity ratio is 61 percent. This is an error. Avista recently filed a rate case requesting an equity ratio of 48.5 percent, not 61 percent.[72] In that case, Avista reports its operating company's equity ratio as 50.7 percent.[73]

Q.55 WHAT IS THE RELATIONSHIP BETWEEN OPERATING SUBSIDIARY CAPITAL STRUCTURE AND HOLDING COMPANY CAPITAL STRUCTURE?

A.55 Publicly traded utility stocks are typically holding companies that operate one or more subsidiary companies. If the holding company issues debt and invests this debt in its subsidiary as an equity infusion, the subsidiary's equity ratio will be higher than the holding company's

[72] Direct Testimony of Adrien M. Mckenzie, CFA p. 10. Washington Utilities and Transportation Commission Docket No. UE-240006.
[73] Exhibit AMM-6, p. 2. Washington Utilities and Transportation Commission Docket No. UE-240006.

ratio. However, the actual shareholder equity at risk in this situation remains consistent with the holding company's equity ratio.

Q.56 WOULD USE OF THE HOLDING COMPANY'S CAPITAL STRUCTURE INSTEAD OF THE OPERATING COMPANY'S CREATE UNREASONABLE COSTS FOR CUSTOMERS?

A.56 Yes. Cost of capital models require the use of market data. This data is only available for utility holding companies, not operating companies. The ROE estimates that use this reflect the risk of the holding company, not the risk of the operating company. The holding company is often more leveraged than the operating company, and thus riskier than the operating company. The proxy group's holding companies are much more leveraged than the operating companies. Every dollar of equity invested in the holding company is exposed to greater risk than every dollar of equity invested in the operating company. Mixing holding company-based ROEs with operating company based equity ratios is inconsistent and results in windfall profits for equity investors.

I recommend resolving this inconsistency by using a hypothetical capital structure that is closer to the proxy group, i.e. 50 percent equity and 50 percent debt. The cost of equity decreases by 0.8 to 1.4 percent per 10 percent increase in equity ratio.[74] SPPC's requested equity ratio is 5 percent higher than the proxy group's holding company. This translates into a decrease of 0.4 to 0.7 percent in ROE. If the Commission finds in favor in my cost of capital models, but selects SPPC's proposed equity ratio, the authorized ROE should be reduced by 0.4 percent, from 9.25 to 8.85.

[74] Morin, R. A. (2006). *New Regulatory Finance*. Austria: Public Utilities Reports, p. 469.

Q.57 WHAT IS THE BENEFIT OF YOUR RECOMMENDED CAPTIAL STRUCTURE OVER THE ALTERNATIVE COMBINATION OF SPPC'S CERTIFIED STRUCTURE AND LOWER ROE?

A.57 This is primarily an issue of optics. An ROE of 8.85 is certainly justified under SPPC's requested capital structure. However, it would be one of the lowest ROEs recently approved in the US. As a result, this approach may attract undue criticism by investors.

Q.58 WHAT TRENDS HAVE YOU SEEN WITH RESPECT TO SPPC'S EQUITY PERCENTAGE?

A.58 Since BHE acquired both Nevada Power and SPPC, the equity ratios have been steadily increasing which increases costs to customers to increase profit to the shareholder. Table LK-14 and Figure LK-7 below shows the equity increases that have occurred for the last ten years since the BHE acquisition occurred.

Table LK-16: 10-Year Capital Structure History

Docket	Year	Authorized Debt Percentage	Authorized Equity Percentage
14-05004 (NPC)[75]	2014	51.82%	48.18%
16-06006 (SPPC)[76]	2016	51.97%	48.03%
17-06003 (NPC)[77]	2017	50.01%	49.99%
19-06002 (SPPC)[78]	2019	49.08%	50.92%
20-06003 (NPC)[79]	2020	48.63%	51.37%
22-06014 (SPPC)[80]	2022	47.6%	52.4%
23-06007 (NPC)[81]	2023	47.28%	52.72%

[75] Stipulation accepting Certification Statement F, approved in Docket No. 14-05004, Order (Oct. 15, 2014).
[76] Stipulation accepting Certification Statement F, approved in Docket No. 16-06006, Order (Dec. 28, 2016).
[77] Docket No. 17-06003, Modified Final Order (Dec. 19, 2018).
[78] Stipulation accepting Certification Statement F, approved in Modified Final Order (Apr. 2, 2020).
[79] Docket No. 20-06003, Certification Statement F. The Order issued on Jan 28, 2021, approving the stipulation does not make specific reference to an approved capital structure, but this represents what was included in Certification Statement F.
[80] Docket No. 22-06014, Modified Order ¶ 164 (Feb .16, 2023), imputing Staff's hypothetical capital structure.
[81] Docket 23-06007, Modified Final Order ¶ 92 (Feb 16, 2024), imputing Staff's recommended capital structure.

Q.59 WHAT IS THE CAPITAL STRUCTURE OF SPPC'S HOLDING COMPANY?

A.59 BHE's capital structure was 53 percent debt 47 percent equity in 2021, 2022, and 2023.[82] BHE is an intermediate holding company, which is in turn held by other investors. This means that equity investors in SPPC can increase their equity ratio in SPPC without increasing their equity at risk by acquiring debt through the intermediate holding company, BHE, rather than directly through SPPC. Ms. Bulkley calls on the "stand-alone" principal to assert that the Commission should evaluate SPPC as an individual company. However, BHE's capital structure is evidence that SPPC could cost effectively operate at a lower equity level. BHE equity investors would be exposed to similar risk and would have the same equity investment in the holding company if debt held by SPPC rather than BHE. The fact that BHE's capital structure has substantially less equity than SPPC means that the Commission is not disadvantaging BHE shareholders by applying a 50-50 capital structure.

Q.60 DOES MS. BULKLY CONSISTENTLY APPLY THE STANDALONE PRINCIPAL?

A.60 No, Ms. Bulkley considers the standalone capital structure, but not the standalone cost of equity. As I discussed above, Ms. Bulkley's ROE recommendations are based on an average equity ratio of 42 percent, which is 13 percent lower than SPPC's standalone equity ratio. Consistent application of the standalone principal would require a reduction to ROE to reflect higher equity of the subsidiary company. The cost of equity decreases by 0.8 to 1.4 percent per 10 percent increase in equity ratio.[83] This translates to a 1.04 to 1.82 percent decrease in ROE.

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[82] Berkshire Hathaway Energy Company FORM 10-K for fiscal year ending December 31, 2022 and December 31, 2023.
[83] Morin, R. A. (2006). *New Regulatory Finance*. Austria: Public Utilities Reports, p. 469.

Q.61 WOULD THE COMMISSION'S ADOPTION OF SPPC'S UNREASONABLE CAPITAL STRUCTURE UNNECESSARILY BURDEN CUSTOMERS WITH INCREASED COSTS?

A.61 Yes. A capital structure that is weighted at over 55% equity is unreasonable and not in line with other similarly situated utilities. The average authorized equity ratio for utilities ranged from 48.9 percent to 49.98 percent between 2017 and Q1 of 2021.[84] The average authorized equity ratio in 2022 and 2023 was [redacted][85] Given that equity is more expensive than debt, and given the rapid increase in SPPC's overall energy rate in the recent years,[86] Nevada's ratepayers should not be asked to bear an unreasonable cost burden associated with a 55% equity ratio.

Q.62 CAN THE COMMISSION'S TREATMENT OF CAPITAL STRUCTURE IN THIS CASE AVOID A CREDIT DOWNGRADE?

A.62 No, SPPC's decision to invest in the Sierra Solar project triggered a downgrade by Moody's on May 6, 2024.[87] Prior to this downgrade, SPPC may have been at risk for a downgrade because it was on the threshold of a downgrade. However, now that that risk has materialized, SPPC is no longer on the threshold of a downgrade and the Commission's decision is unlikely to have a material impact on SPPC's rating in the near future.

Q.63 WHAT CAN THE COMMISSION DO TO MITIGATE THESE COSTS FOR RATEPAYERS?

A.63 The Commission has the power to impute a hypothetical capital structure that is more reasonable, as was done in the 2022 Sierra General Rate Case. In Docket 22-06014, at the

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[84] Illinois Commerce Commission RRA Regulatory Focus Major Rate Case Decisions - January - March 2021, Docket No. 23-0066, Nicor Gas Ex. 28.5.
[85] Calculated from Ms. Bulkley's confidential workpaper "Risk Premium Analysis -11.30.2024 CONFIDENTIAL.xlsx"
[86] NV Energy shocked by energy bills from hottest July on record | Las Vegas Review-Journal. Available at: https://www.reviewjournal.com/business/energy/sticker-shock-nv-energy-customers-react-to-bills-from-record-hot-july-2891862.
[87] Rating Action: Moody's downgrades Sierra Pacific Power to Baa2, outlook stable, May 6, 2024.

request of Staff and other parties, the Commission issued an order imputing a hypothetical 52.4% equity ratio, notwithstanding the fact that the actual equity ratio was 54.76%.[88] I am not an attorney, but I understand the Commission is not limited by either *Hope* or *Bluefield* in the ability to impute a hypothetical capital structure, and such is not barred under NRS 704.110(3) either, as the Commission correctly concluded in the 2022 Sierra General Rate Case.[89] The Commission used this tool in 2022 to mitigate against unusual circumstances, and I recommend that it do so here again to protect ratepayers from an unreasonably high equity ratio.

Q.64 WOULD YOUR RECOMMENDATION ON SPPC'S CAPITAL STRUCTURE TESTIMONY SAVE CUSTOMERS FROM UNNECESSARY AND UNREASONABLE INCREASES WHILE STILL PROVIDING FAIR TREATMENT FOR INVESTORS?

A.64 Yes. I recommend the use of a hypothetical capital structure with 50 percent common equity and 50 percent debt. My capital structure recommendation reduces SPPC's revenue requirement by $7.8 million relative to the certification filing.

IV. COST OF CAPITAL

Q.65 WHAT IS SPPC'S COST OF CAPITAL UNDER YOUR PROPOSALS?

A.65 My proposals reduce SPPC's weighted average cost of capital from 7.93 percent to 7.08 percent, as shown in the table below.

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[88] Docket No. 22-06014, Modified Order ¶ 164 (Feb. 16, 2023).
[89] *Id.* at ¶¶ 166-170.

Table LK-17: SPPC Weighted Average Cost of Capital

Description	Amount ($000)	Ratio (%)	Cost (%)	WACC
Debt				
Short Term	-	0.00%	0.00%	0.00%
Cust. Dep.	$21,910	0.63%	5.24%	0.03%
Long Term	$1,716,941	0.4937	4.89%	2.41%
Total Debt	$1,738,851	0.5	4.89%	2.45%
Equity				
Preferred	-	0.00%	0	0.00%
Common	$1,738,851	0.5	0.0925	4.63%
Total Equity	$1,738,851	0.5	0.0925	4.63%
Total Capital	$3,477,701	100.00%		**7.07%**

Q.66 WHAT ARE THE IMPACTS OF YOUR RECOMMENDATIONS ON SPPC'S REVENUE REQUIREMENT?

A.66 My ROE recommendation reduces SPPC's revenue requirement by $17.6 million relative to the certification filing. My capital structure recommendations reduce SPPC's revenue requirement by $7.8 million relative to the certification filing. Together these recommendations reduce SPPC's revenue requirement by $25.3 million relative to the certification filing.[90]

Q.67 DOES THIS CONCLUDE YOUR TESTIMONY?

A.67 Yes.

[90] This change is approximate and may not include all revenue sensitive factors.

AFFIRMATION

Pursuant to the requirements of NRS 53.045 and NAC 703.710, Lance D. Kaufman, states that he is the person identified in the foregoing prepared testimony and/or Exhibits; that such testimony and/or exhibits were prepared by or under the direction of said person; that the answers and/or information appearing therein are true to the best of his knowledge and belief; and that if asked the questions appearing therein, his answers thereto would, under oath, be the same.

I declare under the penalty of perjury that the foregoing is true and correct.

Dated 5/21/2024

Lance Kaufman

Lance D. Kaufman

CERTIFICATE OF SERVICE

The undersigned certifies under penalty of perjury under the laws of the State of Nevada that, on the date given below, (he/she) caused to be served a copy of Prepared Direct Testimony of Lance D. Kaufman upon the following person(s) via First Class U.S. mail, postage prepaid:

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DATED this 21st day of May, 2024, at Reno, Nevada.2024.

/s/Amanda Sanchez
Amanda L. Sanchez

EXHIBIT - KAUFMAN - DIRECT - 1

QUALIFICATION STATEMENT OF LANCE D. KAUFMAN

CURRICULUM VITAE

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EDUCATION:

University of Oregon	Ph.D.	Economics	2008 – 2013
University of Oregon	M.S.	Economics	2006 – 2008
University of Anchorage Alaska	B.B.A.	Economics	2001 – 2004

CERTIFICATIONS:

Certified Depreciation Professional	Society of Depreciation Professionals	2018

PROFESSIONAL EXPERIENCE:

Consultant	Lance Kaufman Consulting	2014 – Present
Senior Economist	Oregon Public Utility Commission	2015 – 2018
Public Utility Advocate	Alaska Department of Law	2014 – 2015
Senior Economist	Oregon Public Utility Commission	2013 – 2014
Instructor	University of Oregon	2008 – 2012
Research Assistant	University of Alaska Anchorage	2003 – 2008

PROFESSIONAL MEMBERSHIPS:

Society of Depreciation Professionals	2015 – Present
American Economics Association	2017 – Present

PUBLICATIONS:

Kaufman, Lance (2013) Three Essays on Governance Structure in the Hospital Industry. University of Oregon

Laura R. Sangaré, Lance Kaufman, Robert A. Bardwell, Deborah Nichols, and Mersine Bryan (forthcoming) The risk of sleep-related death in an inclined sleep environment. *BMC Public Health.*

RESEARCH, CONSULTING, AND ECONOMETRIC ANALYSIS:

- Hughes Socol Piers Resnick & Dym, Ltd.Martinez v TCC Wireless 2024

Deposed as an expert witness for plaintiffs re calculation of economic harm due to breach of contract in Martinez et al. v. TCC Wireless Circuit Court of Cook County, Illinois, County Department, Chancery Division.

- The Municipality of Cedar Falls, Iowa, Cedar Falls, IA 2023
  Retained as a consultant for Cedar Falls Utilities to conduct a depreciation study of their electric, gas, water, and telecommunications utilities.
- Davison Van Cleve, PC, Portland, OR 2023
  Retained as an expert witness for Alliance of Western Energy Consumers regarding revenue requirement, rate spread, and rate design in Portland General Electric Company, Request for a General Rate Revision, Public Utility Commission of Oregon, Docket No. UE 416.
- Davison Van Cleve, PC, Portland, OR 2023
  Retained as an expert witness for Alliance of Western Energy Consumers regarding cost of capital, rate spread, and rate design in PacifiCorp Request for a General Rate Revision, Washington Utilities and Transportation Commission, Docket No. UE-230172.
- Alliance for Retail Energy Markets, La Jolla, CA 2023
  Retained as an expert witness for Alliance for Retail Energy Markets regarding resource adequacy of generation service providers in Arizona Public Service Company, Request for a General Rate Revision, Arizona Public Utilities Commission, Docket No. E-01345A-22-0144.
- North Carolina Sustainable Energy Association, Raleigh, NC 2023
  Retained as an expert witness forNorth Carolina Sustainable Energy Association regarding depreciation rates and coal plant securitization in Duke Energy Carolinas, Request for a General Rate Revision, North Carolina Utility Commission Docket No. E-7 Sub 1276.
- Deep Blue Pacific Wind, Portland, OR 2023
  Retained as an expert witness for Deep Blue Pacific Wind regarding least cost planning in Portland General Electric Company, 2023 Integrated Resource Plan, Public Utility Commission of Oregon, Docket No. LC 80.
- Duane Morris LLP Boston, MA 2022
  Deposed as an expert witness for plaintiffs re calculation of economic harm due to breach of contract in Harold Parsons v. The Commerce Insurance Company Suffolk Superior Court Commonwealth of Massachusetts.
- Davison Van Cleve, PC, Portland, OR 2022
  Retained as an expert witness for Alliance of Western Energy Consumers regarding revenue requirement, rate spread, and rate design in Portland General Electric Company, Request for a General Rate Revision, Public Utility Commission of Oregon, Docket No. UE 394.
- Davison Van Cleve, PC, Portland, OR 2022
  Retained as an expert witness for Alliance of Western Energy Consumers regarding depreciation rates in Portland General Electric Company Detailed Depreciation Study of Electric Utility Properties, Public Utility Commission of Oregon, Docket No. UM 2152.
- Davison Van Cleve, PC, Portland, OR 2022

Retained as an expert witness for Alliance of Western Energy Consumers regarding revenue requirement, rate spread, and rate design in Pacific Power Request for a General Rate Revision, Public Utility Commission of Oregon, Docket No. UE 399.

- Davison Van Cleve, PC, Portland, OR 2022
  Retained as an expert witness for Alliance of Western Energy Consumers regarding revenue requirement, rate spread, and rate design in Puget Sound Energy General Rate Case to Update Base Rates, Washington Utility and Transportation Commission, Docket No. UE-220066, UG-220067, UE-210918.
- Davison Van Cleve, PC, Portland, OR 2022
  Retained as an expert witness for Alliance of Western Energy Consumers competitive energy service in AWEC's Investigation into Long-Term Direct Access Programs, Public Utility Commission of Oregon, Docket No. UM 2024.
- Davison Van Cleve, PC, Portland, OR 2021
  Retained as an expert witness for Alliance of Western Energy Consumers competitive energy service in Direct Access Rulemaking, Public Utility Commission of Oregon, Docket No. AR 651.
- Davison Van Cleve, PC, Portland, OR 2022
  Retained as an expert witness for Smart Energy Alliance regarding revenue requirement, rate spread, and rate design in Sierra Pacific General Rate Case to Update Base Rates, Public Utility Commission of Nevada, Docket No. 22-06014.
- Davison Van Cleve, PC, Portland, OR 2022
  Retained as an expert witness for Alliance of Western Energy Consumers regarding revenue requirement, rate spread, and rate design in Avista Corp General Rate Case to Update Base Rates, Washington Utility and Transportation Commission, Docket No. UE-220053 & UG-220054.
- Georgia Public Service Commission, OR 2022
  Retained as an expert witness for Georgia Public Service Commission depreciation rates and decommissioning costs in Georgia Power Company's 2022 General Rate Case, Georgia Public Service Commission, Docket No. 44280.
- Nichols Kaster, PLLP, Minneapolis, Minnesota, 2013 –
  Deposed as expert witness for the plaintiffs re analysis of termination of older employees in re Raymond, et al. v. Spirit Aerosystems, Inc., Case No. 16-1282-JTM-GEB, United States District Court, District of Kansas.
- Jester, Gibson & Moore, Denver, CO 2022
  Deposed as an expert witness for defendants and countersuit plaintiffs regarding lost earnings in Franklin D. Azar & Associates, P.C., v. Ivy Ngo v. Franklin D. Azar.
- Georgia Public Service Commission Public Interest Advocacy Staff, Atlanta, GA (2022)
  Provided **Testimony** as an expert witness in Docket No. 44280 Georgia Power Company's 2022 Rate Case Depreciation Study.
- Inland Empire Paper Co., Spokane, WA (2020)
  Provided **Testimony** as an expert witness in WUTC Docket No. UE-200900, Avista Corp's 2020 Rate Case regarding avoided cost pricing for a special contract.
- Davison Van Cleve, PC, Portland, OR 2021
  Provided **Testimony** as an expert witness for Alliance of Western Energy Consumers regarding depreciation, cost of service, rate design, and revenue requirement in Portland

General Electric Company 2021 General Rate Case, Public Utility Commission of Oregon, Docket No. UE 394.

- Davison Van Cleve, PC, Portland, OR 2021
  Provided comments as an expert witness for Alliance of Western Energy Consumers in Puget Sound Energy's 2022 General Rate Case, Washington Utilities and Transportation Commission.
- Davison Van Cleve, PC, Portland, OR 2022
  Provided comments as an expert witness for Alliance of Western Energy Consumers in Puget Sound Energy's 2022 General Rate Case, Washington Utilities and Transportation Commission.
- Davison Van Cleve, PC, Portland, OR 2021
  Provided comments as an expert witness for Alliance of Western Energy Consumers in Avista Corp's Clean Energy Implementation Plan, Washington Utilities and Transportation Commission.
- Davison Van Cleve, PC, Portland, OR 2021
  Provided comments as an expert witness for Alliance of Western Energy Consumers in PacifiCorp's General Rate Case, Public Utility Commission of Oregon, Docket No. UE 399.
- Davison Van Cleve, PC, Portland, OR 2021
  Provided comments as an expert witness for Alliance of Western Energy Consumers in Puget Sound Energy's Clean Energy Implementation Plan, Washington Utilities and Transportation Commission.
- Hagens Berman Sobol Shapiro LLP, Phoenix, Arizona, 2021
  Deposed as an expert witness for plaintiffs re calculation of economic harm due to breach of contract in Kronenberg, et al. vs. Allstate Insurance Company, et al. United States District Court Eastern District of New York Case No.: 18-cv-06899 (NGG) (JO).
- Baumgartner Law, LLC, Denver, CO, 2021
  Deposed as an expert witness for plaintiffs re calculation of economic harm due to injury in re In Re: Bernadette Romero and Leonard Martinez v. City of Westminster
- Killmer, Lane, and Newman, LLP, Denver, Colorado, 2020
  Retained as expert witness for plaintiff re racial disparities in police use of force re Estate of Elijah J. McClain V. City Of Aurora, Colorado, Case No. 1:19-cv-01160-RM-MEH, United States District Court, District of Colorado.
- Hagens Berman Sobol Shapiro LLP, Phoenix, Arizona, 2020
  Deposed as an expert witness for plaintiffs re calculation of economic harm due to breach of contract in Fortson, et al. v. Garrison Property and Casualty Insurance Co. United States District Court Middle District of North Carolina Civil Action No. 1:19-cv-294.
- Hagens Berman Sobol Shapiro LLP, Phoenix, Arizona, 2020
  Deposed as an expert witness for plaintiffs re calculation of economic harm due to breach of contract in Lewis and Lewis, et al. v. Government Employees Insurance Co. United States District Court For the District of New Jersey Civil Action No. 1:18−CV−05111−RBK−AMD.
- Cable Huston, LLP, Portland, OR 2020
  Retained as an expert witness for Alliance of Western Energy Consumers regarding revenue requirement, rate spread and rate design in Cascade Natural Gas Corporation

Request for General Rate Revision, Public Utility Commission of Oregon, Docket No. UG 390.

- Davison Van Cleve, PC, Portland, OR 2020
  Retained as an expert witness for Alliance of Western Energy Consumers regarding net power costs in Portland General Electric Company 2021 Annual Power Cost Update Tariff, Public Utility Commission of Oregon, Docket No. UE 377.
- Davison Van Cleve, PC, Portland, OR 2020
  Retained as an expert witness for Alliance of Western Energy Consumers regarding net power costs in Portland General Electric Company 2021 Annual Update Tariff, Public Utility Commission of Oregon, Docket No. UE 381.
- Davison Van Cleve, PC, Portland, OR 2020
  Retained as an expert witness for Alliance of Western Energy Consumers regarding revenue requirement, rate spread and rate design in Nevada Power Company 2021 General Rate Case, Public Utility Commission of Nevada, Docket No. 20-06003
- Frank & Salahuddin LLC, Denver, Colorado, 2020
  Retained as an expert witness for plaintiffs regarding calculation of lost earnings.
- Level Development Group, LLC, Denver, Colorado, 2020
  Develop real estate valuation model for establishing sale price of newly constructed residential housing.
- Hagens Berman Sobol Shapiro LLP, Phoenix, Arizona, 2020
  Deposed as an expert witness for plaintiffs re calculation of economic harm due to breach of contract in Jeff Olberg v. Allstate Insurance Company, Case No. C18-0573-JCC, United States District Court, Western District of Washington at Seattle.
- Hagens Berman Sobol Shapiro LLP, Phoenix, Arizona, 2020
  Deposed as an expert witness for plaintiffs re calculation of economic harm due to breach of contract in re Cameron Lundquist v. First National Insurance Company of America, Case No. 18-cv-05301-RJB, United States District Court, Western District of Washington at Tacoma.
- Killmer, Lane, and Newman, LLP, Denver, Colorado, 2020
  Deposed as expert witness for plaintiff re racial disparities in police use of force re Brandon Washington V. City Of Aurora, Colorado, Case No. 1:19-cv-01160-RM-MEH, United States District Court, District of Colorado.
- Davison Van Cleve, PC, Portland, OR 2020
  Retained as an expert witness for Alliance of Western Energy Consumers regarding coal plant pollution control investments, coal plant decommissioning costs, rate spread and rate design re PacifiCorp 2020 Request for a General Rate Revision, Public Utility Commission of Oregon Docket No. UE 374.
- Davison Van Cleve, PC, Portland, OR and Washington Attorney General, 2020
  Retained as an expert witness for Packaging Company of America and Washington Public Council regarding decommissioning costs and rate design re PacifiCorp 2020 Request for a General Rate Revision, Washington Utility and Transportation Commission.
- Sanger Law, PC, Portland, OR, 2019
  Retained as a consultant for Renewable Energy Coalition and for Northwest & Intermountain Power Producers Coalition to provide analysis of PacifiCorp avoided costs

in a Utility PURPA Compliance Filing at the Washington Utility and Transportation Commission Docket, No. UE-190666.

- Sanger Law, PC, Portland, OR, 2019
  Retained as a consultant for Northwest & Intermountain Power Producers Coalition to provide analysis of Portland General Electric avoided costs in support of testimony to the Oregon Legislature.
- Powder River Basin Resource Council, Laramie, Wyoming, 2019.
  Testified as an expert witness for Powder River Basin Resource Council regarding coal plant closures re PacifiCorp 2019 Integrated Resource Plan, Wyoming Public Service Commission Docket No. 90000-147-XI-19.
- The Law Office of Ralph Lamar, Arvada, CO 2019
  Deposed as an expert witness for plaintiffs regarding lost profits of a Farmers insurance agency
- Jester, Gibson & Moore, Denver, CO 2019
  Retained as an expert witness for plaintiffs regarding lost earnings in an ADEA wrongful termination matter.
- Albrechta & Coble, Ltd. Fremont, OH 2019
  Retained as an expert witness for plaintiff regarding lost earnings in a race related wrongful termination matter.
- Conrad Law, PC, Salt Lake City, UT 2019
  Retained as an expert witness for Ellis-Hall Consultants, LLC. regarding economic damages in Ellis-Hall Consultants, LLC. et. al. v. George B. Hofmann IV, United States District Court, District of Utah, Central Division.
- Davison Van Cleve, PC, Portland, OR 2019
  Retained as an expert witness for Alliance of Western Energy Consumers regarding net variable power cost calculations in PORTLAND GENERAL ELECTRIC COMPANY, 2020 Annual Power Cost Update Tariff Public Utility Commission of Oregon Docket No. UE 359.
- Sanger Law, PC, Portland, OR, 2019
  Testified as an expert witness for Renewable Energy Coalition and Rocky Mountain Coalition for Renewable Energy regarding Qualified Facility avoided costs in Application of Rocky Mountain Power for a Modification of Avoided Cost Methodology and Reduced Term of PURPA Power Purchase Agreements Public Service Commission of Wyoming Docket No. 20000-545-ET-18
- Sanger Law, PC, Portland, OR, 2019
  Retained as an expert witness for Cafeto Coffee Company regarding the necessity, design, and location of transmission lines in SPRINGFIELD UTILITY BOARD Petition for Certificate of Public Convenience and Necessity Public Utility Commission of Oregon Docket No. PCN 3.
- Baumgartner Law, LLC, Denver, CO, 2018
  Retained as an expert witness for plaintiffs re calculation of economic harm due to injury in re Eric Bowman, v. Top Tier Colorado, LLC,, Case No. 18CV31359, United States District Court, District of Colorado.
- Cohen Milstein Sellers & Toll PLLC, Washington DC, 2018

Retained as an expert witness for plaintiffs re calculation of economic harm due to breach of contract in re Isaac Harris et al. v. Medical Transportation Management, Inc., Civil Action No. 17-1371, United States District Court, District of Columbia.

- Davison Van Cleve, PC, Portland, OR 2020
  Retained as an expert witness for Alliance of Western Energy Consumers regarding depreciation rates in re PacifiCorp Application for Authority to Implement Revised Depreciation Rates, Public Utility Commission of Oregon Docket No. UM 1968.
- Davison Van Cleve, PC, Salem, OR and Washington Attorney General, OR 2020
  Retained as an expert witness for Packaging Company of America and Washington Public Council regarding depreciation rates in re Pacific Power 2018 Depreciation Study, Washington Utility and Transportation Commission, Docket No. UE-180778.
- Hagens Berman Sobol Shapiro LLP, Phoenix, Arizona, 2018
  Deposed as an expert witness for plaintiffs re calculation of economic harm due to breach of contract in re Vicky Maldonado and Carter v. Apple Inc., AppleCare Services Company, Inc., and Apple CSC, Inc., Case No. 3:16-cv-04067-WHO, United States District Court, District of California.
- Hagens Berman Sobol Shapiro, LLP, Phoenix, Arizona, 2018
  Deposed and testified as an expert witness for plaintiffs re calculation of unpaid mileage for truck drivers in re Swift Transportation Co., Inc., Civil Action No. CV2004-001777, Superior Court of the State of Arizona, County of Maricopa.
- Killmer, Lane, and Newman, LLP, Denver, Colorado, 2018
  Retained as expert witness for plaintiffs re reasonable attorney fees in re Jeanne Stroup and Ruben Lee, v. United Airlines, Inc., Case No. 15-cv-01389-WYD-STV, United States District Court, District of Colorado.
- Klein and Frank, PC, Denver, Colorado, 2018
  Retained as expert witness for plaintiffs re potential jury bias in re Gail Goehrig and Chris Goehrig v. Core Mountain Enterprises, LLC, Case No. 2016CV030004, San Juan County District Court.
- Robert Belluso, Pennsylvania, 2017
  Retained as expert witness for plaintiff re lost profit in re Robert Belluso D.O. v Trustees of Charleroi Community Park, PHRC Case No. 201505365, Pennsylvania Human Relations Commission.
- Lowery Parady, LLC, Denver, Colorado, 2017
  Analyzed payroll data and calculated unpaid overtime and unpaid hours for plaintiff class action in re Violeta Solis, et al. v. The Circle Group, LLC, et al., Case No. 1:16-cv-01329-RBJ, United States District Court, District of Colorado.
- Sawaya & Miller Law Firm, Denver, Colorado, 2017
  Provided data processing and analysis of employment records.
- Financial Scholars Group, Orinda, California, 2017
  Provided analysis of risk profile in bundled real estate and personal loans in re Old Republic Insurance Company v. Countrywide Bank et al., Circuit Court of Cook County, Illinois, Chancery Division.
- Financial Scholars Group, Orinda, California, 2017

Provided consultation and analysis of financial market transactions in preparation of settlement claims filings in re Laydon v. Mizuho Bank, Ltd., et al. and Sonterra Capital Master Fund Ltd., et al v. UBS AG et al.

- Clean Energy Action, Boulder, Colorado, 2016 – 2017
  Provided consultation on the appropriate discounting methodology used in energy resource planning in the Public Service Company of Colorado application for approval of the 2016 Electric Resource Plan, Proceeding No. 16A-0396E, Public Utilities Commission of the State of Colorado.
- Confidential Client, 2016
  Provided analysis and report on the probability that distinct crimes are independent events based on geographical analysis of crime rates.
- Christine Lamb and Kevin James Burns, Denver, Colorado, 2016
  Provided data analysis for defendant of the impact of ethnicity on termination decisions in re Aragon et al v. Home Depot USA, Inc., Case No. 1:15-cv- 00466-MCA-KK, United States District Court, District of New Mexico.
- Steptoe & Johnson LLP, Washington, DC, 2015 – 2016
  Programmed analysis of internet traffic data for plaintiffs applying a proprietary probability model developed to identify and verify accounts responsible for repeated infringements of asserted copyrights by defendants' internet subscribers in re BMG Rights Management (US) LLC, and Round Hill Music LP v. Cox Enterprises, Inc., et al., Case No. 1:14-cv-1611(LOG/JFA), United States District Court Eastern District of Virginia, Alexandria Division.
- Padilla & Padilla, PLLC, Denver, Colorado, 2014 – 2016
  Provided research and analysis for plaintiffs re the impact on minority applicants from use of the AccuPlacer Test by the City and County of Denver, and estimated damages in re Marian G. Kerner et al. v. City and County of Denver, Civil Action No. 11-cv-00256-MSK-KMT, United States District Court, District of Colorado.
- U.S. Equal Employment Opportunity Commission, 2013
  Provided statistical analysis of EEOC filings.

OTHER REGULATORY PROCEEDINGS:

- Portland General Electric 2018 AUT UE 335
- Portland General Electric 2016 Annual Power Cost Variance Docket No. UE 329.
- PacifiCorp 2016 Power Cost Adjustment Mechanism Docket No. UE 327.
- Public Utility Commission of Oregon Staff Investigation into the Treatment of New Facility Direct Access Charges Docket No. UM 1837
- PacifiCorp Oregon Specific Cost Allocation Investigation Docket No. UM 1824.
- PacifiCorp 2018 Transition Adjustment Mechanism Docket No. UE 323.
- Portland General Electric 2018 General Rate Case Docket No. UE 319.
- Avista Corp. 2017 General Rate Case Docket No. UG 325.
- Portland General Electric Affiliated Interest Agreement with Portland General Gas Supply Docket No. UI 376.
- Portland General Electric 2017 Automated Update Tariff Docket No. UE 308
- PacifiCorp 2017 Transition Adjustment Mechanism Docket No. UE 307

- Portland General Electric 2017 Reauthorization of Decoupling Adjustment Docket No. UE 306
- Northwest Natural Gas Investigation of WARM Program Docket No. UM 1750.
- PacifiCorp Investigation into Multi-Jurisdictional Allocation Issues Docket No. UM 1050.
- Idaho Power Company 2015 Power Supply Expense True Up Docket No. UE 305
- Homer Electric Association 2015 Depreciation Study U-15-094
- Submitted prefiled testimony regarding the depreciation study.
- Chugach Electric Association 2015 Rate Case U-15-081
- Developed staff position regarding margin calculations.
- ENSTAR 2014 Rate Case U-14-111
- Submitted prefiled testimony regarding sales forecast.
- Alaska Pacific Environmental Services 2014 Rate Case U-14-114/115/116/117/118
  Submitted prefiled testimony regarding cost allocations, cost of service, cost of capital, affiliated interests, and depreciation.
- Alaska Waste 2014 Rate Case U-14-104/105/106/107
  Submitted prefiled testimony regarding cost of service study, cost of capital, operating ratio, and affiliated interest real estate contracts.
- Fairbanks Natural Gas 2014 Rate Case U-14-102
  Submitted prefiled testimony regarding cost of service study and forecasting models.
- Avista 2015 Rate Case U-14-104
  Submitted analysis supporting OPUC Staff settlement positions regarding Avista's sales and load forecast, decoupling mechanisms and interstate cost allocation methodology. Represented Staff in settlement conferences on November 21, November 26, and December 4, 2013.
- Portland General Electric 2015 Rate Case
  Submitted pre-filed opening testimony addressing PGE's sales forecast, printing and mailing budget forecast, mailing budget, marginal cost study, line extension policy and reactive demand charge. Represented OPUC Staff in settlement conferences on May 20, May 27, and June 12, 2014.
- Portland General Electric 2014 General Rate Case
  Submitted analysis supporting OPUC Staff settlement positions regarding PGE's sales and load forecast, revenue decoupling mechanism, and cost of service study. Represented OPUC Staff in settlement conferences on May 29, June 3, June 6, July 2, and July 9 of 2013. Submitted testimony in support of partial stipulation, pre-filed opening testimony addressing PGE's decoupling mechanism, and testimony in support of a second partial stipulation.
- PacifiCorp 2014 General Electric Rate Case
  Submitted analysis supporting OPUC Staff settlement positions regarding PacifiCorp's sales and load forecast and cost of service study. Represented Staff in settlement conferences on June 12 through June 14, 2013.

EXHIBIT - KAUFMAN - DIRECT - 2

DISCOVERY RESPONSES

NV Energy

RESPONSE TO INFORMATION REQUEST

DOCKET NO:	24-02026	**REQUEST DATE:**	05-06-2024
REQUEST NO:	SEA 02	**KEYWORD:**	Exhibit Behrens Direct-2
REQUESTER:	Ledford	**RESPONDER:**	Gabatino, Christina

REQUEST:

Please provide Exhibit Behrens-Direct-2.

RESPONSE CONFIDENTIAL (yes or no): No.

TOTAL NUMBER OF ATTACHMENTS: None.

RESPONSE:

The requested Exhibit Behrens-Direct-2 is in the External Discovery Library (https://ucmx.nvenergy.com/) in Docket 24-02026 SPPC Electric GRC Commission Filings folder under ID# 6638407 - Commission Filings - SPPC - Electric and Gas GRC Errata_04.18.24, Attachment 5.

NV Energy

RESPONSE TO INFORMATION REQUEST

DOCKET NO:	24-02026	**REQUEST DATE:**	05-06-2024
REQUEST NO:	SEA 07	**KEYWORD:**	Behrens-Direct Testimony pg 12
REQUESTER:	Ledford	**RESPONDER:**	Behrens, Michael

REQUEST:

Please refer to Behrens-DIRECT page 12, lines 1 to 2:

a. In the event that BHE declines to deploy capital to the Company, could the Company raise equity in traditional capital markets? If not, why not?

b. Has BHE failed to deploy sufficient capital to any of its subsidiary regulated utility companies? If yes, please identify each such instance.

RESPONSE CONFIDENTIAL (yes or no): No.

TOTAL NUMBER OF ATTACHMENTS: None.

RESPONSE:

a) I am not aware of any interest that BHE or the Company has in selling equity in the business. If BHE would decline to deploy capital, it would be because of unfavorable returns, and therefore a business decision, not because the equity is unavailable. Such a scenario is not currently being evaluated as the Company made a proposal for the necessary regulatory support to avoid such a situation.

b.) Mr. Behrens is not involved in the decisions made on deploying capital to other businesses, and therefore, he does not know.

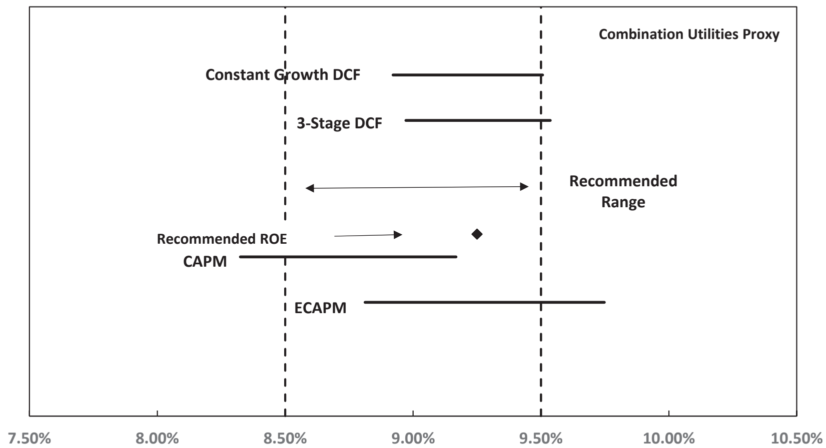
EXHIBIT - KAUFMAN - DIRECT - 3

WORKPAPERS - COST OF CAPITAL CALCULATIONS

SUMMARY OF COE ANALYSES RESULTS
COMBINATION UTILITIES PROXY GROUP

Discounted Cash Flow Models			
		CBO Term. Rate	30-Year Bond Term. Rate
Constant Growth DCF			
30-Day Average		8.92%	9.51%
90-Day Average		8.99%	9.48%
180-Day Average		8.95%	9.51%
Average		8.95%	9.50%
Three Stage DCF			
30-Day Average		9.21%	9.54%
90-Day Average		9.17%	9.50%
180-Day Average		8.97%	9.30%
Average		9.12%	9.45%
CAPM / ECAPM / Bond Yield Risk Premium			
	Kroll Market Return	Value Line Market Return	
CAPM:			
Industry Adj. Beta	8.37%	9.17%	
Raw Beta	8.32%	9.11%	
ECAPM:			
Industry Adj. Beta	8.85%	9.75%	
Raw Beta	8.81%	9.70%	

	X	Y
Constant Growth Mean DCF	8.92%	7.5
	9.51%	7.5
		7.5
Constant Growth Median DCF	8.97%	6.5
	9.54%	6.5
		6.5
CAPM	8.32%	3.5
	9.17%	3.5
ECAPM	8.81%	2.5
	9.75%	2.5
Low End ROE Recommendation	8.50%	0.0
	8.50%	9.0
High End ROE Recommendation	9.50%	0.0
	9.50%	9.0
Recommended ROE	9.25%	4.0



Combination Utilities Proxy
Constant Growth DCF
3-Stage DCF
Recommended
Range
Recommended ROE
CAPM
ECAPM
7.50%
8.00%
8.50%
9.00%
9.50%
10.00%
10.50%

Stock Data and Growth Forecasts

Company	Ticker	[1] Annualized Dividend	[2] Stock Price	[3] Dividend Yield	[4] Expected Dividend Yield	[5] Value Line EPS Growth	[6] Yahoo! Finance EPS	[7] Zacks EPS Growth	[8] Average Growth Rate
Atmos Energy Corporation	ATO	$3.22	$110.15	2.92%	3.03%	7.00%	7.50%	7.30%	7.27%
NiSource Inc.	NI	$1.00	$25.47	3.93%	4.09%	9.50%	8.30%	7.20%	8.33%
Northwest Natural Gas Company	NWN	$1.95	$37.13	5.25%	5.36%	6.50%	2.80%	3.70%	4.33%
ONE Gas, Inc.	OGS	$2.60	$60.91	4.27%	4.39%	6.50%	5.00%	5.00%	5.50%
Spire, Inc.	SR	$2.88	$58.30	4.94%	5.11%	8.00%	n/a	5.60%	6.80%
ALLETE, Inc.	ALE	$2.71	$54.18	5.00%	5.19%	6.00%	8.10%	8.10%	7.40%
Alliant Energy Corporation	LNT	$1.81	$49.32	3.67%	3.79%	6.50%	6.65%	6.30%	6.48%
Ameren Corporation	AEE	$2.52	$76.88	3.28%	3.38%	6.50%	6.20%	6.60%	6.43%
American Electric Power Company, Inc.	AEP	$3.52	$76.65	4.59%	4.71%	6.50%	3.70%	4.80%	5.00%
Avista Corporation	AVA	$1.84	$33.32	5.52%	5.69%	6.00%	5.90%	5.90%	5.93%
CMS Energy Corporation	CMS	$1.95	$55.46	3.52%	3.64%	6.50%	7.70%	7.50%	7.23%
Duke Energy Corporation	DUK	$4.10	$88.52	4.63%	4.77%	5.00%	6.55%	6.10%	5.88%
Entergy Corporation	ETR	$4.52	$96.53	4.68%	4.82%	0.50%	11.00%	6.40%	5.97%
Evergy, Inc.	EVRG	$2.57	$49.33	5.21%	5.33%	7.50%	2.50%	4.30%	4.77%
IDACORP, Inc.	IDA	$3.32	$96.12	3.45%	3.52%	4.00%	3.70%	4.10%	3.93%
MGE Energy, Inc.	MGEE	$1.71	$72.34	2.36%	2.43%	6.50%	5.40%	5.30%	5.73%
NextEra Energy, Inc.	NEE	$1.87	$56.48	3.31%	3.45%	9.50%	8.15%	8.20%	8.62%
NorthWestern Corporation	NWE	$2.56	$49.46	5.18%	5.29%	3.50%	4.08%	5.20%	4.26%
OGE Energy Corporation	OGE	$1.67	$34.43	4.86%	4.98%	6.50%	negative	3.70%	5.10%
Pinnacle West Capital Corporation	PNW	$3.52	$72.98	4.82%	4.94%	2.50%	5.90%	5.90%	4.77%
Portland General Electric Company	POR	$1.90	$40.73	4.66%	4.79%	5.00%	4.60%	6.00%	5.20%
Southern Company	SO	$2.80	$68.05	4.11%	4.24%	6.50%	7.10%	4.00%	5.87%
Wisconsin Energy Corporation	WEC	$3.12	$81.41	3.83%	3.95%	6.00%	5.80%	5.90%	5.90%
Xcel Energy Inc.	XEL	$2.08	$59.77	3.48%	3.59%	6.00%	6.80%	6.10%	6.30%

30-DAY CONSTANT GROWTH DCF -- Treasury Long Term Growth Rate

		[1]	[2]	[3]	[4]	[8]	[9]	[10]	[11]
Company	Ticker	Annualized Dividend	Stock Price	Dividend Yield	Expected Dividend Yield	Average Growth Rate	Terminal Growth Rate	30-Year Average Growth	ROE
Atmos Energy Corporation	ATO	$3.22	$110.15	2.92%	3.03%	7.27%	4.77%	5.98%	9.01%
NiSource Inc.	NI	$1.00	$25.47	3.93%	4.09%	8.33%	4.77%	6.49%	10.58%
Northwest Natural Gas Company	NWN	$1.95	$37.13	5.25%	5.36%	4.33%	4.77%	4.56%	9.93%
ONE Gas, Inc.	OGS	$2.60	$60.91	4.27%	4.39%	5.50%	4.77%	5.13%	9.51%
Spire, Inc.	SR	$2.88	$58.30	4.94%	5.11%	6.80%	4.77%	5.75%	10.86%
ALLETE, Inc.	ALE	$2.71	$54.18	5.00%	5.19%	7.40%	4.77%	6.04%	11.23%
Alliant Energy Corporation	LNT	$1.81	$49.32	3.67%	3.79%	6.48%	4.77%	5.60%	9.39%
Ameren Corporation	AEE	$2.52	$76.88	3.28%	3.38%	6.43%	4.77%	5.58%	8.96%
American Electric Power Company, Inc.	AEP	$3.52	$76.65	4.59%	4.71%	5.00%	4.77%	4.88%	9.59%
Avista Corporation	AVA	$1.84	$33.32	5.52%	5.69%	5.93%	4.77%	5.33%	11.02%
CMS Energy Corporation	CMS	$1.95	$55.46	3.52%	3.64%	7.23%	4.77%	5.96%	9.61%
Duke Energy Corporation	DUK	$4.10	$88.52	4.63%	4.77%	5.88%	4.77%	5.31%	10.08%
Entergy Corporation	ETR	$4.52	$96.53	4.68%	4.82%	5.97%	4.77%	5.35%	10.17%
Evergy, Inc.	EVRG	$2.57	$49.33	5.21%	5.33%	4.77%	4.77%	4.77%	10.10%
IDACORP, Inc.	IDA	$3.32	$96.12	3.45%	3.52%	3.93%	4.77%	4.37%	7.89%
MGE Energy, Inc.	MGEE	$1.71	$72.34	2.36%	2.43%	5.73%	4.77%	5.24%	7.67%
NextEra Energy, Inc.	NEE	$1.87	$56.48	3.31%	3.45%	8.62%	4.77%	6.63%	10.09%
NorthWestern Corporation	NWE	$2.56	$49.46	5.18%	5.29%	4.26%	4.77%	4.53%	9.81%
OGE Energy Corporation	OGE	$1.67	$34.43	4.86%	4.98%	5.10%	4.77%	4.93%	9.91%
Pinnacle West Capital Corporation	PNW	$3.52	$72.98	4.82%	4.94%	4.77%	4.77%	4.77%	9.71%
Portland General Electric Company	POR	$1.90	$40.73	4.66%	4.79%	5.20%	4.77%	4.98%	9.77%
Southern Company	SO	$2.80	$68.05	4.11%	4.24%	5.87%	4.77%	5.30%	9.54%
Wisconsin Energy Corporation	WEC	$3.12	$81.41	3.83%	3.95%	5.90%	4.77%	5.32%	9.26%
Xcel Energy Inc.	XEL	$2.08	$59.77	3.48%	3.59%	6.30%	4.77%	5.51%	9.10%
Mean									
Gas only [12]				4.26%	4.40%	6.45%	4.77%	5.58%	9.98%
Electric only [13]				4.28%	4.41%	5.74%	4.77%	5.24%	9.65%
Combination Utilities [14]				3.91%	4.03%	6.22%	4.77%	5.47%	9.51%
Combined Gas & Electric [15]				4.28%	4.40%	5.90%	4.77%	5.32%	9.72%
Median									
Gas only [12]				4.27%	4.39%	6.80%	4.77%	5.75%	9.93%
Electric only [13]				4.63%	4.77%	5.87%	4.77%	5.30%	9.77%
Combination Utilities [14]				3.83%	3.95%	5.93%	4.77%	5.33%	9.54%
Combined Gas & Electric [15]				4.61%	4.74%	5.88%	4.77%	5.31%	9.79%

90-DAY CONSTANT GROWTH DCF -- Treasury Long Term Growth Rate

		[1]	[2]	[3]	[4]	[8]	[9]	[10]	[11]
Company	Ticker	Annualized Dividend	Stock Price	Dividend Yield	Expected Dividend Yield	Average Growth Rate	Terminal Growth Rate	30-Year Average Growth	ROE
Atmos Energy Corporation	ATO	$3.22	$112.18	2.87%	2.97%	7.27%	4.77%	5.98%	8.95%
NiSource Inc.	NI	$1.00	$25.91	3.86%	4.02%	8.33%	4.77%	6.49%	10.52%
Northwest Natural Gas Company	NWN	$1.95	$38.73	5.04%	5.14%	4.33%	4.77%	4.56%	9.71%
ONE Gas, Inc.	OGS	$2.60	$68.57	3.79%	3.90%	5.50%	4.77%	5.13%	9.02%
Spire, Inc.	SR	$2.88	$58.60	4.91%	5.08%	6.80%	4.77%	5.75%	10.84%
ALLETE, Inc.	ALE	$2.71	$54.27	4.99%	5.18%	7.40%	4.77%	6.04%	11.22%
Alliant Energy Corporation	LNT	$1.81	$49.86	3.63%	3.75%	6.48%	4.77%	5.60%	9.35%
Ameren Corporation	AEE	$2.52	$78.29	3.22%	3.32%	6.43%	4.77%	5.58%	8.90%
American Electric Power Company, Inc.	AEP	$3.52	$77.17	4.56%	4.68%	5.00%	4.77%	4.88%	9.56%
Avista Corporation	AVA	$1.84	$33.50	5.49%	5.66%	5.93%	4.77%	5.33%	10.99%
CMS Energy Corporation	CMS	$1.95	$55.55	3.51%	3.64%	7.23%	4.77%	5.96%	9.60%
Duke Energy Corporation	DUK	$4.10	$89.10	4.60%	4.74%	5.88%	4.77%	5.31%	10.05%
Entergy Corporation	ETR	$4.52	$95.22	4.75%	4.89%	5.97%	4.77%	5.35%	10.24%
Evergy, Inc.	EVRG	$2.57	$52.10	4.93%	5.05%	4.77%	4.77%	4.77%	9.82%
IDACORP, Inc.	IDA	$3.32	$95.86	3.46%	3.53%	3.93%	4.77%	4.37%	7.90%
MGE Energy, Inc.	MGEE	$1.71	$72.89	2.35%	2.41%	5.73%	4.77%	5.24%	7.65%
NextEra Energy, Inc.	NEE	$1.87	$61.29	3.05%	3.18%	8.62%	4.77%	6.63%	9.81%
NorthWestern Corporation	NWE	$2.56	$50.42	5.08%	5.19%	4.26%	4.77%	4.53%	9.71%
OGE Energy Corporation	OGE	$1.67	$34.14	4.90%	5.03%	5.10%	4.77%	4.93%	9.96%
Pinnacle West Capital Corporation	PNW	$3.52	$75.15	4.68%	4.80%	4.77%	4.77%	4.77%	9.57%
Portland General Electric Company	POR	$1.90	$42.56	4.46%	4.58%	5.20%	4.77%	4.98%	9.56%
Southern Company	SO	$2.80	$67.52	4.15%	4.27%	5.87%	4.77%	5.30%	9.57%
Wisconsin Energy Corporation	WEC	$3.12	$82.96	3.76%	3.87%	5.90%	4.77%	5.32%	9.19%
Xcel Energy Inc.	XEL	$2.08	$58.79	3.54%	3.65%	6.30%	4.77%	5.51%	9.16%
Mean									
Gas only [12]				4.09%	4.22%	6.45%	4.77%	5.58%	9.81%
Electric only [13]				4.23%	4.35%	5.74%	4.77%	5.24%	9.59%
Combination Utilities [14]				3.88%	4.00%	6.22%	4.77%	5.47%	9.48%
Combined Gas & Electric [15]				4.20%	4.32%	5.90%	4.77%	5.32%	9.64%
Median									
Gas only [12]				3.86%	4.02%	6.80%	4.77%	5.75%	9.71%
Electric only [13]				4.56%	4.68%	5.87%	4.77%	5.30%	9.57%
Combination Utilities [14]				3.76%	3.87%	5.93%	4.77%	5.33%	9.57%
Combined Gas & Electric [15]				4.51%	4.63%	5.88%	4.77%	5.31%	9.64%

180-DAY CONSTANT GROWTH DCF -- Treasury Long Term Growth Rate

		[1]	[2]	[3]	[4]	[8]	[9]	[10]	[11]
Company	Ticker	Annualized Dividend	Stock Price	Dividend Yield	Expected Dividend Yield	Short Term Growth Rate	Terminal Growth Rate	30-Year Average Growth	ROE
Atmos Energy Corporation	ATO	$3.22	$113.07	2.85%	2.95%	7.27%	4.77%	5.98%	8.93%
NiSource Inc.	NI	$1.00	$26.50	3.77%	3.93%	8.33%	4.77%	6.49%	10.43%
Northwest Natural Gas Company	NWN	$1.95	$41.27	4.73%	4.83%	4.33%	4.77%	4.56%	9.39%
ONE Gas, Inc.	OGS	$2.60	$72.99	3.56%	3.66%	5.50%	4.77%	5.13%	8.79%
Spire, Inc.	SR	$2.88	$62.07	4.64%	4.80%	6.80%	4.77%	5.75%	10.55%
ALLETE, Inc.	ALE	$2.71	$56.88	4.76%	4.94%	7.40%	4.77%	6.04%	10.98%
Alliant Energy Corporation	LNT	$1.81	$51.12	3.54%	3.66%	6.48%	4.77%	5.60%	9.26%
Ameren Corporation	AEE	$2.52	$81.27	3.10%	3.20%	6.43%	4.77%	5.58%	8.78%
American Electric Power Company, Inc.	AEP	$3.52	$81.52	4.32%	4.43%	5.00%	4.77%	4.88%	9.31%
Avista Corporation	AVA	$1.84	$36.89	4.99%	5.14%	5.93%	4.77%	5.33%	10.47%
CMS Energy Corporation	CMS	$1.95	$57.38	3.40%	3.52%	7.23%	4.77%	5.96%	9.48%
Duke Energy Corporation	DUK	$4.10	$90.33	4.54%	4.67%	5.88%	4.77%	5.31%	9.98%
Entergy Corporation	ETR	$4.52	$97.81	4.62%	4.76%	5.97%	4.77%	5.35%	10.11%
Evergy, Inc.	EVRG	$2.57	$55.28	4.65%	4.76%	4.77%	4.77%	4.77%	9.53%
IDACORP, Inc.	IDA	$3.32	$100.25	3.31%	3.38%	3.93%	4.77%	4.37%	7.75%
MGE Energy, Inc.	MGEE	$1.71	$74.47	2.30%	2.36%	5.73%	4.77%	5.24%	7.60%
NextEra Energy, Inc.	NEE	$1.87	$67.60	2.77%	2.89%	8.62%	4.77%	6.63%	9.52%
NorthWestern Corporation	NWE	$2.56	$53.59	4.78%	4.88%	4.26%	4.77%	4.53%	9.40%
OGE Energy Corporation	OGE	$1.67	$34.93	4.79%	4.91%	5.10%	4.77%	4.93%	9.84%
Pinnacle West Capital Corporation	PNW	$3.52	$76.59	4.60%	4.71%	4.77%	4.77%	4.77%	9.48%
Portland General Electric Company	POR	$1.90	$45.25	4.20%	4.31%	5.20%	4.77%	4.98%	9.29%
Southern Company	SO	$2.80	$68.47	4.09%	4.21%	5.87%	4.77%	5.30%	9.51%
Wisconsin Energy Corporation	WEC	$3.12	$86.53	3.61%	3.71%	5.90%	4.77%	5.32%	9.03%
Xcel Energy Inc.	XEL	$2.08	$61.98	3.36%	3.46%	6.30%	4.77%	5.51%	8.97%
Mean									
Gas only [12]				3.91%	4.03%	6.45%	4.77%	5.58%	9.98%
Electric only [13]				4.04%	4.16%	5.74%	4.77%	5.24%	9.65%
Combination Utilities [14]				3.71%	3.82%	6.22%	4.77%	5.47%	9.51%
Combined Gas & Electric [15]				4.01%	4.13%	5.90%	4.77%	5.32%	9.72%
Median									
Gas only [12]				3.77%	3.93%	6.80%	4.77%	5.75%	9.93%
Electric only [13]				4.32%	4.43%	5.87%	4.77%	5.30%	9.77%
Combination Utilities [14]				3.61%	3.71%	5.93%	4.77%	5.33%	9.54%
Combined Gas & Electric [15]				4.26%	4.37%	5.88%	4.77%	5.31%	9.79%

30-DAY CONSTANT GROWTH DCF -- CBO Long Term Growth Rate

		[1]	[2]	[3]	[4]	[8]	[9]	[10]	[11]
Company	Ticker	Annualized Dividend	Stock Price	Dividend Yield	Expected Dividend Yield	Average Growth Rate	Terminal Growth Rate	30-Year Average Growth	ROE
Atmos Energy Corporation	ATO	$3.22	$110.15	2.92%	3.03%	7.27%	3.64%	5.39%	8.42%
NiSource Inc.	NI	$1.00	$25.47	3.93%	4.09%	8.33%	3.64%	5.91%	10.00%
Northwest Natural Gas Company	NWN	$1.95	$37.13	5.25%	5.36%	4.33%	3.64%	3.98%	9.34%
ONE Gas, Inc.	OGS	$2.60	$60.91	4.27%	4.39%	5.50%	3.64%	4.54%	8.93%
Spire, Inc.	SR	$2.88	$58.30	4.94%	5.11%	6.80%	3.64%	5.17%	10.28%
ALLETE, Inc.	ALE	$2.71	$54.18	5.00%	5.19%	7.40%	3.64%	5.46%	10.65%
Alliant Energy Corporation	LNT	$1.81	$49.32	3.67%	3.79%	6.48%	3.64%	5.02%	8.80%
Ameren Corporation	AEE	$2.52	$76.88	3.28%	3.38%	6.43%	3.64%	4.99%	8.37%
American Electric Power Company, Inc.	AEP	$3.52	$76.65	4.59%	4.71%	5.00%	3.64%	4.30%	9.01%
Avista Corporation	AVA	$1.84	$33.32	5.52%	5.69%	5.93%	3.64%	4.75%	10.44%
CMS Energy Corporation	CMS	$1.95	$55.46	3.52%	3.64%	7.23%	3.64%	5.38%	9.02%
Duke Energy Corporation	DUK	$4.10	$88.52	4.63%	4.77%	5.88%	3.64%	4.73%	9.49%
Entergy Corporation	ETR	$4.52	$96.53	4.68%	4.82%	5.97%	3.64%	4.77%	9.59%
Evergy, Inc.	EVRG	$2.57	$49.33	5.21%	5.33%	4.77%	3.64%	4.19%	9.52%
IDACORP, Inc.	IDA	$3.32	$96.12	3.45%	3.52%	3.93%	3.64%	3.78%	7.31%
MGE Energy, Inc.	MGEE	$1.71	$72.34	2.36%	2.43%	5.73%	3.64%	4.65%	7.08%
NextEra Energy, Inc.	NEE	$1.87	$56.48	3.31%	3.45%	8.62%	3.64%	6.05%	9.50%
NorthWestern Corporation	NWE	$2.56	$49.46	5.18%	5.29%	4.26%	3.64%	3.94%	9.23%
OGE Energy Corporation	OGE	$1.67	$34.43	4.86%	4.98%	5.10%	3.64%	4.35%	9.33%
Pinnacle West Capital Corporation	PNW	$3.52	$72.98	4.82%	4.94%	4.77%	3.64%	4.19%	9.12%
Portland General Electric Company	POR	$1.90	$40.73	4.66%	4.79%	5.20%	3.64%	4.40%	9.18%
Southern Company	SO	$2.80	$68.05	4.11%	4.24%	5.87%	3.64%	4.72%	8.95%
Wisconsin Energy Corporation	WEC	$3.12	$81.41	3.83%	3.95%	5.90%	3.64%	4.73%	8.68%
Xcel Energy Inc.	XEL	$2.08	$59.77	3.48%	3.59%	6.30%	3.64%	4.93%	8.52%
Mean									
Gas only [12]				4.26%	4.40%	6.45%	3.64%	5.00%	9.39%
Electric only [13]				4.28%	4.41%	5.74%	3.64%	4.66%	9.06%
Combination Utilities [14]				3.91%	4.03%	6.22%	3.64%	4.89%	8.92%
Combined Gas & Electric [15]				4.28%	4.40%	5.90%	3.64%	4.74%	9.14%
Median									
Gas only [12]				4.27%	4.39%	6.80%	3.64%	5.17%	9.34%
Electric only [13]				4.63%	4.77%	5.87%	3.64%	4.72%	9.18%
Combination Utilities [14]				3.83%	3.95%	5.93%	3.64%	4.75%	8.95%
Combined Gas & Electric [15]				4.61%	4.74%	5.88%	3.64%	4.72%	9.20%

90-DAY CONSTANT GROWTH DCF -- CBO Long Term Growth Rate

Company	Ticker	[1] Annualized Dividend	[2] Stock Price	[3] Dividend Yield	[4] Expected Dividend Yield	[8] Average Growth Rate	[9] Terminal Growth Rate	[10] 30-Year Average Growth	[11] ROE
Atmos Energy Corporation	ATO	$3.22	$112.18	2.87%	2.97%	7.27%	3.64%	5.39%	8.37%
NiSource Inc.	NI	$1.00	$25.91	3.86%	4.02%	8.33%	3.64%	5.91%	9.93%
Northwest Natural Gas Company	NWN	$1.95	$38.73	5.04%	5.14%	4.33%	3.64%	3.98%	9.12%
ONE Gas, Inc.	OGS	$2.60	$68.57	3.79%	3.90%	5.50%	3.64%	4.54%	8.44%
Spire, Inc.	SR	$2.88	$58.60	4.91%	5.08%	6.80%	3.64%	5.17%	10.25%
ALLETE, Inc.	ALE	$2.71	$54.27	4.99%	5.18%	7.40%	3.64%	5.46%	10.64%
Alliant Energy Corporation	LNT	$1.81	$49.86	3.63%	3.75%	6.48%	3.64%	5.02%	8.76%
Ameren Corporation	AEE	$2.52	$78.29	3.22%	3.32%	6.43%	3.64%	4.99%	8.31%
American Electric Power Company, Inc.	AEP	$3.52	$77.17	4.56%	4.68%	5.00%	3.64%	4.30%	8.97%
Avista Corporation	AVA	$1.84	$33.50	5.49%	5.66%	5.93%	3.64%	4.75%	10.41%
CMS Energy Corporation	CMS	$1.95	$55.55	3.51%	3.64%	7.23%	3.64%	5.38%	9.02%
Duke Energy Corporation	DUK	$4.10	$89.10	4.60%	4.74%	5.88%	3.64%	4.73%	9.46%
Entergy Corporation	ETR	$4.52	$95.22	4.75%	4.89%	5.97%	3.64%	4.77%	9.65%
Evergy, Inc.	EVRG	$2.57	$52.10	4.93%	5.05%	4.77%	3.64%	4.19%	9.24%
IDACORP, Inc.	IDA	$3.32	$95.86	3.46%	3.53%	3.93%	3.64%	3.78%	7.31%
MGE Energy, Inc.	MGEE	$1.71	$72.89	2.35%	2.41%	5.73%	3.64%	4.65%	7.07%
NextEra Energy, Inc.	NEE	$1.87	$61.29	3.05%	3.18%	8.62%	3.64%	6.05%	9.23%
NorthWestern Corporation	NWE	$2.56	$50.42	5.08%	5.19%	4.26%	3.64%	3.94%	9.13%
OGE Energy Corporation	OGE	$1.67	$34.14	4.90%	5.03%	5.10%	3.64%	4.35%	9.37%
Pinnacle West Capital Corporation	PNW	$3.52	$75.15	4.68%	4.80%	4.77%	3.64%	4.19%	8.98%
Portland General Electric Company	POR	$1.90	$42.56	4.46%	4.58%	5.20%	3.64%	4.40%	8.98%
Southern Company	SO	$2.80	$67.52	4.15%	4.27%	5.87%	3.64%	4.72%	8.99%
Wisconsin Energy Corporation	WEC	$3.12	$82.96	3.76%	3.87%	5.90%	3.64%	4.73%	8.61%
Xcel Energy Inc.	XEL	$2.08	$58.79	3.54%	3.65%	6.30%	3.64%	4.93%	8.58%
Mean									
Gas only [12]				4.09%	4.22%	6.45%	3.64%	5.00%	9.22%
Electric only [13]				4.23%	4.35%	5.74%	3.64%	4.66%	9.00%
Combination Utilities [14]				3.88%	4.00%	6.22%	3.64%	4.89%	8.89%
Combined Gas & Electric [15]				4.20%	4.32%	5.90%	3.64%	4.74%	9.05%
Median									
Gas only [12]				3.86%	4.02%	6.80%	3.64%	5.17%	9.12%
Electric only [13]				4.56%	4.68%	5.87%	3.64%	4.72%	8.99%
Combination Utilities [14]				3.76%	3.87%	5.93%	3.64%	4.75%	8.99%
Combined Gas & Electric [15]				4.51%	4.63%	5.88%	3.64%	4.72%	9.05%

180-DAY CONSTANT GROWTH DCF -- CBO Long Term Growth Rate

		[1]	[2]	[3]	[4]	[8]	[9]	[10]	[11]
Company	Ticker	Annualized Dividend	Stock Price	Dividend Yield	Expected Dividend Yield	Short Term Growth Rate	Terminal Growth Rate	30-Year Average Growth	ROE
Atmos Energy Corporation	ATO	$3.22	$113.07	2.85%	2.95%	7.27%	3.64%	5.39%	8.35%
NiSource Inc.	NI	$1.00	$26.50	3.77%	3.93%	8.33%	3.64%	5.91%	9.84%
Northwest Natural Gas Company	NWN	$1.95	$41.27	4.73%	4.83%	4.33%	3.64%	3.98%	8.80%
ONE Gas, Inc.	OGS	$2.60	$72.99	3.56%	3.66%	5.50%	3.64%	4.54%	8.20%
Spire, Inc.	SR	$2.88	$62.07	4.64%	4.80%	6.80%	3.64%	5.17%	9.97%
ALLETE, Inc.	ALE	$2.71	$56.88	4.76%	4.94%	7.40%	3.64%	5.46%	10.40%
Alliant Energy Corporation	LNT	$1.81	$51.12	3.54%	3.66%	6.48%	3.64%	5.02%	8.67%
Ameren Corporation	AEE	$2.52	$81.27	3.10%	3.20%	6.43%	3.64%	4.99%	8.19%
American Electric Power Company, Inc.	AEP	$3.52	$81.52	4.32%	4.43%	5.00%	3.64%	4.30%	8.72%
Avista Corporation	AVA	$1.84	$36.89	4.99%	5.14%	5.93%	3.64%	4.75%	9.89%
CMS Energy Corporation	CMS	$1.95	$57.38	3.40%	3.52%	7.23%	3.64%	5.38%	8.90%
Duke Energy Corporation	DUK	$4.10	$90.33	4.54%	4.67%	5.88%	3.64%	4.73%	9.40%
Entergy Corporation	ETR	$4.52	$97.81	4.62%	4.76%	5.97%	3.64%	4.77%	9.53%
Evergy, Inc.	EVRG	$2.57	$55.28	4.65%	4.76%	4.77%	3.64%	4.19%	8.95%
IDACORP, Inc.	IDA	$3.32	$100.25	3.31%	3.38%	3.93%	3.64%	3.78%	7.16%
MGE Energy, Inc.	MGEE	$1.71	$74.47	2.30%	2.36%	5.73%	3.64%	4.65%	7.02%
NextEra Energy, Inc.	NEE	$1.87	$67.60	2.77%	2.89%	8.62%	3.64%	6.05%	8.93%
NorthWestern Corporation	NWE	$2.56	$53.59	4.78%	4.88%	4.26%	3.64%	3.94%	8.82%
OGE Energy Corporation	OGE	$1.67	$34.93	4.79%	4.91%	5.10%	3.64%	4.35%	9.26%
Pinnacle West Capital Corporation	PNW	$3.52	$76.59	4.60%	4.71%	4.77%	3.64%	4.19%	8.89%
Portland General Electric Company	POR	$1.90	$45.25	4.20%	4.31%	5.20%	3.64%	4.40%	8.70%
Southern Company	SO	$2.80	$68.47	4.09%	4.21%	5.87%	3.64%	4.72%	8.93%
Wisconsin Energy Corporation	WEC	$3.12	$86.53	3.61%	3.71%	5.90%	3.64%	4.73%	8.45%
Xcel Energy Inc.	XEL	$2.08	$61.98	3.36%	3.46%	6.30%	3.64%	4.93%	8.39%
Mean									
Gas only [12]				3.91%	4.03%	6.45%	3.64%	5.00%	9.39%
Electric only [13]				4.04%	4.16%	5.74%	3.64%	4.66%	9.06%
Combination Utilities [14]				3.71%	3.82%	6.22%	3.64%	4.89%	8.92%
Combined Gas & Electric [15]				4.01%	4.13%	5.90%	3.64%	4.74%	9.14%
Median									
Gas only [12]				3.77%	3.93%	6.80%	3.64%	5.17%	9.34%
Electric only [13]				4.32%	4.43%	5.87%	3.64%	4.72%	9.18%
Combination Utilities [14]				3.61%	3.71%	5.93%	3.64%	4.75%	8.95%
Combined Gas & Electric [15]				4.26%	4.37%	5.88%	3.64%	4.72%	9.20%

30-DAY Three Stage DCF -- Treasury Long Term Growth Rate

Company	Ticker	Annualized Dividend	Stock Price	Quarterly Dividend	Average Growth Rate	ROE
Atmos Energy Corporation	ATO	$3.22	$110.15	$3.34	7.27%	8.79%
NiSource Inc.	NI	$1.00	$25.47	$1.04	8.33%	10.68%
Northwest Natural Gas Company	NWN	$1.95	$37.13	$1.99	4.33%	10.05%
ONE Gas, Inc.	OGS	$2.60	$60.91	$2.67	5.50%	9.60%
Spire, Inc.	SR	$2.88	$58.30	$2.98	6.80%	11.11%
ALLETE, Inc.	ALE	$2.71	$54.18	$2.81	7.40%	11.56%
Alliant Energy Corporation	LNT	$1.81	$49.32	$1.87	6.48%	9.38%
Ameren Corporation	AEE	$2.52	$76.88	$2.60	6.43%	8.88%
American Electric Power Company, Inc.	AEP	$3.52	$76.65	$3.61	5.00%	9.71%
Avista Corporation	AVA	$1.84	$33.32	$1.89	5.93%	11.28%
CMS Energy Corporation	CMS	$1.95	$55.46	$2.02	7.23%	9.55%
Duke Energy Corporation	DUK	$4.10	$88.52	$4.22	5.88%	10.22%
Entergy Corporation	ETR	$4.52	$96.53	$4.65	5.97%	10.33%
Evergy, Inc.	EVRG	$2.57	$49.33	$2.63	4.77%	10.25%
IDACORP, Inc.	IDA	$3.32	$96.12	$3.39	3.93%	8.04%
MGE Energy, Inc.	MGEE	$1.71	$72.34	$1.76	5.73%	7.52%
NextEra Energy, Inc.	NEE	$1.87	$56.48	$1.95	8.62%	9.96%
NorthWestern Corporation	NWE	$2.56	$49.46	$2.61	4.26%	9.93%
OGE Energy Corporation	OGE	$1.67	$34.43	$1.72	5.10%	10.05%
Pinnacle West Capital Corporation	PNW	$3.52	$72.98	$3.60	4.77%	9.83%
Portland General Electric Company	POR	$1.90	$40.73	$1.95	5.20%	9.89%
Southern Company	SO	$2.80	$68.05	$2.88	5.87%	9.61%
Wisconsin Energy Corporation	WEC	$3.12	$81.41	$3.21	5.90%	9.30%
Xcel Energy Inc.	XEL	$2.08	$59.77	$2.15	6.30%	9.07%
Mean						
Gas only [12]						10.05%
Electric only [13]						9.74%
Combination Utilities [14]						9.54%
Combined Gas & Electric [15]						9.81%
Median						
Gas only [12]						10.05%
Electric only [13]						9.89%
Combination Utilities [14]						9.55%
Combined Gas & Electric [15]						9.91%

90-DAY Three Stage DCF -- Treasury Long Term Growth Rate

Company	Ticker	Annualized Dividend	Stock Price	Quarterly Dividend	Average Growth Rate	ROE
Atmos Energy Corporation	ATO	$3.22	$112.18	$3.34	7.27%	8.72%
NiSource Inc.	NI	$1.00	$25.91	$1.04	8.33%	10.59%
Northwest Natural Gas Company	NWN	$1.95	$38.73	$1.99	4.33%	9.83%
ONE Gas, Inc.	OGS	$2.60	$68.57	$2.67	5.50%	9.06%
Spire, Inc.	SR	$2.88	$58.60	$2.98	6.80%	11.08%
ALLETE, Inc.	ALE	$2.71	$54.27	$2.81	7.40%	11.55%
Alliant Energy Corporation	LNT	$1.81	$49.86	$1.87	6.48%	9.34%
Ameren Corporation	AEE	$2.52	$78.29	$2.60	6.43%	8.81%
American Electric Power Company, Inc.	AEP	$3.52	$77.17	$3.61	5.00%	9.67%
Avista Corporation	AVA	$1.84	$33.50	$1.89	5.93%	11.25%
CMS Energy Corporation	CMS	$1.95	$55.55	$2.02	7.23%	9.55%
Duke Energy Corporation	DUK	$4.10	$89.10	$4.22	5.88%	10.19%
Entergy Corporation	ETR	$4.52	$95.22	$4.65	5.97%	10.40%
Evergy, Inc.	EVRG	$2.57	$52.10	$2.63	4.77%	9.95%
IDACORP, Inc.	IDA	$3.32	$95.86	$3.39	3.93%	8.05%
MGE Energy, Inc.	MGEE	$1.71	$72.89	$1.76	5.73%	7.50%
NextEra Energy, Inc.	NEE	$1.87	$61.29	$1.95	8.62%	9.58%
NorthWestern Corporation	NWE	$2.56	$50.42	$2.61	4.26%	9.83%
OGE Energy Corporation	OGE	$1.67	$34.14	$1.72	5.10%	10.10%
Pinnacle West Capital Corporation	PNW	$3.52	$75.15	$3.60	4.77%	9.68%
Portland General Electric Company	POR	$1.90	$42.56	$1.95	5.20%	9.67%
Southern Company	SO	$2.80	$67.52	$2.88	5.87%	9.65%
Wisconsin Energy Corporation	WEC	$3.12	$82.96	$3.21	5.90%	9.21%
Xcel Energy Inc.	XEL	$2.08	$58.79	$2.15	6.30%	9.14%
Mean						
Gas only [12]						9.86%
Electric only [13]						9.67%
Combination Utilities [14]						9.50%
Combined Gas & Electric [15]						9.71%
Median						
Gas only [12]						9.83%
Electric only [13]						9.67%
Combination Utilities [14]						9.55%
Combined Gas & Electric [15]						9.68%

180-Day Three Stage DCF -- Treasury Long Term Growth Rate

Company	Ticker	Annualized Dividend	Stock Price	Quarterly Dividend	Average Growth Rate	ROE
Atmos Energy Corporation	ATO	$3.22	$113.07	$3.34	7.27%	8.69%
NiSource Inc.	NI	$1.00	$26.50	$1.04	8.33%	10.47%
Northwest Natural Gas Company	NWN	$1.95	$41.27	$1.99	4.33%	9.50%
ONE Gas, Inc.	OGS	$2.60	$72.99	$2.67	5.50%	8.80%
Spire, Inc.	SR	$2.88	$62.07	$2.98	6.80%	10.74%
ALLETE, Inc.	ALE	$2.71	$56.88	$2.81	7.40%	11.25%
Alliant Energy Corporation	LNT	$1.81	$51.12	$1.87	6.48%	9.23%
Ameren Corporation	AEE	$2.52	$81.27	$2.60	6.43%	8.66%
American Electric Power Company, Inc.	AEP	$3.52	$81.52	$3.61	5.00%	9.41%
Avista Corporation	AVA	$1.84	$36.89	$1.89	5.93%	10.66%
CMS Energy Corporation	CMS	$1.95	$57.38	$2.02	7.23%	9.40%
Duke Energy Corporation	DUK	$4.10	$90.33	$4.22	5.88%	10.11%
Entergy Corporation	ETR	$4.52	$97.81	$4.65	5.97%	10.25%
Evergy, Inc.	EVRG	$2.57	$55.28	$2.63	4.77%	9.65%
IDACORP, Inc.	IDA	$3.32	$100.25	$3.39	3.93%	7.90%
MGE Energy, Inc.	MGEE	$1.71	$74.47	$1.76	5.73%	7.45%
NextEra Energy, Inc.	NEE	$1.87	$67.60	$1.95	8.62%	9.17%
NorthWestern Corporation	NWE	$2.56	$53.59	$2.61	4.26%	9.52%
OGE Energy Corporation	OGE	$1.67	$34.93	$1.72	5.10%	9.97%
Pinnacle West Capital Corporation	PNW	$3.52	$76.59	$3.60	4.77%	9.59%
Portland General Electric Company	POR	$1.90	$45.25	$1.95	5.20%	9.37%
Southern Company	SO	$2.80	$68.47	$2.88	5.87%	9.58%
Wisconsin Energy Corporation	WEC	$3.12	$86.53	$3.21	5.90%	9.03%
Xcel Energy Inc.	XEL	$2.08	$61.98	$2.15	6.30%	8.92%
Mean						
Gas only [12]						9.64%
Electric only [13]						9.45%
Combination Utilities [14]						9.30%
Combined Gas & Electric [15]						9.50%
Median						
Gas only [12]						9.50%
Electric only [13]						9.52%
Combination Utilities [14]						9.40%
Combined Gas & Electric [15]						9.51%

30-Day Three Stage DCF -- CBO Long Term Growth Rate

Company	Ticker	Annualized Dividend	Stock Price	Quarterly Dividend	Average Growth Rate	ROE
Atmos Energy Corporation	ATO	$3.22	$110.15	$3.34	7.27%	8.47%
NiSource Inc.	NI	$1.00	$25.47	$1.04	8.33%	10.33%
Northwest Natural Gas Company	NWN	$1.95	$37.13	$1.99	4.33%	9.71%
ONE Gas, Inc.	OGS	$2.60	$60.91	$2.67	5.50%	9.27%
Spire, Inc.	SR	$2.88	$58.30	$2.98	6.80%	10.77%
ALLETE, Inc.	ALE	$2.71	$54.18	$2.81	7.40%	11.21%
Alliant Energy Corporation	LNT	$1.81	$49.32	$1.87	6.48%	9.05%
Ameren Corporation	AEE	$2.52	$76.88	$2.60	6.43%	8.56%
American Electric Power Company, Inc.	AEP	$3.52	$76.65	$3.61	5.00%	9.37%
Avista Corporation	AVA	$1.84	$33.32	$1.89	5.93%	10.94%
CMS Energy Corporation	CMS	$1.95	$55.46	$2.02	7.23%	9.22%
Duke Energy Corporation	DUK	$4.10	$88.52	$4.22	5.88%	9.88%
Entergy Corporation	ETR	$4.52	$96.53	$4.65	5.97%	9.98%
Evergy, Inc.	EVRG	$2.57	$49.33	$2.63	4.77%	9.91%
IDACORP, Inc.	IDA	$3.32	$96.12	$3.39	3.93%	7.74%
MGE Energy, Inc.	MGEE	$1.71	$72.34	$1.76	5.73%	7.25%
NextEra Energy, Inc.	NEE	$1.87	$56.48	$1.95	8.62%	9.61%
NorthWestern Corporation	NWE	$2.56	$49.46	$2.61	4.26%	9.59%
OGE Energy Corporation	OGE	$1.67	$34.43	$1.72	5.10%	9.71%
Pinnacle West Capital Corporation	PNW	$3.52	$72.98	$3.60	4.77%	9.49%
Portland General Electric Company	POR	$1.90	$40.73	$1.95	5.20%	9.55%
Southern Company	SO	$2.80	$68.05	$2.88	5.87%	9.27%
Wisconsin Energy Corporation	WEC	$3.12	$81.41	$3.21	5.90%	8.97%
Xcel Energy Inc.	XEL	$2.08	$59.77	$2.15	6.30%	8.74%
Mean						
Gas only [12]						9.71%
Electric only [13]						9.40%
Combination Utilities [14]						9.21%
Combined Gas & Electric [15]						9.47%
Median						
Gas only [12]						9.71%
Electric only [13]						9.55%
Combination Utilities [14]						9.22%
Combined Gas & Electric [15]						9.57%

90-Day Three Stage DCF -- CBO Long Term Growth Rate

Company	Ticker	Annualized Dividend	Stock Price	Quarterly Dividend	Average Growth Rate	ROE
Atmos Energy Corporation	ATO	$3.22	$112.18	$3.34	7.27%	8.40%
NiSource Inc.	NI	$1.00	$25.91	$1.04	8.33%	10.24%
Northwest Natural Gas Company	NWN	$1.95	$38.73	$1.99	4.33%	9.49%
ONE Gas, Inc.	OGS	$2.60	$68.57	$2.67	5.50%	8.73%
Spire, Inc.	SR	$2.88	$58.60	$2.98	6.80%	10.74%
ALLETE, Inc.	ALE	$2.71	$54.27	$2.81	7.40%	11.20%
Alliant Energy Corporation	LNT	$1.81	$49.86	$1.87	6.48%	9.00%
Ameren Corporation	AEE	$2.52	$78.29	$2.60	6.43%	8.48%
American Electric Power Company, Inc.	AEP	$3.52	$77.17	$3.61	5.00%	9.33%
Avista Corporation	AVA	$1.84	$33.50	$1.89	5.93%	10.91%
CMS Energy Corporation	CMS	$1.95	$55.55	$2.02	7.23%	9.21%
Duke Energy Corporation	DUK	$4.10	$89.10	$4.22	5.88%	9.84%
Entergy Corporation	ETR	$4.52	$95.22	$4.65	5.97%	10.06%
Evergy, Inc.	EVRG	$2.57	$52.10	$2.63	4.77%	9.61%
IDACORP, Inc.	IDA	$3.32	$95.86	$3.39	3.93%	7.75%
MGE Energy, Inc.	MGEE	$1.71	$72.89	$1.76	5.73%	7.23%
NextEra Energy, Inc.	NEE	$1.87	$61.29	$1.95	8.62%	9.24%
NorthWestern Corporation	NWE	$2.56	$50.42	$2.61	4.26%	9.49%
OGE Energy Corporation	OGE	$1.67	$34.14	$1.72	5.10%	9.76%
Pinnacle West Capital Corporation	PNW	$3.52	$75.15	$3.60	4.77%	9.35%
Portland General Electric Company	POR	$1.90	$42.56	$1.95	5.20%	9.33%
Southern Company	SO	$2.80	$67.52	$2.88	5.87%	9.31%
Wisconsin Energy Corporation	WEC	$3.12	$82.96	$3.21	5.90%	8.88%
Xcel Energy Inc.	XEL	$2.08	$58.79	$2.15	6.30%	8.81%
Mean						
Gas only [12]						9.52%
Electric only [13]						9.34%
Combination Utilities [14]						9.17%
Combined Gas & Electric [15]						9.38%
Median						
Gas only [12]						9.49%
Electric only [13]						9.33%
Combination Utilities [14]						9.21%
Combined Gas & Electric [15]						9.34%

1800-Day Three Stage DCF -- CBO Long Term Growth Rate

Company	Ticker	Annualized Dividend	Stock Price	Quarterly Dividend	Average Growth Rate	ROE
Atmos Energy Corporation	ATO	$3.22	$113.07	$3.34	7.27%	8.37%
NiSource Inc.	NI	$1.00	$26.50	$1.04	8.33%	10.12%
Northwest Natural Gas Company	NWN	$1.95	$41.27	$1.99	4.33%	9.17%
ONE Gas, Inc.	OGS	$2.60	$72.99	$2.67	5.50%	8.48%
Spire, Inc.	SR	$2.88	$62.07	$2.98	6.80%	10.40%
ALLETE, Inc.	ALE	$2.71	$56.88	$2.81	7.40%	10.91%
Alliant Energy Corporation	LNT	$1.81	$51.12	$1.87	6.48%	8.89%
Ameren Corporation	AEE	$2.52	$81.27	$2.60	6.43%	8.34%
American Electric Power Company, Inc.	AEP	$3.52	$81.52	$3.61	5.00%	9.07%
Avista Corporation	AVA	$1.84	$36.89	$1.89	5.93%	10.32%
CMS Energy Corporation	CMS	$1.95	$57.38	$2.02	7.23%	9.06%
Duke Energy Corporation	DUK	$4.10	$90.33	$4.22	5.88%	9.77%
Entergy Corporation	ETR	$4.52	$97.81	$4.65	5.97%	9.91%
Evergy, Inc.	EVRG	$2.57	$55.28	$2.63	4.77%	9.31%
IDACORP, Inc.	IDA	$3.32	$100.25	$3.39	3.93%	7.61%
MGE Energy, Inc.	MGEE	$1.71	$74.47	$1.76	5.73%	7.17%
NextEra Energy, Inc.	NEE	$1.87	$67.60	$1.95	8.62%	8.83%
NorthWestern Corporation	NWE	$2.56	$53.59	$2.61	4.26%	9.19%
OGE Energy Corporation	OGE	$1.67	$34.93	$1.72	5.10%	9.63%
Pinnacle West Capital Corporation	PNW	$3.52	$76.59	$3.60	4.77%	9.25%
Portland General Electric Company	POR	$1.90	$45.25	$1.95	5.20%	9.04%
Southern Company	SO	$2.80	$68.47	$2.88	5.87%	9.24%
Wisconsin Energy Corporation	WEC	$3.12	$86.53	$3.21	5.90%	8.70%
Xcel Energy Inc.	XEL	$2.08	$61.98	$2.15	6.30%	8.59%
Mean						
Gas only [12]						9.31%
Electric only [13]						9.12%
Combination Utilities [14]						8.97%
Combined Gas & Electric [15]						9.17%
Median						
Gas only [12]						9.17%
Electric only [13]						9.19%
Combination Utilities [14]						9.06%
Combined Gas & Electric [15]						9.18%

CAPITAL ASSET PRICING MODEL -- VL MKT RETURN & INDUSTRY ADJUSTED BETA

$$K = Rf + \beta\ (Rm - Rf)$$
$$K = Rf + 0.25 \times (Rm - Rf) + 0.75 \times \beta \times (Rm - Rf)$$

		[1]	[2]	[3]	[4]	[5]	[6]
Company	Ticker	Current 30-day average of 30-year U.S. Treasury bond yield	Beta (β)	Market Return (Rm)	Risk Premium (Rm − Rf)	ROE (K)	ECAPM ROE (K)
Atmos Energy Corporation	ATO	4.77%	0.64	11.49%	6.71%	9.09%	9.69%
NiSource Inc.	NI	4.77%	0.70	11.49%	6.71%	9.50%	10.00%
Northwest Natural Gas Company	NWN	4.77%	0.60	11.49%	6.71%	8.78%	9.46%
ONE Gas, Inc.	OGS	4.77%	0.67	11.49%	6.71%	9.30%	9.85%
Spire, Inc.	SR	4.77%	0.66	11.49%	6.71%	9.23%	9.80%
ALLETE, Inc.	ALE	4.77%	0.72	11.49%	6.71%	9.59%	10.06%
Alliant Energy Corporation	LNT	4.77%	0.68	11.49%	6.71%	9.35%	9.88%
Ameren Corporation	AEE	4.77%	0.64	11.49%	6.71%	9.08%	9.68%
American Electric Power Company, Inc.	AEP	4.77%	0.65	11.49%	6.71%	9.12%	9.71%
Avista Corporation	AVA	4.77%	0.65	11.49%	6.71%	9.16%	9.74%
CMS Energy Corporation	CMS	4.77%	0.64	11.49%	6.71%	9.06%	9.67%
Duke Energy Corporation	DUK	4.77%	0.61	11.49%	6.71%	8.85%	9.51%
Entergy Corporation	ETR	4.77%	0.75	11.49%	6.71%	9.81%	10.23%
Evergy, Inc.	EVRG	4.77%	0.67	11.49%	6.71%	9.29%	9.84%
IDACORP, Inc.	IDA	4.77%	0.69	11.49%	6.71%	9.41%	9.93%
MGE Energy, Inc.	MGEE	4.77%	0.57	11.49%	6.71%	8.63%	9.34%
NextEra Energy, Inc.	NEE	4.77%	0.70	11.49%	6.71%	9.51%	10.00%
NorthWestern Corporation	NWE	4.77%	0.76	11.49%	6.71%	9.87%	10.27%
OGE Energy Corporation	OGE	4.77%	0.81	11.49%	6.71%	10.19%	10.52%
Pinnacle West Capital Corporation	PNW	4.77%	0.71	11.49%	6.71%	9.54%	10.03%
Portland General Electric Company	POR	4.77%	0.68	11.49%	6.71%	9.35%	9.88%
Southern Company	SO	4.77%	0.67	11.49%	6.71%	9.25%	9.81%
Wisconsin Energy Corporation	WEC	4.77%	0.62	11.49%	6.71%	8.96%	9.59%
Xcel Energy Inc.	XEL	4.77%	0.63	11.49%	6.71%	9.00%	9.62%
Mean							
Gas only [7]						9.18%	9.76%
Electric only [8]						9.35%	9.89%
Combination Utilities [9]						9.17%	9.75%
Combined Gas & Electric [10]						9.31%	9.86%

Notes:

[1] Source: Bloomberg Professional, as of November 30, 2023
[2] Source: Value Line
[3] Source: Market Return
[4] Equals [3] - [1]
[5] Equals [1] + [2] x [4]
[6] Equals [1] + 0.25 x ([4]) + 0.75 x ([2] x [4])
[7] Proxy group consists of only natural gas utilities. Source: AEB-3, page 2
[8] Proxy group consists of only electric utilities. Source: AEB-3, page 1, col. [11]
[9] Proxy group consists of combination utilities. Source: AEB-3, page 1, col. [12]
[10] Proxy group is a combined group of only gas and only electric utilities. Source: AEB-3, page 1, col. [11] and AEB-3, page 2

CAPITAL ASSET PRICING MODEL -- KROLL MKT RETURN & INDUSTRY ADJUSTED BETA

$$K = Rf + \beta (Rm - Rf)$$
$$K = Rf + 0.25 \times (Rm - Rf) + 0.75 \times \beta \times (Rm - Rf)$$

		[1]	[2]	[3]	[4]	[5]	[6]
Company	Ticker	Near-term projected 30-year U.S. Treasury bond yield (Q1 2024 - Q1 2025)	Beta (β)	Market Return (Rm)	Market Risk Premium (Rm − Rf)	ROE (K)	ECAPM ROE (K)
Atmos Energy Corporation	ATO	4.77%	0.64	10.27%	5.50%	8.31%	8.80%
NiSource Inc.	NI	4.77%	0.70	10.27%	5.50%	8.65%	9.05%
Northwest Natural Gas Company	NWN	4.77%	0.60	10.27%	5.50%	8.06%	8.61%
ONE Gas, Inc.	OGS	4.77%	0.67	10.27%	5.50%	8.48%	8.93%
Spire, Inc.	SR	4.77%	0.66	10.27%	5.50%	8.43%	8.89%
ALLETE, Inc.	ALE	4.77%	0.72	10.27%	5.50%	8.72%	9.11%
Alliant Energy Corporation	LNT	4.77%	0.68	10.27%	5.50%	8.52%	8.96%
Ameren Corporation	AEE	4.77%	0.64	10.27%	5.50%	8.30%	8.80%
American Electric Power Company, Inc.	AEP	4.77%	0.65	10.27%	5.50%	8.33%	8.82%
Avista Corporation	AVA	4.77%	0.65	10.27%	5.50%	8.37%	8.84%
CMS Energy Corporation	CMS	4.77%	0.64	10.27%	5.50%	8.29%	8.78%
Duke Energy Corporation	DUK	4.77%	0.61	10.27%	5.50%	8.11%	8.65%
Entergy Corporation	ETR	4.77%	0.75	10.27%	5.50%	8.90%	9.25%
Evergy, Inc.	EVRG	4.77%	0.67	10.27%	5.50%	8.47%	8.92%
IDACORP, Inc.	IDA	4.77%	0.69	10.27%	5.50%	8.57%	9.00%
MGE Energy, Inc.	MGEE	4.77%	0.57	10.27%	5.50%	7.93%	8.52%
NextEra Energy, Inc.	NEE	4.77%	0.70	10.27%	5.50%	8.65%	9.06%
NorthWestern Corporation	NWE	4.77%	0.76	10.27%	5.50%	8.95%	9.28%
OGE Energy Corporation	OGE	4.77%	0.81	10.27%	5.50%	9.21%	9.48%
Pinnacle West Capital Corporation	PNW	4.77%	0.71	10.27%	5.50%	8.68%	9.08%
Portland General Electric Company	POR	4.77%	0.68	10.27%	5.50%	8.52%	8.96%
Southern Company	SO	4.77%	0.67	10.27%	5.50%	8.44%	8.90%
Wisconsin Energy Corporation	WEC	4.77%	0.62	10.27%	5.50%	8.20%	8.72%
Xcel Energy Inc.	XEL	4.77%	0.63	10.27%	5.50%	8.23%	8.74%
Mean							
Gas only [7]						8.38%	8.86%
Electric only [8]						8.53%	8.96%
Combination Utilities [9]						8.37%	8.85%
Combined Gas & Electric [10]						8.49%	8.94%

Notes:
[1] Blue Chip Financial Forecasts, Vol. 42, No. 12, December 1, 2023, at 2
[2] Source: Value Line
[3] Source: Market Return
[4] Equals [3] - [1]
[5] Equals [1] + [2] x [4]
[6] Equals [1] + 0.25 x ([4]) + 0.75 x ([2] x [4])
[7] Proxy group consists of only natural gas utilities. Source: AEB-3, page 2
[8] Proxy group consists of only electric utilities. Source: AEB-3, page 1, col. [11]
[9] Proxy group consists of combination utilities. Source: AEB-3, page 1, col. [12]
[10] Proxy group is a combined group of only gas and only electric utilities. Source: AEB-3, page 1, col. [11] and AEB-3, page 2

CAPITAL ASSET PRICING MODEL -- VL MKT RETURN & BLOOMBERG RAW BETA

$K = Rf + \beta\ (Rm - Rf)$
$K = Rf + 0.25 \times (Rm - Rf) + 0.75 \times \beta \times (Rm - Rf)$

		[1]	[2]	[3]	[4]	[5]	[6]
Company	Ticker	Projected 30-year U.S. Treasury bond yield (2025 - 2029)	Beta (β)	Market Return (Rm)	Market Risk Premium (Rm − Rf)	ROE (K)	ECAPM ROE (K)
Atmos Energy Corporation	ATO	4.77%	0.63	11.49%	6.71%	8.99%	9.61%
NiSource Inc.	NI	4.77%	0.72	11.49%	6.71%	9.61%	10.08%
Northwest Natural Gas Company	NWN	4.77%	0.56	11.49%	6.71%	8.53%	9.27%
ONE Gas, Inc.	OGS	4.77%	0.67	11.49%	6.71%	9.30%	9.85%
Spire, Inc.	SR	4.77%	0.66	11.49%	6.71%	9.20%	9.77%
ALLETE, Inc.	ALE	4.77%	0.74	11.49%	6.71%	9.74%	10.18%
Alliant Energy Corporation	LNT	4.77%	0.69	11.49%	6.71%	9.38%	9.90%
Ameren Corporation	AEE	4.77%	0.63	11.49%	6.71%	8.98%	9.61%
American Electric Power Company, Inc.	AEP	4.77%	0.64	11.49%	6.71%	9.04%	9.65%
Avista Corporation	AVA	4.77%	0.64	11.49%	6.71%	9.10%	9.69%
CMS Energy Corporation	CMS	4.77%	0.62	11.49%	6.71%	8.95%	9.58%
Duke Energy Corporation	DUK	4.77%	0.57	11.49%	6.71%	8.63%	9.35%
Entergy Corporation	ETR	4.77%	0.79	11.49%	6.71%	10.07%	10.43%
Evergy, Inc.	EVRG	4.77%	0.67	11.49%	6.71%	9.29%	9.84%
IDACORP, Inc.	IDA	4.77%	0.70	11.49%	6.71%	9.47%	9.97%
MGE Energy, Inc.	MGEE	4.77%	0.53	11.49%	6.71%	8.30%	9.10%
NextEra Energy, Inc.	NEE	4.77%	0.72	11.49%	6.71%	9.61%	10.08%
NorthWestern Corporation	NWE	4.77%	0.80	11.49%	6.71%	10.16%	10.49%
OGE Energy Corporation	OGE	4.77%	0.87	11.49%	6.71%	10.64%	10.85%
Pinnacle West Capital Corporation	PNW	4.77%	0.73	11.49%	6.71%	9.67%	10.13%
Portland General Electric Company	POR	4.77%	0.69	11.49%	6.71%	9.38%	9.91%
Southern Company	SO	4.77%	0.66	11.49%	6.71%	9.23%	9.79%
Wisconsin Energy Corporation	WEC	4.77%	0.60	11.49%	6.71%	8.80%	9.47%
Xcel Energy Inc.	XEL	4.77%	0.61	11.49%	6.71%	8.85%	9.51%
Mean							
Gas only [7]						9.13%	9.72%
Electric only [8]						9.38%	9.91%
Combination Utilities [9]						9.11%	9.70%
Combined Gas & Electric [10]						9.33%	9.87%

Notes:
[1] Blue Chip Financial Forecasts, Vol. 42, No. 12, December 1, 2023, at 14
[2] Source: Value Line
[3] Source: Market Return
[4] Equals [3] - [1]
[5] Equals [1] + [2] x [4]
[6] Equals [1] + 0.25 x ([4]) + 0.75 x ([2] x [4])
[7] Proxy group consists of only natural gas utilities. Source: AEB-3, page 2
[8] Proxy group consists of only electric utilities. Source: AEB-3, page 1, col. [11]
[9] Proxy group consists of combination utilities. Source: AEB-3, page 1, col. [12]
[10] Proxy group is a combined group of only gas and only electric utilities. Source: AEB-3, page 1, col. [11] and AEB-3, page 2

CAPITAL ASSET PRICING MODEL -- KROLL MKT RETURN & BLOOMBERG RAW BETA

$$K = Rf + \beta\ (Rm - Rf)$$
$$K = Rf + 0.25 \times (Rm - Rf) + 0.75 \times \beta \times (Rm - Rf)$$

		[1]	[2]	[3]	[4]	[5]	[6]
Company	Ticker	Current 30-day average of 30-year U.S. Treasury bond yield	Beta (β)	Market Return (Rm)	Market Risk Premium (Rm − Rf)	ROE (K)	ECAPM ROE (K)
Atmos Energy Corporation	ATO	4.77%	0.63	10.27%	5.50%	8.23%	8.74%
NiSource Inc.	NI	4.77%	0.72	10.27%	5.50%	8.73%	9.12%
Northwest Natural Gas Company	NWN	4.77%	0.56	10.27%	5.50%	7.85%	8.46%
ONE Gas, Inc.	OGS	4.77%	0.67	10.27%	5.50%	8.49%	8.93%
Spire, Inc.	SR	4.77%	0.66	10.27%	5.50%	8.40%	8.87%
ALLETE, Inc.	ALE	4.77%	0.74	10.27%	5.50%	8.84%	9.20%
Alliant Energy Corporation	LNT	4.77%	0.69	10.27%	5.50%	8.54%	8.98%
Ameren Corporation	AEE	4.77%	0.63	10.27%	5.50%	8.22%	8.73%
American Electric Power Company, Inc.	AEP	4.77%	0.64	10.27%	5.50%	8.27%	8.77%
Avista Corporation	AVA	4.77%	0.64	10.27%	5.50%	8.32%	8.81%
CMS Energy Corporation	CMS	4.77%	0.62	10.27%	5.50%	8.19%	8.71%
Duke Energy Corporation	DUK	4.77%	0.57	10.27%	5.50%	7.94%	8.52%
Entergy Corporation	ETR	4.77%	0.79	10.27%	5.50%	9.12%	9.41%
Evergy, Inc.	EVRG	4.77%	0.67	10.27%	5.50%	8.47%	8.92%
IDACORP, Inc.	IDA	4.77%	0.70	10.27%	5.50%	8.62%	9.03%
MGE Energy, Inc.	MGEE	4.77%	0.53	10.27%	5.50%	7.67%	8.32%
NextEra Energy, Inc.	NEE	4.77%	0.72	10.27%	5.50%	8.74%	9.12%
NorthWestern Corporation	NWE	4.77%	0.80	10.27%	5.50%	9.18%	9.46%
OGE Energy Corporation	OGE	4.77%	0.87	10.27%	5.50%	9.58%	9.75%
Pinnacle West Capital Corporation	PNW	4.77%	0.73	10.27%	5.50%	8.79%	9.16%
Portland General Electric Company	POR	4.77%	0.69	10.27%	5.50%	8.55%	8.98%
Southern Company	SO	4.77%	0.66	10.27%	5.50%	8.42%	8.89%
Wisconsin Energy Corporation	WEC	4.77%	0.60	10.27%	5.50%	8.07%	8.62%
Xcel Energy Inc.	XEL	4.77%	0.61	10.27%	5.50%	8.12%	8.66%
Mean							
Gas only [7]						8.34%	8.82%
Electric only [8]						8.55%	8.98%
Combination Utilities [9]						8.32%	8.81%
Combined Gas & Electric [10]						8.50%	8.95%

Notes:
[1] Source: Bloomberg Professional, as of November 30, 2023
[2] Source: Bloomberg Professional, based on 10-year weekly returns
[3] Source: Market Return
[4] Equals [3] - [1]
[5] Equals [1] + [2] x [4]
[6] Equals [1] + 0.25 x ([4]) + 0.75 x ([2] x [4])
[7] Proxy group consists of only natural gas utilities. Source: AEB-3, page 2
[8] Proxy group consists of only electric utilities. Source: AEB-3, page 1, col. [11]
[9] Proxy group consists of combination utilities. Source: AEB-3, page 1, col. [12]
[10] Proxy group is a combined group of only gas and only electric utilities. Source: AEB-3, page 1, col. [11] and AEB-3, page 2

Company	Ticker	Unadjusted	Adjusted to Market	Adjusted to Industry
Atmos Energy Corporatioı	ATO	0.6275214	0.75	0.642301
NiSource Inc.	NI	0.7197296	0.81	0.70408
Northwest Natural Gas Cc	NWN	0.5597535	0.71	0.596896
ONE Gas, Inc.	OGS	0.6746575	0.78	0.673882
Spire, Inc.	SR	0.6596358	0.77	0.663817
ALLETE, Inc.	ALE	0.7392907	0.83	0.717186
Alliant Energy Corporatio	LNT	0.6854054	0.79	0.681083
Ameren Corporation	AEE	0.6264043	0.75	0.641552
American Electric Power (	AEP	0.6350158	0.76	0.647322
Avista Corporation	AVA	0.6437185	0.76	0.653153
CMS Energy Corporation	CMS	0.6216317	0.75	0.638355
Duke Energy Corporation	DUK	0.5749248	0.72	0.607061
Entergy Corporation	ETR	0.7892072	0.86	0.75063
Evergy, Inc.	EVRG	0.6722225	0.78	0.67225
IDACORP, Inc.	IDA	0.6993852	0.80	0.690449
MGE Energy, Inc.	MGEE	0.5255726	0.68	0.573995
NextEra Energy, Inc.	NEE	0.7209111	0.81	0.704872
NorthWestern Corporatioı	NWE	0.8015854	0.87	0.758924
OGE Energy Corporation	OGE	0.8733088	0.92	0.806978
Pinnacle West Capital Coı	PNW	0.7293167	0.82	0.710504
Portland General Electric	POR	0.6858398	0.79	0.681374
Southern Company	SO	0.663551	0.77	0.666441
Wisconsin Energy Corpor	WEC	0.5994182	0.73	0.623472
Xcel Energy Inc.	XEL	0.6073641	0.74	0.628795
Average		0.6723071		

[1] Estimated Weighted Average Dividend Yield	1.72%
[2] Estimated Weighted Average Long-Term Growth Ra	9.77%
[3] S&P 500 Estimated Required Market Return	11.49%

STANDARD AND POOR'S 500 INDEX

		[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
Name	Ticker	Shares Outst'g	Price	Market Capitalization	Weight in Index	Estimated Dividend Yield	Cap-Weighted Dividend Yield	Bloomberg Long-Term Growth Est.	Cap-Weighted Long-Term Growth Est.
LyondellBasell Industries NV	LYB	324.36	95.10	30,846.83	0.10%	5.26%	0.01%	8.00%	0.01%
American Express Co	AXP	728.75	170.77	124,447.95	0.40%	1.41%	0.01%	14.01%	0.06%
Verizon Communications Inc	VZ	4,204.10	38.33	161,143.23		6.94%			
Broadcom Inc	AVGO	469.43	925.73	434,561.73	1.39%	1.99%	0.03%	13.89%	0.19%
Boeing Co/The	BA	604.98	231.63	140,130.82				183.61%	
Caterpillar Inc	CAT	509.09	250.72	127,637.79	0.41%	2.07%	0.01%	20.00%	0.08%
JPMorgan Chase & Co	JPM	2,891.01	156.08	451,228.53	1.45%	2.69%	0.04%	1.00%	0.01%
Chevron Corp	CVX	1,887.75	143.60	271,080.76	0.87%	4.21%	0.04%	7.27%	0.06%
Coca-Cola Co/The	KO	4,323.41	58.44	252,660.31	0.81%	3.15%	0.03%	6.51%	0.05%
AbbVie Inc	ABBV	1,765.54	142.39	251,394.81	0.81%	4.35%	0.04%	0.19%	0.00%
Walt Disney Co/The	DIS	1,830.32	92.69	169,651.99	0.54%	0.65%	0.00%	18.88%	0.10%
FleetCor Technologies Inc	FLT	72.20	240.50	17,365.06	0.06%			12.92%	0.01%
Extra Space Storage Inc	EXR	211.28	130.17	27,502.06	0.09%	4.98%	0.00%	1.10%	0.00%
Exxon Mobil Corp	XOM	4,006.13	102.74	411,590.10		3.70%		45.59%	
Phillips 66	PSX	439.96	128.89	56,705.93	0.18%	3.26%	0.01%	15.21%	0.03%
General Electric Co	GE	1,088.39	121.80	132,565.41		0.26%		22.50%	
HP Inc	HPQ	988.27	29.34	28,995.81	0.09%	3.76%	0.00%	3.00%	0.00%
Home Depot Inc/The	HD	995.26	313.49	312,004.68	1.00%	2.67%	0.03%	1.69%	0.02%
Monolithic Power Systems Inc	MPWR	47.91	548.72	26,290.27	0.08%	0.73%	0.00%	8.00%	0.01%
International Business Machines Corp	IBM	913.12	158.56	144,784.15	0.46%	4.19%	0.02%	2.77%	0.01%
Johnson & Johnson	JNJ	2,407.28	154.66	372,309.77	1.19%	3.08%	0.04%	3.86%	0.05%
Lululemon Athletica Inc	LULU	121.43	446.80	54,252.69					
McDonald's Corp	MCD	725.34	281.84	204,430.39	0.66%	2.37%	0.02%	9.34%	0.06%
Merck & Co Inc	MRK	2,534.02	102.48	259,686.68	0.83%	3.01%	0.03%	9.08%	0.08%
3M Co	MMM	552.32	99.07	54,718.05	0.18%	6.06%	0.01%	4.00%	0.01%
American Water Works Co Inc	AWK	194.71	131.84	25,669.91	0.08%	2.15%	0.00%	8.00%	0.01%
Bank of America Corp	BAC	7,913.73	30.49	241,289.69	0.77%	3.15%	0.02%	-5.00%	-0.04%
Pfizer Inc	PFE	5,646.41	30.47	172,046.20		5.38%		50.40%	
Procter & Gamble Co/The	PG	2,356.89	153.52	361,829.14	1.16%	2.45%	0.03%	7.51%	0.09%
AT&T Inc	T	7,150.02	16.57	118,475.83	0.38%	6.70%	0.03%	3.36%	0.01%
Travelers Cos Inc/The	TRV	228.40	180.62	41,253.43	0.13%	2.21%	0.00%	15.33%	0.02%

RTX Corp	RTX	1,437.90	81.48	117,160.17	0.38%	2.90%	0.01%	8.61%	0.03%
Analog Devices Inc	ADI	496.26	182.52	90,577.69	0.29%	1.88%	0.01%	4.50%	0.01%
Walmart Inc	WMT	2,692.23	155.69	419,153.91	1.34%	1.46%	0.02%	3.00%	0.04%
Cisco Systems Inc	CSCO	4,063.48	48.38	196,590.97	0.63%	3.22%	0.02%	10.00%	0.06%
Intel Corp	INTC	4,216.00	44.70	188,455.20	0.60%	1.12%	0.01%	-1.82%	-0.01%
General Motors Co	GM	1,369.48	31.60	43,275.60	0.14%	1.14%	0.00%	-4.65%	-0.01%
Microsoft Corp	MSFT	7,432.26	378.91	2,816,158.39	9.03%	0.79%	0.07%	15.72%	1.42%
Dollar General Corp	DG	219.48	131.12	28,777.69	0.09%	1.80%	0.00%	-2.50%	0.00%
Cigna Group/The	CI	292.62	262.88	76,923.95	0.25%	1.87%	0.00%	9.80%	0.02%
Kinder Morgan Inc	KMI	2,222.77	17.57	39,054.14	0.13%	6.43%	0.01%	2.00%	0.00%
Citigroup Inc	C	1,913.88	46.10	88,229.96	0.28%	4.60%	0.01%	-9.70%	-0.03%
American International Group Inc	AIG	702.04	65.81	46,201.25	0.15%	2.19%	0.00%	10.00%	0.01%
Altria Group Inc	MO	1,768.65	42.04	74,353.92	0.24%	9.32%	0.02%	4.50%	0.01%
HCA Healthcare Inc	HCA	267.66	250.48	67,043.73	0.21%	0.96%	0.00%	7.56%	0.02%
International Paper Co	IP	346.02	36.94	12,781.87	0.04%	5.01%	0.00%	-2.00%	0.00%
Hewlett Packard Enterprise Co	HPE	1,283.00	16.91	21,695.53	0.07%	3.08%	0.00%	3.03%	0.00%
Abbott Laboratories	ABT	1,736.06	104.29	181,053.59	0.58%	1.96%	0.01%	3.27%	0.02%
Aflac Inc	AFL	584.38	82.71	48,334.07	0.15%	2.42%	0.00%	8.04%	0.01%
Air Products and Chemicals Inc	APD	222.21	270.55	60,118.37	0.19%	2.59%	0.00%	12.55%	0.02%
Royal Caribbean Cruises Ltd	RCL	256.24	107.46	27,535.01					
Hess Corp	HES	307.15	140.56	43,173.29	0.14%	1.25%	0.00%	13.00%	0.02%
Archer-Daniels-Midland Co	ADM	533.38	73.73	39,326.18	0.13%	2.44%	0.00%	-7.07%	-0.01%
Automatic Data Processing Inc	ADP	411.31	229.92	94,567.25	0.30%	2.44%	0.01%	16.00%	0.05%
Verisk Analytics Inc	VRSK	144.99	241.43	35,004.21	0.11%	0.56%	0.00%	12.15%	0.01%
AutoZone Inc	AZO	17.63	2,609.93	46,023.51	0.15%			13.72%	0.02%
Linde PLC	LIN	484.89	412.50	200,014.80	0.64%	1.24%	0.01%	14.00%	0.09%
Avery Dennison Corp	AVY	80.53	194.50	15,663.28	0.05%	1.67%	0.00%	7.00%	0.00%
Enphase Energy Inc	ENPH	136.55	101.02	13,794.38				28.59%	
MSCI Inc	MSCI	79.09	520.85	41,194.55	0.13%	1.06%	0.00%	14.48%	0.02%
Ball Corp	BALL	315.30	55.29	17,432.99	0.06%	1.45%	0.00%	10.30%	0.01%
Axon Enterprise Inc	AXON	74.93	229.87	17,225.08					
Ceridian HCM Holding Inc	CDAY	156.13	68.90	10,757.15					
Carrier Global Corp	CARR	839.05	51.96	43,596.88	0.14%	1.42%	0.00%	10.80%	0.02%
Bank of New York Mellon Corp/The	BK	769.07	48.32	37,161.61	0.12%	3.48%	0.00%	10.00%	0.01%
Otis Worldwide Corp	OTIS	409.26	85.79	35,110.33	0.11%	1.59%	0.00%	9.00%	0.01%
Baxter International Inc	BAX	507.32	36.08	18,304.25	0.06%	3.22%	0.00%	-1.17%	0.00%
Becton Dickinson & Co	BDX	290.41	236.18	68,587.85	0.22%	1.61%	0.00%	-2.02%	0.00%
Berkshire Hathaway Inc	BRK/B	1,308.41	360.00	471,029.04					
Best Buy Co Inc	BBY	217.64	70.94	15,439.24	0.05%	5.19%	0.00%	2.93%	0.00%
Boston Scientific Corp	BSX	1,464.98	55.89	81,877.90	0.26%			12.10%	0.03%
Bristol-Myers Squibb Co	BMY	2,034.76	49.38	100,476.35	0.32%	4.62%	0.01%	9.92%	0.03%
Brown-Forman Corp	BF/B	310.14	58.74	18,217.39	0.06%	1.48%	0.00%	6.42%	0.00%
Coterra Energy Inc	CTRA	752.19	26.25	19,745.04		3.05%		55.04%	
Campbell Soup Co	CPB	297.62	40.18	11,958.45	0.04%	3.68%	0.00%	2.81%	0.00%
Hilton Worldwide Holdings Inc	HLT	256.44	167.52	42,958.83	0.14%	0.36%	0.00%	17.09%	0.02%
Carnival Corp	CCL	1,119.45	15.06	16,858.84					
Qorvo Inc	QRVO	97.35	96.50	9,393.89	0.03%			10.04%	0.00%
UDR Inc	UDR	328.93	33.40	10,986.20	0.04%	5.03%	0.00%	6.08%	0.00%
Clorox Co/The	CLX	124.06	143.35	17,783.86	0.06%	3.35%	0.00%	11.53%	0.01%

Paycom Software Inc	PAYC	60.23	181.66	10,941.02	0.04%	0.83%	0.00%	15.19%	0.01%
CMS Energy Corp	CMS	291.76	56.76	16,560.52	0.05%	3.44%	0.00%	7.75%	0.00%
Colgate-Palmolive Co	CL	823.37	78.77	64,857.01	0.21%	2.44%	0.01%	7.21%	0.01%
EPAM Systems Inc	EPAM	57.70	258.19	14,897.56	0.05%			4.87%	0.00%
Comerica Inc	CMA	131.87	45.22	5,963.30	0.02%	6.28%	0.00%	10.63%	0.00%
Conagra Brands Inc	CAG	477.97	28.29	13,521.71	0.04%	4.95%	0.00%	0.84%	0.00%
Airbnb Inc	ABNB	434.75	126.34	54,925.68	0.18%			18.20%	0.03%
Consolidated Edison Inc	ED	344.92	90.11	31,081.10	0.10%	3.60%	0.00%	4.88%	0.00%
Corning Inc	GLW	853.18	28.49	24,306.96	0.08%	3.93%	0.00%	1.57%	0.00%
Cummins Inc	CMI	141.75	224.16	31,773.56	0.10%	3.00%	0.00%	9.15%	0.01%
Caesars Entertainment Inc	CZR	215.71	44.72	9,646.60				110.92%	
Danaher Corp	DHR	738.93	223.31	165,009.79	0.53%	0.48%	0.00%	-7.03%	-0.04%
Target Corp	TGT	461.66	133.81	61,774.99	0.20%	3.29%	0.01%	0.15%	0.00%
Deere & Co	DE	288.00	364.41	104,950.44	0.34%	1.48%	0.00%	3.96%	0.01%
Dominion Energy Inc	D	836.77	45.34	37,939.29	0.12%	5.89%	0.01%	-0.72%	0.00%
Dover Corp	DOV	139.89	141.16	19,746.87	0.06%	1.45%	0.00%	10.00%	0.01%
Alliant Energy Corp	LNT	252.72	50.57	12,780.00	0.04%	3.58%	0.00%	6.26%	0.00%
Steel Dynamics Inc	STLD	161.82	119.13	19,277.14	0.06%	1.43%	0.00%	-13.17%	-0.01%
Duke Energy Corp	DUK	771.00	92.28	71,147.88	0.23%	4.44%	0.01%	6.06%	0.01%
Regency Centers Corp	REG	184.58	62.78	11,587.68	0.04%	4.27%	0.00%	4.64%	0.00%
Eaton Corp PLC	ETN	399.30	227.69	90,916.62	0.29%	1.51%	0.00%	15.00%	0.04%
Ecolab Inc	ECL	285.14	191.73	54,669.89	0.18%	1.11%	0.00%	16.00%	0.03%
Revvity Inc	RVTY	123.41	88.90	10,970.88		0.31%		-26.69%	
Emerson Electric Co	EMR	570.10	88.90	50,681.89	0.16%	2.36%	0.00%	12.01%	0.02%
EOG Resources Inc	EOG	583.15	123.07	71,768.27	0.23%	2.96%	0.01%	17.83%	0.04%
Aon PLC	AON	200.22	328.49	65,768.95	0.21%	0.75%	0.00%	11.58%	0.02%
Entergy Corp	ETR	211.46	101.41	21,443.75	0.07%	4.46%	0.00%	6.22%	0.00%
Equifax Inc	EFX	123.22	217.71	26,825.57	0.09%	0.72%	0.00%	12.33%	0.01%
EQT Corp	EQT	411.33	39.96	16,436.83		1.58%		20.04%	
IQVIA Holdings Inc	IQV	182.50	214.10	39,073.25	0.13%			-13.67%	-0.02%
Gartner Inc	IT	77.95	434.84	33,895.34	0.11%			7.35%	0.01%
FedEx Corp	FDX	251.42	258.83	65,075.04	0.21%	1.95%	0.00%	14.50%	0.03%
FMC Corp	FMC	124.76	53.66	6,694.57	0.02%	4.32%	0.00%	-4.00%	0.00%
Brown & Brown Inc	BRO	284.60	74.74	21,270.85	0.07%	0.70%	0.00%	11.00%	0.01%
Ford Motor Co	F	3,932.10	10.26	40,343.37	0.13%	5.85%	0.01%	-2.52%	0.00%
NextEra Energy Inc	NEE	2,023.71	58.51	118,407.51	0.38%	3.20%	0.01%	8.10%	0.03%
Franklin Resources Inc	BEN	494.58	24.80	12,265.68	0.04%	4.84%	0.00%	-9.00%	0.00%
Garmin Ltd	GRMN	191.33	122.24	23,388.30	0.07%	2.39%	0.00%	5.60%	0.00%
Freeport-McMoRan Inc	FCX	1,433.98	37.32	53,516.02	0.17%	1.61%	0.00%	-15.66%	-0.03%
Dexcom Inc	DXCM	386.37	115.52	44,633.92				30.59%	
General Dynamics Corp	GD	272.90	246.97	67,397.37	0.22%	2.14%	0.00%	10.40%	0.02%
General Mills Inc	GIS	581.28	63.66	37,004.22	0.12%	3.71%	0.00%	8.00%	0.01%
Genuine Parts Co	GPC	140.20	132.78	18,615.36	0.06%	2.86%	0.00%	9.49%	0.01%
Atmos Energy Corp	ATO	148.50	113.81	16,900.33	0.05%	2.83%	0.00%	7.25%	0.00%
WW Grainger Inc	GWW	49.63	786.19	39,021.75		0.95%			
Halliburton Co	HAL	895.05	37.03	33,143.78		1.73%		24.14%	
L3Harris Technologies Inc	LHX	189.54	190.81	36,166.13	0.12%	2.39%	0.00%	3.50%	0.00%
Healthpeak Properties Inc	PEAK	547.07	17.32	9,475.32	0.03%	6.93%	0.00%	1.24%	0.00%
Insulet Corp	PODD	69.83	189.09	13,203.78				41.08%	

Catalent Inc	CTLT	180.27	38.85	7,003.57	0.02%			9.24%	0.00%
Fortive Corp	FTV	351.43	68.98	24,241.92	0.08%	0.46%	0.00%	8.68%	0.01%
Hershey Co/The	HSY	149.89	187.92	28,166.39	0.09%	2.54%	0.00%	9.00%	0.01%
Synchrony Financial	SYF	413.80	32.36	13,390.70		3.09%			
Hormel Foods Corp	HRL	546.48	30.59	16,716.85	0.05%	3.69%	0.00%	1.08%	0.00%
Arthur J Gallagher & Co	AJG	215.90	249.00	53,759.10	0.17%	0.88%	0.00%	14.11%	0.02%
Mondelez International Inc	MDLZ	1,360.90	71.06	96,705.27	0.31%	2.39%	0.01%	9.17%	0.03%
CenterPoint Energy Inc	CNP	629.43	28.27	17,794.04	0.06%	2.83%	0.00%	8.02%	0.00%
Humana Inc	HUM	123.11	484.86	59,691.60	0.19%	0.73%	0.00%	12.32%	0.02%
Willis Towers Watson PLC	WTW	103.26	246.30	25,432.94	0.08%	1.36%	0.00%	11.19%	0.01%
Illinois Tool Works Inc	ITW	300.89	242.21	72,877.60	0.23%	2.31%	0.01%	3.91%	0.01%
CDW Corp/DE	CDW	133.96	210.88	28,249.48	0.09%	1.18%	0.00%	13.10%	0.01%
Trane Technologies PLC	TT	227.56	225.41	51,293.62	0.16%	1.33%	0.00%	13.29%	0.02%
Interpublic Group of Cos Inc/The	IPG	383.00	30.74	11,773.54	0.04%	4.03%	0.00%	5.71%	0.00%
International Flavors & Fragrances Inc	IFF	255.28	75.38	19,242.93	0.06%	4.30%	0.00%	5.50%	0.00%
Generac Holdings Inc	GNRC	61.43	117.07	7,191.84	0.02%			5.00%	0.00%
NXP Semiconductors NV	NXPI	257.76	204.08	52,604.27		1.99%		34.00%	
Kellanova	K	342.52	52.54	17,996.00	0.06%	4.26%	0.00%	1.69%	0.00%
Broadridge Financial Solutions Inc	BR	117.65	193.82	22,802.34		1.65%			
Kimberly-Clark Corp	KMB	337.94	123.73	41,813.44	0.13%	3.81%	0.01%	9.64%	0.01%
Kimco Realty Corp	KIM	619.89	19.32	11,976.31	0.04%	4.97%	0.00%	4.35%	0.00%
Oracle Corp	ORCL	2,739.38	116.21	318,342.88	1.02%	1.38%	0.01%	14.45%	0.15%
Kroger Co/The	KR	719.32	44.27	31,844.12	0.10%	2.62%	0.00%	4.21%	0.00%
Lennar Corp	LEN	250.15	127.92	31,999.44	0.10%	1.17%	0.00%	1.00%	0.00%
Eli Lilly & Co	LLY	949.31	591.04	561,078.41		0.76%		21.47%	
Bath & Body Works Inc	BBWI	227.38	32.62	7,417.17	0.02%	2.45%	0.00%	6.51%	0.00%
Charter Communications Inc	CHTR	147.92	400.13	59,187.23	0.19%			12.31%	0.02%
Loews Corp	L	223.25	70.29	15,692.31		0.36%			
Lowe's Cos Inc	LOW	575.11	198.83	114,349.72		2.21%		20.20%	
Hubbell Inc	HUBB	53.62	300.00	16,086.60		1.63%			
IDEX Corp	IEX	75.63	201.68	15,252.25	0.05%	1.27%	0.00%	11.00%	0.01%
Marsh & McLennan Cos Inc	MMC	493.07	199.42	98,328.42	0.32%	1.42%	0.00%	11.53%	0.04%
Masco Corp	MAS	224.50	60.55	13,593.54	0.04%	1.88%	0.00%	4.36%	0.00%
S&P Global Inc	SPGI	316.80	415.83	131,734.94	0.42%	0.87%	0.00%	13.66%	0.06%
Medtronic PLC	MDT	1,329.65	79.27	105,401.67	0.34%	3.48%	0.01%	4.33%	0.01%
Viatris Inc	VTRS	1,199.67	9.18	11,012.98	0.04%	5.23%	0.00%	-2.58%	0.00%
CVS Health Corp	CVS	1,286.90	67.95	87,444.65	0.28%	3.56%	0.01%	6.99%	0.02%
DuPont de Nemours Inc	DD	430.04	71.54	30,765.20	0.10%	2.01%	0.00%	11.43%	0.01%
Micron Technology Inc	MU	1,098.03	76.12	83,582.35	0.27%	0.60%	0.00%	-11.00%	-0.03%
Motorola Solutions Inc	MSI	165.97	322.87	53,586.09	0.17%	1.21%	0.00%	10.82%	0.02%
Cboe Global Markets Inc	CBOE	105.56	182.19	19,231.25	0.06%	1.21%	0.00%	10.21%	0.01%
Laboratory Corp of America Holdings	LH	84.90	216.91	18,415.66		1.33%		-32.45%	
Newmont Corp	NEM	1,152.49	40.19	46,318.65	0.15%	3.98%	0.01%	11.58%	0.02%
NIKE Inc	NKE	1,224.01	109.90	134,519.03	0.43%	1.35%	0.01%	16.07%	0.07%
NiSource Inc	NI	413.42	25.64	10,599.96	0.03%	3.90%	0.00%	7.65%	0.00%
Norfolk Southern Corp	NSC	226.14	218.16	49,333.83	0.16%	2.48%	0.00%	0.73%	0.00%
Principal Financial Group Inc	PFG	238.41	73.83	17,601.96	0.06%	3.63%	0.00%	8.98%	0.01%
Eversource Energy	ES	349.09	59.41	20,739.20	0.07%	4.54%	0.00%	5.21%	0.00%
Northrop Grumman Corp	NOC	150.79	475.16	71,650.80	0.23%	1.57%	0.00%	2.53%	0.01%

Wells Fargo & Co	WFC	3,631.64	44.59	161,934.83	0.52%	3.14%	0.02%	13.41%	0.07%
Nucor Corp	NUE	245.84	169.97	41,785.25	0.13%	1.20%	0.00%	-10.84%	-0.01%
Occidental Petroleum Corp	OXY	880.37	59.15	52,073.94		1.22%			
Omnicom Group Inc	OMC	197.93	80.63	15,959.42	0.05%	3.47%	0.00%	4.72%	0.00%
ONEOK Inc	OKE	582.55	68.85	40,108.64	0.13%	5.55%	0.01%	6.93%	0.01%
Raymond James Financial Inc	RJF	208.61	105.15	21,935.03		1.71%			
PG&E Corp	PCG	2,133.51	17.17	36,632.33	0.12%	0.23%	0.00%	6.26%	0.01%
Parker-Hannifin Corp	PH	128.48	433.18	55,653.23	0.18%	1.37%	0.00%	15.28%	0.03%
Rollins Inc	ROL	484.04	40.74	19,719.71	0.06%	1.47%	0.00%	14.86%	0.01%
PPL Corp	PPL	737.09	26.12	19,252.76	0.06%	3.68%	0.00%	4.20%	0.00%
ConocoPhillips	COP	1,187.41	115.57	137,228.74	0.44%	0.50%	0.00%	6.00%	0.03%
PulteGroup Inc	PHM	215.60	88.42	19,062.91	0.06%	0.90%	0.00%	2.04%	0.00%
Pinnacle West Capital Corp	PNW	113.31	74.94	8,491.60	0.03%	4.70%	0.00%	5.95%	0.00%
PNC Financial Services Group Inc/The	PNC	398.34	133.96	53,361.76	0.17%	4.63%	0.01%	12.87%	0.02%
PPG Industries Inc	PPG	235.80	141.99	33,481.24	0.11%	1.83%	0.00%	12.91%	0.01%
Progressive Corp/The	PGR	585.04	164.03	95,964.28		0.24%		39.34%	
Veralto Corp	VLTO	246.31	77.25	19,027.29					
Public Service Enterprise Group Inc	PEG	499.11	62.43	31,159.50	0.10%	3.65%	0.00%	5.47%	0.01%
Robert Half Inc	RHI	105.90	81.98	8,681.27	0.03%	2.34%	0.00%	1.26%	0.00%
Cooper Cos Inc/The	COO	49.52	336.92	16,685.63	0.05%	0.02%	0.00%	7.54%	0.00%
Edison International	EIX	383.57	66.99	25,695.22	0.08%	4.40%	0.00%	4.80%	0.00%
Schlumberger NV	SLB	1,423.42	52.04	74,074.83		1.92%		33.41%	
Charles Schwab Corp/The	SCHW	1,771.68	61.32	108,639.54	0.35%	1.63%	0.01%	3.60%	0.01%
Sherwin-Williams Co/The	SHW	255.97	278.80	71,363.32	0.23%	0.87%	0.00%	10.90%	0.02%
West Pharmaceutical Services Inc	WST	73.99	350.76	25,952.73	0.08%	0.23%	0.00%	5.80%	0.00%
J M Smucker Co/The	SJM	106.13	109.73	11,645.97	0.04%	3.86%	0.00%	5.95%	0.00%
Snap-on Inc	SNA	52.78	274.69	14,498.14	0.05%	2.71%	0.00%	4.85%	0.00%
AMETEK Inc	AME	230.80	155.23	35,826.93	0.11%	0.64%	0.00%	6.36%	0.01%
Southern Co/The	SO	1,091.52	70.98	77,475.73	0.25%	3.94%	0.01%	5.05%	0.01%
Truist Financial Corp	TFC	1,333.67	32.14	42,864.09	0.14%	6.47%	0.01%	16.00%	0.02%
Southwest Airlines Co	LUV	596.12	25.57	15,242.66	0.05%	2.82%	0.00%	10.15%	0.00%
W R Berkley Corp	WRB	257.87	72.55	18,708.61	0.06%	0.61%	0.00%	13.00%	0.01%
Stanley Black & Decker Inc	SWK	153.31	90.90	13,935.97	0.04%	3.56%	0.00%	9.00%	0.00%
Public Storage	PSA	175.83	258.76	45,497.51	0.15%	4.64%	0.01%	3.77%	0.01%
Arista Networks Inc	ANET	311.10	219.71	68,351.78	0.22%			19.72%	0.04%
Sysco Corp	SYY	504.37	72.17	36,400.53	0.12%	2.77%	0.00%	13.00%	0.02%
Corteva Inc	CTVA	704.88	45.20	31,860.58	0.10%	1.42%	0.00%	16.17%	0.02%
Texas Instruments Inc	TXN	908.20	152.71	138,691.83	0.44%	3.41%	0.02%	10.00%	0.04%
Textron Inc	TXT	196.01	76.66	15,025.74	0.05%	0.10%	0.00%	11.73%	0.01%
Thermo Fisher Scientific Inc	TMO	386.37	495.76	191,547.78	0.61%	0.28%	0.00%	-5.00%	-0.03%
TJX Cos Inc/The	TJX	1,139.68	88.11	100,416.94	0.32%	1.51%	0.00%	6.38%	0.02%
Globe Life Inc	GL	94.12	123.13	11,588.87		0.73%			
Johnson Controls International plc	JCI	680.32	52.80	35,920.90	0.12%	2.80%	0.00%	13.36%	0.02%
Ulta Beauty Inc	ULTA	48.56	425.99	20,686.93	0.07%			6.41%	0.00%
Union Pacific Corp	UNP	609.60	225.27	137,323.92	0.44%	2.31%	0.01%	11.00%	0.05%
Keysight Technologies Inc	KEYS	174.60	135.89	23,726.39	0.08%			1.81%	0.00%
UnitedHealth Group Inc	UNH	924.93	551.09	509,716.92	1.63%	1.36%	0.02%	13.40%	0.22%
Blackstone Inc	BX	710.55	112.37	79,843.94	0.26%	2.85%	0.01%	7.63%	0.02%
Marathon Oil Corp	MRO	585.25	25.43	14,882.83	0.05%	1.73%	0.00%	8.00%	0.00%

Bio-Rad Laboratories Inc	BIO	24.06	304.92	7,336.07	0.02%			4.00%	0.00%
Ventas Inc	VTR	402.38	45.84	18,445.15	0.06%	3.93%	0.00%	8.02%	0.00%
VF Corp	VFC	388.88	16.73	6,506.01	0.02%	2.15%	0.00%	3.10%	0.00%
Vulcan Materials Co	VMC	132.87	213.56	28,376.36		0.81%		23.22%	
Weyerhaeuser Co	WY	730.00	31.35	22,885.53		2.42%			
Whirlpool Corp	WHR	54.85	108.90	5,973.49	0.02%	6.43%	0.00%	-2.33%	0.00%
Williams Cos Inc/The	WMB	1,216.50	36.79	44,755.00	0.14%	4.87%	0.01%	3.50%	0.01%
Constellation Energy Corp	CEG	319.38	121.04	38,658.00		0.93%		26.33%	
WEC Energy Group Inc	WEC	315.44	83.62	26,376.67	0.08%	3.73%	0.00%	6.41%	0.01%
Adobe Inc	ADBE	455.30	611.01	278,192.85	0.89%			17.33%	0.15%
AES Corp/The	AES	669.63	17.21	11,524.32	0.04%	3.86%	0.00%	10.12%	0.00%
Expeditors International of Washington Inc	EXPD	145.39	120.34	17,496.11	0.06%	1.15%	0.00%	-16.00%	-0.01%
Amgen Inc	AMGN	535.18	269.64	144,305.40	0.46%	3.16%	0.01%	4.88%	0.02%
Apple Inc	AAPL	15,552.75	189.95	2,954,245.24	9.47%	0.51%	0.05%	13.00%	1.23%
Autodesk Inc	ADSK	213.76	218.43	46,692.47	0.15%			12.48%	0.02%
Cintas Corp	CTAS	101.85	553.25	56,350.73	0.18%	0.98%	0.00%	11.84%	0.02%
Comcast Corp	CMCSA	4,015.64	41.89	168,214.95	0.54%	2.77%	0.01%	9.26%	0.05%
Molson Coors Beverage Co	TAP	200.96	61.54	12,366.77	0.04%	2.66%	0.00%	12.99%	0.01%
KLA Corp	KLAC	135.93	544.62	74,031.29	0.24%	1.06%	0.00%	9.93%	0.02%
Marriott International Inc/MD	MAR	293.69	202.70	59,531.17	0.19%	1.03%	0.00%	17.38%	0.03%
Fiserv Inc	FI	600.19	130.61	78,390.29	0.25%			14.08%	0.04%
McCormick & Co Inc/MD	MKC	251.29	64.83	16,291.20	0.05%	2.59%	0.00%	7.01%	0.00%
PACCAR Inc	PCAR	523.08	91.82	48,028.84	0.15%	1.18%	0.00%	12.00%	0.02%
Costco Wholesale Corp	COST	442.74	592.74	262,430.30	0.84%	0.69%	0.01%	13.06%	0.11%
Stryker Corp	SYK	379.90	296.33	112,574.29	0.36%	1.01%	0.00%	7.62%	0.03%
Tyson Foods Inc	TSN	285.23	46.84	13,360.22		4.18%		46.71%	
Lamb Weston Holdings Inc	LW	144.93	100.03	14,497.05	0.05%	1.12%	0.00%	13.32%	0.01%
Applied Materials Inc	AMAT	836.53	149.78	125,296.06	0.40%	0.85%	0.00%	5.50%	0.02%
American Airlines Group Inc	AAL	653.54	12.43	8,123.51				54.64%	
Cardinal Health Inc	CAH	246.47	107.08	26,391.79	0.08%	1.87%	0.00%	13.32%	0.01%
Cincinnati Financial Corp	CINF	156.91	102.79	16,128.57	0.05%	2.92%	0.00%	18.21%	0.01%
Paramount Global	PARA	610.70	14.37	8,775.82		1.39%		-20.36%	
DR Horton Inc	DHI	333.18	127.67	42,537.60	0.14%	0.94%	0.00%	1.70%	0.00%
Electronic Arts Inc	EA	268.97	138.01	37,120.00	0.12%	0.55%	0.00%	10.32%	0.01%
Fair Isaac Corp	FICO	24.71	1,087.60	26,878.95				22.00%	
Fastenal Co	FAST	571.41	59.97	34,267.64		2.33%			
M&T Bank Corp	MTB	165.96	128.17	21,271.09	0.07%	4.06%	0.00%	11.59%	0.01%
Xcel Energy Inc	XEL	551.82	60.84	33,572.49	0.11%	3.42%	0.00%	6.12%	0.01%
Fifth Third Bancorp	FITB	681.02	28.95	19,715.44		4.84%		25.00%	
Gilead Sciences Inc	GILD	1,246.04	76.60	95,446.82	0.31%	3.92%	0.01%	2.10%	0.01%
Hasbro Inc	HAS	138.76	46.41	6,440.04	0.02%	6.03%	0.00%	-3.49%	0.00%
Huntington Bancshares Inc/OH	HBAN	1,448.08	11.26	16,305.32	0.05%	5.51%	0.00%	-7.69%	0.00%
Welltower Inc	WELL	556.09	89.10	49,547.98	0.16%	2.74%	0.00%	10.96%	0.02%
Biogen Inc	BIIB	144.90	234.08	33,917.72	0.11%			0.87%	0.00%
Northern Trust Corp	NTRS	207.04	79.25	16,407.60	0.05%	3.79%	0.00%	5.93%	0.00%
Packaging Corp of America	PKG	89.62	168.01	15,057.73	0.05%	2.98%	0.00%	5.00%	0.00%
Paychex Inc	PAYX	361.23	121.97	44,059.47	0.14%	2.92%	0.00%	7.00%	0.01%
QUALCOMM Inc	QCOM	1,113.00	129.05	143,632.65	0.46%	2.48%	0.01%	11.61%	0.05%
Ross Stores Inc	ROST	338.63	130.38	44,150.84	0.14%	1.03%	0.00%	10.00%	0.01%

IDEXX Laboratories Inc	IDXX	83.05	465.82	38,687.28	0.12%			17.98%	0.02%
Starbucks Corp	SBUX	1,136.70	99.30	112,874.31	0.36%	2.30%	0.01%	17.41%	0.06%
KeyCorp	KEY	936.26	12.39	11,600.26	0.04%	6.62%	0.00%	7.08%	0.00%
Fox Corp	FOXA	247.23	29.54	7,303.09	0.02%	1.76%	0.00%	6.24%	0.00%
Fox Corp	FOX	235.58	27.66	6,516.17	0.02%	1.88%	0.00%	6.24%	0.00%
State Street Corp	STT	308.58	72.82	22,471.09	0.07%	3.79%	0.00%	6.92%	0.00%
Norwegian Cruise Line Holdings Ltd	NCLH	425.43	15.27	6,496.24					
US Bancorp	USB	1,557.01	38.12	59,353.30	0.19%	5.04%	0.01%	7.50%	0.01%
A O Smith Corp	AOS	122.83	75.36	9,256.32		1.70%			
Gen Digital Inc	GEN	640.72	22.08	14,146.99	0.05%	2.26%	0.00%	12.98%	0.01%
T Rowe Price Group Inc	TROW	223.47	100.13	22,376.05	0.07%	4.87%	0.00%	-4.09%	0.00%
Waste Management Inc	WM	402.78	170.99	68,870.50	0.22%	1.64%	0.00%	10.05%	0.02%
Constellation Brands Inc	STZ	183.66	240.49	44,169.11	0.14%	1.48%	0.00%	9.75%	0.01%
DENTSPLY SIRONA Inc	XRAY	211.86	31.75	6,726.56	0.02%	1.76%	0.00%	7.93%	0.00%
Zions Bancorp NA	ZION	148.15	35.63	5,278.55	0.02%	4.60%	0.00%	-9.73%	0.00%
Alaska Air Group Inc	ALK	128.05	37.81	4,841.68	0.02%			3.56%	0.00%
Invesco Ltd	IVZ	449.55	14.27	6,415.14	0.02%	5.61%	0.00%	-0.68%	0.00%
Intuit Inc	INTU	279.94	571.46	159,972.23	0.51%	0.63%	0.00%	18.96%	0.10%
Morgan Stanley	MS	1,641.31	79.34	130,221.69	0.42%	4.29%	0.02%	3.64%	0.02%
Microchip Technology Inc	MCHP	541.05	83.44	45,144.79	0.14%	2.10%	0.00%	-1.00%	0.00%
Chubb Ltd	CB	407.99	229.43	93,605.15	0.30%	1.50%	0.00%	15.50%	0.05%
Hologic Inc	HOLX	240.00	71.30	17,112.21	0.05%			-8.76%	0.00%
Citizens Financial Group Inc	CFG	466.22	27.27	12,713.90	0.04%	6.16%	0.00%	-10.63%	0.00%
O'Reilly Automotive Inc	ORLY	59.16	982.38	58,119.57	0.19%			11.39%	0.02%
Allstate Corp/The	ALL	261.69	137.87	36,078.79		2.58%		50.02%	
Equity Residential	EQR	379.72	56.84	21,583.51	0.07%	4.66%	0.00%	4.75%	0.00%
BorgWarner Inc	BWA	235.06	33.69	7,919.00	0.03%	1.31%	0.00%	4.33%	0.00%
Keurig Dr Pepper Inc	KDP	1,398.34	31.57	44,145.47	0.14%	2.72%	0.00%	6.85%	0.01%
Host Hotels & Resorts Inc	HST	705.40	17.47	12,323.34		4.12%			
Incyte Corp	INCY	224.11	54.34	12,178.08				36.36%	
Simon Property Group Inc	SPG	326.25	124.89	40,744.99	0.13%	6.09%	0.01%	1.71%	0.00%
Eastman Chemical Co	EMN	118.56	83.83	9,939.22	0.03%	3.77%	0.00%	4.75%	0.00%
AvalonBay Communities Inc	AVB	142.02	172.94	24,560.07	0.08%	3.82%	0.00%	6.27%	0.00%
Prudential Financial Inc	PRU	361.00	97.78	35,298.58	0.11%	5.11%	0.01%	10.47%	0.01%
United Parcel Service Inc	UPS	723.26	151.61	109,652.99	0.35%	4.27%	0.02%	1.64%	0.01%
Walgreens Boots Alliance Inc	WBA	863.92	19.94	17,226.47	0.06%	9.63%	0.01%	0.25%	0.00%
STERIS PLC	STE	98.80	200.94	19,852.87		1.04%			
McKesson Corp	MCK	133.06	470.56	62,613.65	0.20%	0.53%	0.00%	10.04%	0.02%
Lockheed Martin Corp	LMT	248.10	447.77	111,091.29	0.36%	2.81%	0.01%	7.04%	0.03%
Cencora Inc	COR	199.43	203.37	40,558.69	0.13%	1.00%	0.00%	9.04%	0.01%
Capital One Financial Corp	COF	380.85	111.66	42,525.38	0.14%	2.15%	0.00%	-6.30%	-0.01%
Waters Corp	WAT	59.13	280.61	16,591.63	0.05%			4.44%	0.00%
Nordson Corp	NDSN	57.01	235.34	13,417.67		1.16%			
Dollar Tree Inc	DLTR	217.87	123.59	26,926.80	0.09%			7.77%	0.01%
Darden Restaurants Inc	DRI	120.32	156.47	18,825.69	0.06%	3.35%	0.00%	10.45%	0.01%
Evergy Inc	EVRG	229.58	51.04	11,717.92	0.04%	5.04%	0.00%	4.82%	0.00%
Match Group Inc	MTCH	271.81	32.38	8,801.27				43.48%	
Domino's Pizza Inc	DPZ	34.88	392.89	13,704.40	0.04%	1.23%	0.00%	13.97%	0.01%
NVR Inc	NVR	3.18	6,155.39	19,567.98	0.06%			-4.57%	0.00%

NetApp Inc	NTAP	206.03	91.39	18,829.17	0.06%	2.19%	0.00%	7.40%	0.00%
Old Dominion Freight Line Inc	ODFL	109.11	389.06	42,451.89	0.14%	0.41%	0.00%	5.83%	0.01%
DaVita Inc	DVA	91.30	101.46	9,263.30				21.67%	
Hartford Financial Services Group Inc/The	HIG	300.77	78.16	23,508.18	0.08%	2.41%	0.00%	7.00%	0.01%
Iron Mountain Inc	IRM	291.99	64.15	18,731.16	0.06%	4.05%	0.00%	4.00%	0.00%
Estee Lauder Cos Inc/The	EL	232.31	127.69	29,663.03	0.10%	2.07%	0.00%	13.86%	0.01%
Cadence Design Systems Inc	CDNS	272.06	273.27	74,346.38	0.24%			18.56%	0.04%
Tyler Technologies Inc	TYL	42.12	408.84	17,221.98					
Universal Health Services Inc	UHS	61.01	137.48	8,387.24	0.03%	0.58%	0.00%	9.41%	0.00%
Skyworks Solutions Inc	SWKS	159.96	96.93	15,504.44	0.05%	2.81%	0.00%	-7.11%	0.00%
Quest Diagnostics Inc	DGX	112.44	137.23	15,429.46	0.05%	2.07%	0.00%	-1.27%	0.00%
Rockwell Automation Inc	ROK	114.67	275.44	31,585.53	0.10%	1.82%	0.00%	12.16%	0.01%
Kraft Heinz Co/The	KHC	1,226.54	35.11	43,063.78	0.14%	4.56%	0.01%	4.03%	0.01%
American Tower Corp	AMT	466.17	208.78	97,325.93	0.31%	3.10%	0.01%	10.93%	0.03%
Regeneron Pharmaceuticals Inc	REGN	107.13	823.81	88,253.94	0.28%			4.00%	0.01%
Amazon.com Inc	AMZN	10,334.03	146.09	1,509,698.59				86.99%	
Jack Henry & Associates Inc	JKHY	72.83	158.69	11,557.08	0.04%	1.31%	0.00%	7.06%	0.00%
Ralph Lauren Corp	RL	39.75	129.38	5,143.11	0.02%	2.32%	0.00%	10.38%	0.00%
Boston Properties Inc	BXP	156.94	56.93	8,934.54	0.03%	6.89%	0.00%	2.82%	0.00%
Amphenol Corp	APH	598.31	90.99	54,440.23	0.17%	0.97%	0.00%	4.04%	0.01%
Howmet Aerospace Inc	HWM	411.74	52.60	21,657.73		0.38%		20.41%	
Pioneer Natural Resources Co	PXD	233.31	231.64	54,043.70	0.17%	5.53%	0.01%	-3.00%	-0.01%
Valero Energy Corp	VLO	340.45	125.36	42,679.19		3.25%		35.66%	
Synopsys Inc	SNPS	152.05	543.23	82,599.75	0.26%			16.68%	0.04%
Etsy Inc	ETSY	119.75	75.81	9,077.94	0.03%			2.74%	0.00%
CH Robinson Worldwide Inc	CHRW	116.65	82.05	9,571.21	0.03%	2.97%	0.00%	5.00%	0.00%
Accenture PLC	ACN	664.79	333.14	221,467.14	0.71%	1.55%	0.01%	10.00%	0.07%
TransDigm Group Inc	TDG	55.31	962.87	53,260.19	0.17%			15.56%	0.03%
Yum! Brands Inc	YUM	280.31	125.55	35,192.67	0.11%	1.93%	0.00%	11.93%	0.01%
Prologis Inc	PLD	923.86	114.93	106,179.46	0.34%	3.03%	0.01%	8.00%	0.03%
FirstEnergy Corp	FE	573.82	36.94	21,196.73	0.07%	4.44%	0.00%	-0.33%	0.00%
VeriSign Inc	VRSN	102.10	212.20	21,665.62	0.07%			11.50%	0.01%
Quanta Services Inc	PWR	145.29	188.31	27,358.62	0.09%	0.17%	0.00%	8.00%	0.01%
Henry Schein Inc	HSIC	130.59	66.73	8,713.94	0.03%			3.44%	0.00%
Ameren Corp	AEE	262.48	77.59	20,365.44	0.07%	3.25%	0.00%	7.11%	0.00%
ANSYS Inc	ANSS	86.87	293.36	25,485.06	0.08%			10.77%	0.01%
FactSet Research Systems Inc	FDS	37.99	453.46	17,226.04	0.06%	0.86%	0.00%	10.45%	0.01%
NVIDIA Corp	NVDA	2,470.00	467.70	1,155,219.00		0.03%		50.82%	
Sealed Air Corp	SEE	144.44	33.38	4,821.27	0.02%	2.40%	0.00%	0.01%	0.00%
Cognizant Technology Solutions Corp	CTSH	501.41	70.38	35,289.45	0.11%	1.65%	0.00%	12.00%	0.01%
Intuitive Surgical Inc	ISRG	352.07	310.84	109,438.06	0.35%			11.57%	0.04%
Take-Two Interactive Software Inc	TTWO	170.07	158.20	26,904.76				58.00%	
Republic Services Inc	RSG	314.64	161.84	50,920.85	0.16%	1.32%	0.00%	9.97%	0.02%
eBay Inc	EBAY	519.00	41.01	21,284.19	0.07%	2.44%	0.00%	0.32%	0.00%
Goldman Sachs Group Inc/The	GS	326.11	341.54	111,380.29	0.36%	3.22%	0.01%	7.71%	0.03%
SBA Communications Corp	SBAC	107.89	246.96	26,643.77	0.09%	1.38%	0.00%	8.00%	0.01%
Sempra	SRE	629.33	72.87	45,859.13	0.15%	3.27%	0.00%	5.49%	0.01%
Moody's Corp	MCO	183.00	364.96	66,787.68	0.21%	0.84%	0.00%	14.08%	0.03%
ON Semiconductor Corp	ON	430.70	71.33	30,721.69	0.10%			3.72%	0.00%

Booking Holdings Inc	BKNG	34.89	3,125.70	109,055.67	0.35%			15.00%	0.05%
F5 Inc	FFIV	59.71	171.19	10,221.24	0.03%			5.45%	0.00%
Akamai Technologies Inc	AKAM	150.83	115.53	17,425.62					
Charles River Laboratories International Inc	CRL	51.30	197.08	10,109.61	0.03%			9.00%	0.00%
MarketAxess Holdings Inc	MKTX	37.91	240.12	9,101.75		1.20%			
Devon Energy Corp	DVN	640.70	44.97	28,812.28		6.85%		51.35%	
Bio-Techne Corp	TECH	158.15	62.90	9,947.64	0.03%	0.51%	0.00%	4.50%	0.00%
Alphabet Inc	GOOGL	5,918.00	132.53	784,312.54	2.51%			16.65%	0.42%
Teleflex Inc	TFX	46.99	225.69	10,605.85	0.03%	0.60%	0.00%	7.00%	0.00%
Netflix Inc	NFLX	437.68	473.97	207,447.19				30.96%	
Allegion plc	ALLE	87.79	106.09	9,313.43	0.03%	1.70%	0.00%	5.93%	0.00%
Agilent Technologies Inc	A	292.12	127.80	37,333.32	0.12%	0.74%	0.00%	8.00%	0.01%
Warner Bros Discovery Inc	WBD	2,438.57	10.45	25,483.01				91.04%	
Elevance Health Inc	ELV	234.96	479.49	112,660.49	0.36%	1.23%	0.00%	10.85%	0.04%
Trimble Inc	TRMB	248.77	46.40	11,542.84					
CME Group Inc	CME	359.99	218.36	78,607.42	0.25%	2.02%	0.01%	11.10%	0.03%
Juniper Networks Inc	JNPR	318.87	28.45	9,071.79	0.03%	3.09%	0.00%	7.96%	0.00%
BlackRock Inc	BLK	148.76	751.23	111,754.48	0.36%	2.66%	0.01%	6.72%	0.02%
DTE Energy Co	DTE	206.11	104.11	21,458.01	0.07%	3.66%	0.00%	7.00%	0.00%
Nasdaq Inc	NDAQ	576.97	55.84	32,217.73	0.10%	1.58%	0.00%	2.68%	0.00%
Celanese Corp	CE	108.86	138.66	15,093.83	0.05%	2.02%	0.00%	2.27%	0.00%
Philip Morris International Inc	PM	1,552.41	93.36	144,932.62	0.46%	5.57%	0.03%	9.19%	0.04%
Salesforce Inc	CRM	968.00	251.90	243,839.20				21.67%	
Ingersoll Rand Inc	IR	404.80	71.43	28,914.65	0.09%	0.11%	0.00%	14.00%	0.01%
Huntington Ingalls Industries Inc	HII	39.72	237.02	9,415.15		2.19%		40.00%	
Roper Technologies Inc	ROP	106.82	538.25	57,496.94	0.18%	0.56%	0.00%	-1.00%	0.00%
MetLife Inc	MET	740.19	63.63	47,098.29	0.15%	3.27%	0.00%	9.17%	0.01%
Tapestry Inc	TPR	229.19	31.67	7,258.32	0.02%	4.42%	0.00%	11.00%	0.00%
CSX Corp	CSX	1,976.13	32.30	63,829.03	0.20%	1.36%	0.00%	6.39%	0.01%
Edwards Lifesciences Corp	EW	606.50	67.71	41,066.12	0.13%			9.23%	0.01%
Ameriprise Financial Inc	AMP	101.20	353.51	35,773.80	0.11%	1.53%	0.00%	15.82%	0.02%
Zebra Technologies Corp	ZBRA	51.36	236.98	12,171.29					
Zimmer Biomet Holdings Inc	ZBH	208.98	116.31	24,306.58	0.08%	0.83%	0.00%	7.12%	0.01%
CBRE Group Inc	CBRE	304.79	78.96	24,066.46					
Camden Property Trust	CPT	106.77	90.26	9,637.15	0.03%	4.43%	0.00%	6.17%	0.00%
Mastercard Inc	MA	930.44	413.83	385,043.16	1.23%	0.55%	0.01%	17.35%	0.21%
CarMax Inc	KMX	158.67	63.94	10,145.23	0.03%			16.34%	0.01%
Intercontinental Exchange Inc	ICE	572.36	113.84	65,157.92	0.21%	1.48%	0.00%	8.66%	0.02%
Fidelity National Information Services Inc	FIS	592.48	58.64	34,743.26	0.11%	3.55%	0.00%	5.51%	0.01%
Chipotle Mexican Grill Inc	CMG	27.45	2,202.25	60,440.75				25.41%	
Wynn Resorts Ltd	WYNN	112.95	84.42	9,534.90		1.18%		153.24%	
Live Nation Entertainment Inc	LYV	230.33	84.22	19,397.97					
Assurant Inc	AIZ	52.59	168.02	8,836.34	0.03%	1.71%	0.00%	14.60%	0.00%
NRG Energy Inc	NRG	225.76	47.84	10,800.55		3.16%			
Regions Financial Corp	RF	930.07	16.68	15,513.48	0.05%	5.76%	0.00%	0.99%	0.00%
Monster Beverage Corp	MNST	1,040.44	55.15	57,380.32				21.32%	
Mosaic Co/The	MOS	326.84	35.89	11,730.11	0.04%	2.23%	0.00%	7.00%	0.00%
Baker Hughes Co	BKR	1,006.23	33.75	33,960.40	0.11%	2.37%	0.00%	16.00%	0.02%
Expedia Group Inc	EXPE	133.33	136.18	18,156.20	0.06%			17.50%	0.01%

CF Industries Holdings Inc	CF	191.06	75.15	14,357.93		2.13%		46.00%	
Leidos Holdings Inc	LDOS	137.51	107.32	14,757.14	0.05%	1.42%	0.00%	8.12%	0.00%
APA Corp	APA	306.72	36.00	11,041.88	0.04%	2.78%	0.00%	0.72%	0.00%
Alphabet Inc	GOOG	5,725.00	133.92	766,692.00	2.46%			16.65%	0.41%
First Solar Inc	FSLR	106.84	157.78	16,857.85				43.22%	
TE Connectivity Ltd	TEL	310.78	131.00	40,712.05		1.80%			
Discover Financial Services	DFS	250.06	93.00	23,255.39		3.01%		56.16%	
Visa Inc	V	1,580.68	256.68	405,728.94	1.30%	0.81%	0.01%	14.32%	0.19%
Mid-America Apartment Communities Inc	MAA	116.69	124.48	14,525.32	0.05%	4.50%	0.00%	1.77%	0.00%
Xylem Inc/NY	XYL	241.08	105.13	25,344.53		1.26%			
Marathon Petroleum Corp	MPC	379.70	149.19	56,647.00		2.21%			
Advanced Micro Devices Inc	AMD	1,615.50	121.16	195,733.86				30.65%	
Tractor Supply Co	TSCO	108.11	203.01	21,948.22	0.07%	2.03%	0.00%	3.81%	0.00%
ResMed Inc	RMD	147.09	157.73	23,200.82		1.22%			
Mettler-Toledo International Inc	MTD	21.68	1,091.93	23,677.41	0.08%			5.01%	0.00%
Jacobs Solutions Inc	J	126.02	127.18	16,027.73	0.05%	0.82%	0.00%	12.31%	0.01%
Copart Inc	CPRT	960.23	50.22	48,222.80					
VICI Properties Inc	VICI	1,034.53	29.89	30,922.16	0.10%	5.55%	0.01%	7.09%	0.01%
Fortinet Inc	FTNT	767.91	52.56	40,361.35	0.13%			15.03%	0.02%
Albemarle Corp	ALB	117.35	121.27	14,231.40	0.05%	1.32%	0.00%	18.79%	0.01%
Moderna Inc	MRNA	381.28	77.70	29,625.77				-29.33%	
Essex Property Trust Inc	ESS	64.18	213.46	13,700.50	0.04%	4.33%	0.00%	5.71%	0.00%
CoStar Group Inc	CSGP	408.36	83.04	33,910.46	0.11%			20.00%	0.02%
Realty Income Corp	O	723.92	53.96	39,062.94	0.13%	5.69%	0.01%	0.68%	0.00%
Westrock Co	WRK	256.47	41.17	10,558.83	0.03%	2.94%	0.00%	4.20%	0.00%
Westinghouse Air Brake Technologies Corp	WAB	179.16	116.56	20,882.77	0.07%	0.58%	0.00%	12.86%	0.01%
Pool Corp	POOL	38.68	347.32	13,433.99	0.04%	1.27%	0.00%	-5.49%	0.00%
Western Digital Corp	WDC	324.24	48.31	15,664.18	0.05%			-11.96%	-0.01%
PepsiCo Inc	PEP	1,374.86	168.29	231,375.86	0.74%	3.01%	0.02%	8.70%	0.06%
Diamondback Energy Inc	FANG	178.99	154.41	27,637.07		8.73%		21.94%	
Palo Alto Networks Inc	PANW	315.30	295.09	93,041.88				30.00%	
ServiceNow Inc	NOW	205.00	685.74	140,576.70					
Church & Dwight Co Inc	CHD	246.38	96.63	23,807.89	0.08%	1.13%	0.00%	5.95%	0.00%
Federal Realty Investment Trust	FRT	81.62	95.59	7,801.86	0.03%	4.56%	0.00%	5.77%	0.00%
MGM Resorts International	MGM	341.58	39.44	13,472.03					
American Electric Power Co Inc	AEP	515.18	79.55	40,982.25	0.13%	4.42%	0.01%	4.83%	0.01%
SolarEdge Technologies Inc	SEDG	56.81	79.38	4,509.66				27.00%	
Invitation Homes Inc	INVH	611.96	33.36	20,414.92	0.07%	3.12%	0.00%	3.15%	0.00%
PTC Inc	PTC	119.25	157.36	18,764.39	0.06%			19.31%	0.01%
JB Hunt Transport Services Inc	JBHT	103.14	185.27	19,109.30		0.91%		27.00%	
Lam Research Corp	LRCX	131.79	715.92	94,352.53	0.30%	1.12%	0.00%	5.44%	0.02%
Mohawk Industries Inc	MHK	63.68	88.31	5,623.76	0.02%			-3.08%	0.00%
Pentair PLC	PNR	165.30	64.54	10,668.40	0.03%	1.36%	0.00%	6.22%	0.00%
GE HealthCare Technologies Inc	GEHC	455.24	68.46	31,165.94	0.10%	0.18%	0.00%	12.70%	0.01%
Vertex Pharmaceuticals Inc	VRTX	257.68	354.81	91,428.51	0.29%			13.38%	0.04%
Amcor PLC	AMCR	1,445.34	9.48	13,701.85	0.04%	5.27%	0.00%	1.33%	0.00%
Meta Platforms Inc	META	2,219.61	327.15	726,144.43				24.05%	
T-Mobile US Inc	TMUS	1,156.48	150.45	173,991.66		1.73%		38.46%	
United Rentals Inc	URI	67.78	476.02	32,265.11	0.10%	1.24%	0.00%	17.87%	0.02%

Honeywell International Inc	HON	659.25	195.92	129,160.46	0.41%	2.20%	0.01%	7.69%	0.03%
Alexandria Real Estate Equities Inc	ARE	173.78	109.40	19,010.99	0.06%	4.53%	0.00%	5.28%	0.00%
Delta Air Lines Inc	DAL	643.46	36.93	23,763.09		1.08%		30.85%	
Seagate Technology Holdings PLC	STX	209.18	79.10	16,546.45	0.05%	3.54%	0.00%	6.11%	0.00%
United Airlines Holdings Inc	UAL	328.02	39.40	12,923.87				46.54%	
News Corp	NWS	191.39	23.04	4,409.51		0.87%			
Centene Corp	CNC	534.20	73.68	39,359.93	0.13%			8.43%	0.01%
Martin Marietta Materials Inc	MLM	61.81	464.59	28,714.91		0.64%		21.60%	
Teradyne Inc	TER	152.88	92.23	14,100.03	0.05%	0.48%	0.00%	7.82%	0.00%
PayPal Holdings Inc	PYPL	1,078.14	57.61	62,111.65	0.20%			6.26%	0.01%
Tesla Inc	TSLA	3,178.92	240.08	763,195.35	2.45%			11.00%	0.27%
Arch Capital Group Ltd	ACGL	373.17	83.69	31,230.76	0.10%			10.00%	0.01%
Dow Inc	DOW	701.40	51.75	36,297.29	0.12%	5.41%	0.01%	-4.72%	-0.01%
Everest Group Ltd	EG	43.39	410.55	17,813.76		1.71%		37.66%	
Teledyne Technologies Inc	TDY	47.19	402.96	19,013.67	0.06%			8.03%	0.00%
News Corp	NWSA	380.67	22.04	8,389.97		0.91%			
Exelon Corp	EXC	994.30	38.51	38,290.45	0.12%	3.74%	0.00%	4.00%	0.00%
Global Payments Inc	GPN	260.39	116.44	30,319.70	0.10%	0.86%	0.00%	13.33%	0.01%
Crown Castle Inc	CCI	433.69	117.28	50,863.05	0.16%	5.34%	0.01%	7.00%	0.01%
Aptiv PLC	APTV	282.86	82.84	23,432.29	0.08%			11.44%	0.01%
Align Technology Inc	ALGN	76.59	213.80	16,374.73					
Illumina Inc	ILMN	158.80	101.95	16,189.66				-51.00%	
Kenvue Inc	KVUE	1,915.00	20.44	39,142.50		3.91%			
Targa Resources Corp	TRGP	222.98	90.45	20,168.18	0.06%	2.21%	0.00%	15.00%	0.01%
Bunge Global SA	BG	161.43	109.87	17,736.20	0.06%	2.41%	0.00%	-5.00%	0.00%
LKQ Corp	LKQ	267.60	44.53	11,916.14		2.69%			
Zoetis Inc	ZTS	459.11	176.67	81,111.67	0.26%	0.85%	0.00%	10.91%	0.03%
Digital Realty Trust Inc	DLR	302.85	138.78	42,028.97	0.13%	3.52%	0.00%	6.80%	0.01%
Equinix Inc	EQIX	93.88	815.01	76,515.58	0.25%	2.09%	0.01%	16.67%	0.04%
Las Vegas Sands Corp	LVS	764.49	46.12	35,258.32		1.73%			
Molina Healthcare Inc	MOH	58.30	365.56	21,312.15	0.07%			11.24%	0.01%

Notes:
[1] Equals sum of Col. [9]
[2] Equals sum of Col. [11]
[3] Equals ([1] x (1 + (0.5 x [2]))) + [2]
[4] Source: Bloomberg Professional as of November 30, 2023
[5] Source: Bloomberg Professional as of November 30, 2023
[6] Equals [4] x [5]
[7] Equals weight in S&P 500 based on market capitalization [6] if Growth Rate >0% and ≤20%
[8] Source: Bloomberg Professional, as of November 30, 2023
[9] Equals [7] x [8]
[10] Source: Bloomberg Professional, as of November 30, 2023
[11] Equals [7] x [10]

Kolbe

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EPRI EA-3392
Project 1920-1-1
Final Report
February 1984

Choice of Discount Rates in Utility Planning: A Critique of Conventional Betas as Risk Indicators for Electric Utilities

Prepared by
Charles River Associates Incorporated
Boston, Massachusetts

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Prepared by
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ABSTRACT

Financial market risk measures are relevant for capital investment decisions by utilities because the cost of capital determined in financial markets should be used as the discount rate when the net present value of the proposed investment is calculated. One widely used measure of the risk of a common stock is "beta." Beta measures the likely increase or decrease in a stock's return when the entire market increases or decreases. For example, stocks with a beta of 0.8 go up by 8% on average when the market goes up by 10%.

This paper reports statistical tests of the way betas are conventionally calculated. The results demonstrate that conventional betas are not appropriate for assessing the risk of electric utility investments. Electric utility betas calculated in an alternative way indicate a much higher level of risk, while the relative risks of comparison unregulated industries do not prove sensitive to the alternative calculation. For example, the results imply that recent data could lead to estimates of the cost of equity that are about 3 percentage points too low for electric utilities.

Further tests reveal that more work is needed. In Phase II of this project, Charles River Associates Incorporated explores, with mixed results, alternative formulations of the relative risk, of utility investments.

EPRI PERSPECTIVE

PROJECT DESCRIPTION

For most of the electric utility industry's history, engineering and technological issues dominated financial issues. Over the last decade or so, however, financial issues have increasingly constrained managers' flexibility to make engineering and technological decisions. For this reason, EPRI has undertaken research to understand and incorporate financial constraints into utility planning models (RP1920). One important financial issue concerns the discount rate that utility managers should use when evaluating proposed investment projects.

This project (RP1920-1-1) examines methods for estimating appropriate discount rates. By definition the appropriate discount rate for an investment is the opportunity cost of capital--the rate of return that shareholders can expect in capital markets while bearing the same degree of risk, as the risk associated with the project being considered. Errors in selecting the appropriate discount rate can lead to the inappropriate choice of capital additions. Because investment projects in the industry are large, small changes in the discount rate imply large changes in the estimated net present value of projects. The selected discount rate can affect the relative ranking of these large projects.

The project was carried out in two phases: evaluation of the "missing asset" problem and examination of alternative model formulations. This report describes the results of the first phase. An important criticism of the conventional basis for estimating the discount rate for electric utility investments is known as the "missing asset" problem and it concerns the financial market risk measure known as "beta." Beta is the key risk measure in the Capital Asset Pricing Model (CAPM). Beta is also considered in discount rate estimation, which relies on models that are more general and more realistic than CAPM.

Beta is usually calculated by statistically analyzing how the return on a particular stock changes in relation to the return on a broad stock market index. In principle, however, assets in addition to common stocks (bonds, gold, and real estate, for example) should be included in the definition of the market. The inclusion of these other assets might be especially important for estimating the financial market risk of regulated companies. This is true because rate regulation often causes the return on regulated stocks to behave more like the return on bonds than on unregulated stocks.

In Phase II, the contractor, Charles River Associates Incorporated (CRA), explored alternative model formulations of the relative financial market risk of utility investments. Specifically, CRA attempted to quantify the sensitivity of utility cost of capital to the level of overall economic activity, inflation, and fuel prices. The results of Phase II are available in a draft report from the project manager.

PROJECT OBJECTIVE

The objective of this research was to evaluate the methods that underlie estimation of discount rates. The project examined conventional methods for estimating financial market risk indicators for electric utilities, and specifically, the project addressed whether or not the conventional methods tend to underestimate the risk of regulated companies.

PROJECT RESULTS

Because of the current procedures used in rate-of-return regulation, electric utility earnings often behave more like interest on bonds than like the earnings of unregulated companies. Specifically, because electric utility rates are fixed, at least between hearings (like interest rates on bonds are fixed), utility earnings do not adjust rapidly to changes in inflation and the cost of capital. For this reason, the estimated betas for electric utilities should be higher if the market index used to estimate the betas is augmented to include other financial assets, such as bonds, than if the market index includes only common stocks. The earnings of unregulated companies, however, do not behave like interest on bonds, so their estimated betas should be unaffected by adding other financial assets to the market index.

Both of these hypotheses, higher betas for regulated companies and unaffected betas for unregulated companies, are confirmed by this research. For electric utilities, gas distribution companies, and operating telephone companies, betas estimated using the augment market index are uniformly higher than betas estimated using a stock market index alone. Betas for the unregulated industries examined in this research show no consistent pattern as a result of the inclusion of other assets.

These results are not the whole story. Additional statistical tests suggest that more than the augmented index is needed to completely explain the variation in the return of utility investments. One explanation is that more than just the return on the market, however defined, is important for explaining the rate of return on electric utility investments--that is, a more complete model may include several factors. The issue of a more complete model is addressed in Phase II.

The results do provide modified estimates of beta that are better measures of the relative risk of utility investments. These estimates of beta can be used, at least under some assumptions, with conventional estimates of the risk premium on common stocks to derive a better estimate of the appropriate discount rate.

Pending the development of a more complete model, the present results demonstrate that beta coefficients calculated in the conventional way are incomplete. Utility planners need to use higher discount rates than conventional betas imply when evaluating regulated investments. The implications of using rates that are too low are that managers will tend to invest too much and will tend to make the wrong choice from among several mutually exclusive investment options.

Stephen W. Chapel, Project Manager
Energy Analysis and Environment Division

ACKNOWLEDGMENTS

CRA gratefully acknowledges the contribution to this report of the comments and advice of Stephen Chapel, the EPRI Project Manager, and of John Chamberlin of EPRI. Also, discussions with Stewart Myers of MIT during our earlier work on inflation and rate-of-return regulation are the source of the hypothesis tested in this paper. Of course, CRA accepts full responsibility for the report's contents and the views expressed.

Within CRA, Lawrence Kolbe directed the research, and he and James Read are the authors of this report. Robert Lincoln was the CRA officer in overall charge of the project, and Bernard Reddy helped design the statistical tests. He and Jack Stuart provided computational assistance, and Terry McKiernan served as editor.

CONTENTS

ILLUSTRATIONS

Section 1

INTRODUCTION AND SUMMARY

INTRODUCTION

For most of the electric utility industry's history, engineering and technological issues dominated financial issues. Over the last decade or so, however, financial issues have increasingly constrained managers' flexibility to make engineering and technological decisions. For this reason, the Electric Power Research Institute (EPRI) asked Charles River Associates (CRA) to explore one important financial issue: the discount rates that utility managers should use in evaluating proposed investment projects. Previous reports for EPRI by CRA have set forth the principles (and pitfalls) that underlie selection of a discount rate for both regulated and unregulated investments (1), and have developed a quite general conceptual model of the discount rate appropriate for regulated investments (2). This report contains interim results of an ongoing effort to attach numbers to the concepts developed in these earlier reports.

One important financial constraint is profitability:* each investment project undertaken by an electric utility must be valuable in the sense that it is expected

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*The other major financial constraint is liquidity: investment projects must not make the company so short of cash that it has trouble meeting its financial obligations. Liquidity is rarely a problem for firms that follow prudent financial policy. A liquidity shortfall might arise for a firm with a large amount of debt outstanding relative to its existing assets. Debt contracts contain restrictive covenants designed to protect lenders, which may, in certain circumstances, limit the ability of management to follow the optimal investment policy.

to provide a return at least as large as alternative investments of comparable risk. If managers violate this constraint by undertaking investment projects that are not profitable, they will confer a loss on utility stockholders. Moreover, capital markets will be increasingly unwilling to provide capital to firms that establish a pattern of unprofitable investment decisions.

The financial view of investment projects is a stream of expected future cash flows, expenditures and receipts, with differing levels of uncertainty and risk. To evaluate whether an investment is valuable to shareholders, utility managers need to discount each future cash flow back to its present value, sum these discounted cash flows, and determine whether this sum (known as the "net present value," or NPV) is positive. Positive NPV projects are profitable in the sense described above; they benefit shareholders by increasing the firm's stock market value, provided the NPV was calculated correctly.

Two basic steps are needed to calculate net present value: forecast cash flows, and select the appropriate discount rates for those cash flows. Both steps are difficult, and neither can be undertaken in isolation from the other. Forecasting cash flows involves an assessment of the probability that different levels of expenditures and receipts will occur. In the selection of discount rates, managers need to consider the level of market risk for the projected cash flows during the different phases of the project. Furthermore, the assumptions used in the two steps must be consistent. For example, current income tax laws imply that explicit inflation forecasts are needed to estimate future cash flows correctly, and those same inflation forecasts need to be incorporated into the discount rates.*

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*For example, depreciation must be stated as a fraction of the original cost of the asset, while other costs and revenues will grow with inflation. An alternative is to forecast "real" (i.e., constant dollar) cash flows, an approach which implies shrinking depreciation and higher real income tax liability, and to use real discount rates as well.

This report, like the previous two, focuses on the appropriate discount rate for investments in the electric utility industry.* With rare exceptions, the goal of discount rate selection should be to identify the "opportunity cost of capital" for the investment, where the cost of capital is the expected rate of return on investments with the same degree of risk. The cost of capital is determined in the capital markets, so it is market risk that is relevant to investment decisions. An investment with high market risk has a higher cost of capital than an investment with low market risk.** A high-risk investment should, therefore, be evaluated with a higher discount rate than a low-risk investment.

As outlined below and explained in detail in Section 2, the results reported here demonstrate that use of the standard way to calculate one important market risk measure (known as "beta") leads to serious underestimates of the relative risk of the electric utility industry. Since the appropriate discount rate increases with risk, these findings imply that utility planners who rely only on conventionally calculated betas to set discount rates will underestimate the discount rate that should be used for regulated electric utility investments. In general, the use of the wrong discount rate can lead to two kinds of mistakes:

- Managers may undertake too much or too little investment. If they use discount rates that are too high, they will tend to underinvest. If they use discount rates that are too low, they will tend to overinvest.

- Managers will tend to make the wrong choice from among mutually exclusive investment options. A high discount rate will tend to favor investments with relatively short time horizons while a low discount rate will tend to favor investments with a relatively long time horizon.

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* This report focuses on the cost of equity capital for electric utility investments and does not address the adjustments that financing decisions may require for calculating project value. See, for example, (3) Chapters 18 and 19, for more extensive discussion of the effects of debt on discount rates and project value.

** See (1) for a more extensive discussion of the cost of capital and the concept of risk.

Either kind of mistake lead to a decline in the firm stock price relative to the correct decision.

SUMMARY

One widely used measure of market risk is known as "beta." Beta is a measure of the average fluctuation in a stock's return relative to a fluctuation in the return on the entire market. (For example, when the stock market goes up by 10 percent, stocks with a beta of 0.8 will go up by 8 percent on average.) Estimates of beta for traded stocks are fairly easy to compute and are widely available from financial analysts and stockbrokers.

The genesis of beta is the Capital Asset Pricing Model (CAPM). "CAPM" refers both to a theory of how the cost of capital is set in financial markets and to various empirical procedures used to estimate the cost of capital.* The CAPM theory states that beta is the only risk measure that matters in capital markets. CAPM empirical procedures usually estimate beta by examining the actual returns on a stock (or a group of stocks) and the actual return on a stock market index, such as the Standard & Poor's 500, over time.**

There have been a number of criticisms of both the CAPM theory and the empirical procedures based on it (1). For electric utilities and five comparison industries, this report empirically tests the importance of one fundamental criticism: the "missing assets" problem. The "market" that is central to CAPM theory includes all assets, not just common stocks. The conventional approach of using a stock market

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*See (1) for discussion of the CAPM and for references.

**Beta is the estimated coefficient of the return on the market index in a regression of stock returns on market index returns. Following the CAPM theory, some empirical procedures, including those used here, use "excess returns:" the difference between risky (stock) returns and riskless (Treasury bill) returns.

index by itself to calculate beta is inappropriate in principle. Whether this is a problem in practice depends on whether estimates of beta change significantly when other assets are added to the definition of the "market."

Because of the current procedures used in rate-of-return regulation, electric utility earnings in several ways behave more like interest on bonds than like the earnings of unregulated companies (1, 4, 5). For this reason, a plausible hypothesis is that estimated betas for electric utilities will be higher if the market index used to estimate the betas is augmented to include other financial assets, such as bonds, than if the market index includes only common stocks. Unregulated companies' earnings, however, do not behave like interest on bonds, so a related hypothesis is that their estimated betas would be unaffected by the addition of other financial assets to the market index.

Both of these hypotheses are confirmed by the results of this study.* Electric utility stocks are strongly responsive to movements in financial assets other than common stocks (Treasury bonds, corporate bonds, and Treasury bills, hereinafter referred to as "other assets") while unregulated stocks in the comparison industries (petroleum refining, pharmaceuticals, and electronic computers) are not. Stocks for gas distribution and operating telephone companies, which are usually subject to the same type of rate-of-return regulation but have probably been less constrained by it, are also responsive to movements in these other assets, although somewhat less so than electric utilities are.

The tests presented in Section 2 are based on a group of industry stock portfolios, using five years of monthly data (60 observations) for 16 overlapping periods from 1962-1966 through 1977-1981. For electric utilities, gas distribution companies, and operating telephone companies, betas estimated using an augmented market index are uniformly higher than betas estimated using a stock market index alone. The

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*More precisely, the hypothesis that electric utility betas are unaffected by the addition of other financial assets to the market index is rejected.

difference is particularly noticeable in the last two sample periods (1976-1980 and 1977-1981), when conventional stock betas for electric utilities fall by almost one half while augmented-market betas fall only slightly.* Betas for the unregulated industries, in contrast, show no consistent pattern. The returns on other financial assets are always statistically significant in explaining electric utility returns, and are nearly always significant for gas distribution and operating telephone companies; they are rarely significant for the unregulated industries.

These results are illustrated in Figure 1-1 (for electric utilities) and Figure 1-2 (for petroleum refining, one of the unregulated industries).** The results are striking: electric utility betas have always been underestimated by the conventional calculation, and the underestimation is dramatic in the last two five-year periods. For petroleum refining, however, use of the augmented market makes virtually no difference.

As discussed in Section 2, these results are not the whole story. Additional tests suggest that more than just an augmented market index, or at least more than this augmented market index, is needed to explain utility investment returns completely. One explanation is that more than just the return on "the market," however defined, is important for determining the required rate of return on electric utility investments -- that is, a complete model of asset prices may include several risk factors, not just one. The implications of this alternative explanation are much more profound. CRA explores this approach in Phase II of this project for EPRI, with mixed results.

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*We suspect that the shift was caused by the Federal Reserve Board's October 1979 decision to focus on monetary instead of interest rate targets, which seems to have made interest rates (and hence returns on the other financial assets) very volatile.

**As explained in Section 2, the betas in these figures are estimated on overlapping five-year periods, so successive values are not independent of one another. The figures show betas for the five years ending in the year on the horizontal axis.

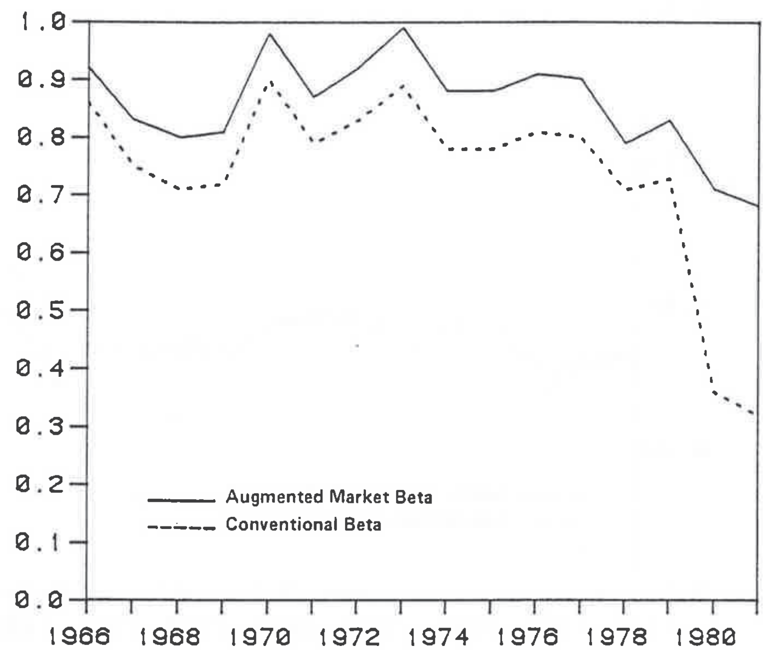

Figure 1–1. ALTERNATIVE ELECTRIC UTILITY BETA ESTIMATES.

SOURCE: Charles River Associates, 1983.

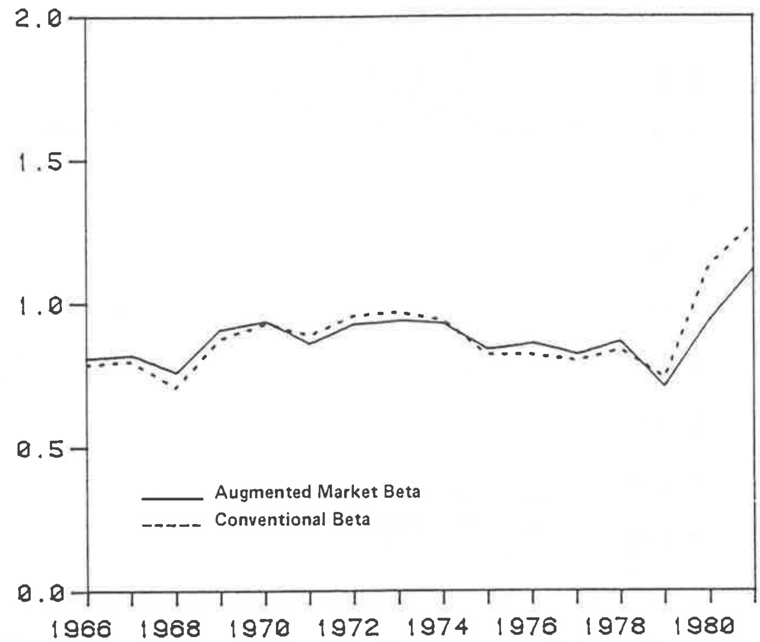

Figure 1–2. ALTERNATIVE PETROLEUM REFINING BETA ESTIMATES.

SOURCE: Charles River Associates, 1983.

Regardless of the ultimate explanation, the present results demonstrate that beta coefficients calculated in the conventional way are incomplete risk measures for electric utility investments. Utility planners need to use higher discount rates than conventional betas imply when evaluating regulated investments.* For example, with the usual stock market risk premium estimates of 8 to 9 percent, our results imply that data for the five years ending in 1981 would lead to conventional CAPM estimates of the cost of equity that are about 3 percentage points too low for electric utilities.** To reiterate, the implications of using a discount rate that is too low are (1) that managers will tend to invest too much and (2) managers will tend to make the wrong choice from among several mutually exclusive investment options.

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*The present results also tend to contradict the view that electric utility equity discount rates should now be closer to, or perhaps even below, interest rates on long-term bonds. (This view seems to arise most often in a regulatory setting, which is explicitly not a topic of this research, under the rubric of a "negative risk premium"; however, we are told that utility planners sometimes use the cost of equity determined for ratemaking as the discount rate for evaluating investments, so that the possible validity of the view is also relevant for planners.) That is, the recent increase in the volatility of bonds has increased their risk, and <u>may</u> have increased the required rate of return on bonds (if investors are unable to diversify this risk sufficiently). Stocks are said to be insulated from this risk and so some analysts argue that the required risk premium of stocks over bonds is now lower, or even negative. However, the present results confirm that conventional rate-of-return regulation makes <u>utility</u> stocks subject to many of the same risks as bonds. If bondholders now require a higher rate of return, these results suggest that utility stockholders do also. The risk premium over bonds that should be used to choose a discount rate for prospective utility investments, therefore, should <u>not</u> be reduced because of the greater volatility of bonds.

**For most of the periods examined, the implied CAPM discount rates are about 0.5 percentage points too low, but a major change seems to have occurred in 1979 or 1980.

Section 2

CONCEPTS AND RESULTS

This section describes empirical tests of the effects of different definitions of "the market" on estimates of the risk for electric utilities and for five reference industries: gas distribution, local telephone service, petroleum refining, pharmaceuticals, and electronic computers. The goal of the tests is to evaluate the hypothesis that allowance for financial assets other than common stocks will significantly affect the estimated risk for industries subject to conventional rate-of-return regulation, while having little effect on the estimated risk for the other industries.

The tests and their results are presented using the Sharpe-Lintner Capital Asset Pricing Model (CAPM) as a framework for discussion.* The empirical results demonstrate that the conventional empirical procedures associated with the CAPM lead to serious underestimates of the relative risk of electric utilities. The results also suggest that a multi-factor model of capital asset prices may be appropriate for electric utilities. CRA is currently investigating such models, but empirical results are not yet available.

CONCEPTUAL BACKGROUND

The Capital Asset Pricing Model holds that expected rates of return are proportional to systematic risk. Systematic risk is a concept from portfolio

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*The "Capital Asset Pricing Model" refers to mean-variance theories of capital market equilibrium. The Sharpe-Lintner model is the earliest and simplest of these. See (1) or (2) for discussion of the CAPM and alternative theories.

theory. The basic idea is that there is a distinction between the risk of a security viewed as an isolated investment and the risk of a security viewed as part of a portfolio of investments. To see this, think of investment risk as the variability of possible investment outcomes about the expected value. For any particular asset, some of this variability or <u>total</u> risk effectively vanishes in a portfolio of investments, because the returns on different investments are not perfectly correlated. The part of total risk that can be diversified away in a portfolio is called <u>unique</u> risk. Systematic risk is risk that cannot be diversified in a portfolio of investments. The Capital Asset Pricing Model says that, since unique risk is of no consequence to diversified investors, only systematic risk is important for pricing risky investments.

How much of the total risk of an investment is systematic and how much is unique depends on the portfolio in which it is evaluated. Thus, to some extent, the risk of an investment is ambiguous. In the Capital Asset Pricing Model, the correct benchmark is the "market portfolio." Under the CAPM's assumptions, the market portfolio consists of a share of all assets in the economy, including stocks, bonds, real estate, gold, art, and so on. It is a fully diversified portfolio of investments. But the market portfolio is a theoretical construct; it cannot be observed directly. In practice both academic and business applications of the CAPM have employed an index of common stocks as a proxy for the market portfolio.

The omission from the market index of assets other than common stocks is often referred to as the "missing assets" problem. The significance of missing assets can be understood in light of empirical research in capital market theory. A consistent finding of these studies is that there is a discrepancy between the observed risk-return line and the risk-return line predicted by the Sharpe-Lintner CAPM. While there is indeed a significant linear relationship between security returns and security betas, the empirical line is flatter than the theory predicts. High-beta stocks have lower rates of return and low-beta stocks have higher rates of return than predicted. The missing assets problem has been offered as an explanation for this discrepancy. That is, the observed relationship between risk and return could be an artifact of a misspecified market index.

The missing assets problem is one possible explanation for the empirical findings. There are, in addition, several theoretical explanations for this discrepancy. It has been shown, for example, that by imposing restrictions on the ability of investors to borrow and lend, one can derive a model very much like the Sharpe-Lintner CAPM except that the slope of the risk-return line is flatter, consistent with the empirical evidence (6). A flatter risk-return line is also obtained from a model which allows for the investment opportunity set to change with time (7).

Alternative theoretical explanations aside, there is a more important point for present purposes. Two empirical studies, one of which has only recently been published, have tested the CAPM with broader market indexes than were used in earlier studies. Both of these studies conclude that broader market indexes fail to explain the discrepancies between the theoretical and empirical market lines (8, 9). Nevertheless, previous research on the missing assets problem has not, to the best of our knowledge, focused on a narrow class of securities, such as public utility stocks. Thus the significance of missing assets for utility stocks has not been resolved by previous research.

One omission from the conventional market proxy is bonds or, more generally, fixed income securities. An important characteristic of fixed income securities is that the amount and timing of cash flows (interest payments and repayment of principle) are fixed at the time of issue. As a result, bond prices move inversely with changes in interest rates. When interest rates rise, bond prices fall, and vice versa. It is also the case that interest rates change to reflect changes in expected inflation. Bond returns are therefore sensitive to changes in the expected rate of inflation.

The pattern of cash flows generated by a company subject to traditional rate-of-return regulation bears an important similarity to the pattern of cash flows on bonds. The reason for this is not hard to see. In most jurisdictions, the allowed return on equity is explicitly fixed for periods of one to two years between regulatory proceedings. Also, the return to equity may be "sticky" for even longer periods, if regulators are slow to accommodate large changes in the cost of capital in the rate of return that they allow (1, 4, 5). Prices charged by unregulated firms, in contrast, are free to respond to market forces. Thus while inflation, for one, puts upward pressure on unregulated prices and the cost of capital, utility prices and allowed rates of return tend to remain flat. The same pattern holds for bonds. As cash flows to other investments fluctuate with market forces, the cash flows (interest payments) on bonds are fixed. Since it is not the level but the variability of cash flows that is the determinant of market risk, the similarity between bonds and utility stocks may be important in evaluating the relative risk of utility stocks. We test this hypothesis below.

EMPIRICAL RESULTS FOR ELECTRIC UTILITIES

The Capital Asset Pricing Model states that equilibrium asset returns are described by the following relationship:

$$E(r_{it}) = r_{ft} + \beta_i[E(r_{mt}) - r_{ft}] \tag{2-1}$$

where

$E(r_{it}) \equiv$ expected rate of return on asset i at time t;

$r_{ft} \equiv$ rate of return on riskless assets at time t;

$\beta_i \equiv$ beta of asset i; and

$E(r_{mt}) \equiv$ expected rate of return on market portfolio at time t.

The linear regression model corresponding to the CAPM is:

$$(r_{it} - r_{ft}) = \alpha_i + \beta_i(r_{mt} - r_{ft}) + \varepsilon_{it}$$

where

$r_{it} \equiv$ realized rate of return on asset i at time t;

$r_{ft} \equiv$ realized rate of return on riskless assets at time t;

$r_{mt} \equiv$ realized rate of return on market portfolio at time t;

$\varepsilon_{it} \equiv$ a random error term; and

$\alpha_i, \beta_i \equiv$ parameters to be estimated.

Estimates of beta are usually obtained by computing this ordinary least squares regression using a time series of monthly returns for a five-year estimation period. U.S. Treasury bills, which are very short-term government securities, are used as the riskless asset and an index of common stocks is used as a proxy for the market portfolio.

As a point of departure, we computed estimates of beta for a value-weighted index of electric utility common stocks. The actual regressions were of the form:

$$(r_u - r_b) = \alpha_u + \beta_u(r_s - r_b) + \epsilon$$

where r_u denotes the return on the portfolio of electric utility common stocks, r_b denotes the return on Treasury bills, and r_s denotes the return on an index of common stocks.*

<u>Conventional Stock Market Betas</u>

Table 2-1 reports estimated beta values for electric utility stocks using two different market indexes. The "S & P" is a value-weighted index of the 500 common stocks in the Standard & Poor's composite index. The "NYSE" is a value-weighted index of all of the common stocks listed on the New York Stock Exchange. Table 2-1 demonstrates two important results. First, electric utility betas are consistently less than unity, which implies that electric utility equities are less risky than "average" NYSE and S & P common stocks. Second, during the last two five-year sample periods (1976-1980 and 1977-1981), estimated beta values fell sharply. This second result is important because it contradicts the perception of industry experts that electric utility stocks have become more risky in recent years, not less risky. For this reason, it is indirect evidence that conventional estimates of electric utility risk are inadequate.

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* All rate-of-return data used in this study were obtained from the Center for Research in Security Prices (CRSP) at the University of Chicago. Returns on Treasury bills, government bonds, corporate bonds, and the S & P common stock index are from the Ibbotson and Sinquefield file. Rates of return on the NYSE common stock index and on all other common stocks were taken from the CRSP monthly returns file. Common stock returns include dividends.

Table 2-1

BETA VALUES FOR ELECTRIC UTILITIES

Years	S & P Beta	NYSE Beta
1962-1966	0.86	0.85
1963-1967	0.75	0.74
1964-1968	0.71	0.68
1965-1969	0.72	0.69
1966-1970	0.90	0.84
1967-1971	0.79	0.75
1968-1972	0.83	0.79
1969-1973	0.89	0.83
1970-1974	0.78	0.77
1971-1975	0.78	0.79
1972-1976	0.81	0.81
1973-1977	0.80	0.80
1974-1978	0.71	0.72
1975-1979	0.73	0.72
1976-1980	0.36	0.37
1977-1981	0.32	0.34

Source: Charles River Associates, 1982.

One more observation is pertinent. Beta estimates obtained using the S & P index and those obtained using the NYSE index are virtually identical. In the remainder of this report, we present results for the S & P index only. All statistical tests were made with both indexes, however, and exactly the same conclusions are reached when the NYSE index is used.

Other Assets

To investigate the possibility that the CAPM as routinely applied yields an incomplete measure of risk for electric utility stocks, we formed a second market index consisting of three types of debt securities: corporate bonds, long-term government bonds, and Treasury bills. (The construction of this index is described in Appendix A.) The returns on this index, denoted r_O, were included in a regression model as a second independent variable:

$$(r_u - r_b) = \alpha_u + \beta_s(r_s - r_b) + \beta_O(r_O - r_b) + \varepsilon$$

If the conventional approach is correct, that is, if other assets do not matter, then the estimate of β_O should be equal to (not significantly different from) zero. If, on the other hand, our conjecture is correct, then the estimate of β_O should be (significantly) greater than zero. The results of the alternative regression model are reported in Table 2, along with the t-statistics of the coefficients.

The results confirm our hypothesis that other assets matter. Estimated beta coefficients for other assets are large and statistically significant in each sample period.* A remarkable aspect of Table 2-2 is that during the last two sample periods, the beta for common stocks declined sharply and became less significant, while the beta coefficients for other assets changed little and became more significant. The common stock index has almost no explanatory power for utility stocks in these last two periods.

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*Since overlapping periods are used, successive values of these t-statistics are not independent of one another. However, the table readily shows that non-overlapping periods consistently indicate significant coefficients for other assets.

Table 2-2

ELECTRIC UTILITY INDUSTRY
ESTIMATED BETAS FOR COMMON STOCKS AND OTHER ASSETS

	Common Stocks		Other Assets	
Years	Beta	t-statistic[a]	Beta	t-statistic[a]
1962-1966	0.81	11.98	1.80	5.66
1963-1967	0.60	5.61	1.20	3.90
1964-1968	0.62	5.22	0.93	3.19
1965-1969	0.63	5.60	0.83	3.17
1966-1970	0.74	6.83	0.85	3.52
1967-1971	0.67	5.75	0.66	2.70
1968-1972	0.70	5.62	0.73	2.77
1969-1973	0.75	6.48	0.80	3.18
1970-1974	0.58	5.19	1.03	3.69
1971-1975	0.59	5.01	1.17	3.85
1972-1976	0.58	5.52	1.41	4.68
1973-1977	0.59	5.82	1.26	4.35
1974-1978	0.42	4.13	1.53	4.94
1975-1979	0.47	4.21	1.14	4.17
1976-1980	-0.18	2.41	1.12	8.97
1977-1981	0.10	1.21	0.86	8.04

[a]Since overlapping periods are used, successive values of these t-statistics are not independent of one another.

Source: Charles River Associates, 1982.

The strength of these results deserves repeating. Estimated coefficients are not only significant, they are significant throughout the twenty-year period. Bond returns have significant explanatory power for electric utility stocks even prior to the advent of high rates of inflation in the 1970s and the volatile bond markets of post-1979. Although other assets have been relatively more important in recent years, they have always been important. In fact, the largest coefficient for other assets is obtained during the earliest (1962-1966) period. This means that the significance of other assets is not merely the result of transient macroeconomic conditions; other assets are always a source of systematic risk for electric utility stocks.

An Augmented Market Index

The preceding results can be taken as evidence in support of the missing assets hypothesis. They are consistent with the hypothesis that the Capital Asset Pricing Model is correct, but a deficient market index biases conventional estimates of risk. This hypothesis can be pursued further by constructing an augmented market index, which consists of bonds as well as common stocks. (The construction of this index is described in Appendix A.) The regression model corresponding to this hypothesis is

$$(r_u - r_f) = \alpha_u + \beta_a(r_a - r_f) + \varepsilon$$

where r_a denotes the return on the augmented market index. Utility beta estimates on the augmented market index are reported in column (1) of Table 2-3.

Other things equal, the beta on the augmented market index will be higher than the beta on the stock market index.* In this case "other things" refers to the correlation between utility stock returns and the two index returns. The important issue is how to compare the new beta to conventional betas.

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*A market index that consists in part of bonds will be less volatile than an index consisting entirely of common stocks, because bond returns are less volatile than common stock returns. Thus the ratio of the standard deviation of electric utility stock returns to the standard deviation of market returns will be larger when the augmented market index is used.

Table 2-3

ELECTRIC UTILITY INDUSTRY ALTERNATIVE BETA ESTIMATES

Years	(1) Electric Utility Beta on Augmented Index	(2) S & P Beta on Augmented Index	(3) Adjusted Electric Utility Beta[a]	(4) Original Electric Utility Beta (S & P)
1962-1966	1.50	1.63	0.92	0.86
1963-1967	1.25	1.50	0.83	0.75
1964-1968	1.17	1.47	0.80	0.71
1965-1969	1.17	1.44	0.81	0.72
1966-1970	1.37	1.40	0.98	0.90
1967-1971	1.21	1.39	0.87	0.79
1968-1972	1.28	1.39	0.92	0.83
1969-1973	1.39	1.41	0.99	0.89
1970-1974	1.29	1.47	0.88	0.78
1971-1975	1.38	1.56	0.88	0.78
1972-1976	1.46	1.60	0.91	0.81
1973-1977	1.43	1.59	0.90	0.80
1974-1978	1.27	1.60	0.79	0.71
1975-1979	1.28	1.54	0.83	0.73
1976-1980	0.96	1.36	0.71	0.36
1977-1981	0.82	1.20	0.68	0.32

[a]Column (1) divided by Column (2)

Source: Charles River Associates, 1982.

Table 2-3 confirms that estimated beta coefficients for the augmented market index are considerably larger than corresponding estimates for the common stock index. To interpret these new betas, we must make them comparable to conventional betas. If we let β_{ij} denote the beta of asset i measured with respect to market index j then

$$\beta_{ij} = \sigma_{ij}/\sigma^2_j$$

$$= \rho_{ij}(\sigma_i/\sigma_j)$$

The other symbols in this definition are

σ_i ≡ the standard deviation of returns on i;

σ^2_i ≡ variance of returns on i;

σ_{ij} ≡ covariance of returns on i with returns on j; and

ρ_{ij} ≡ the correlation coefficient of i with j.

Ordinarily the second subscript for beta (here "j") is omitted since it is understood that the reference is to the market index. In this study, however, we are concerned with the sensitivity of beta estimates to the choice of market index, so we need to make the identity of that index explicit.

With the augmented market index, Equation (2-1) implies

$$(E_u-R) = \beta_{ua}(E_a-R) \quad (2\text{-}2a)$$

$$(E_s-R) = \beta_{sa}(E_a-R) \quad (2\text{-}2b)$$

where the subscripts u, s, and a represent respectively the utility index, the stock market index, and the augmented market index, as before. To compare β_{ua} with β_{us}, we require a variable X compatible with (2-2) such that

$$(E_u-R) = X(E_s-R) \quad (2\text{-}3)$$

It is easily shown that $X = (\beta_{ua}/\beta_{sa})$.*

Thus, calculation of X provides a convenient method of deriving an adjusted beta value that can be compared directly with conventional estimates. Our adjusted beta measure is the ratio of β_{ua} to β_{sa}, where both values are measured with respect to the augmented market index.** If this adjusted beta value is the same as the beta value obtained by conventional methods, then the augmented market index implies the same level of risk as conventional methods. If the two values are not equal, then the augmented market index implies a different level of risk.+

The results of this exercise are also reported in Table 2-3. Column (2) reports the beta of the stock market index on the augmented market. Column (3) reports the ratio of the utility to the stock market beta on the augmented market (i.e., Column (3) is X). Column (4) reproduces the utility beta on the stock market from Table 2-1.

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*From (2-2a) and (2-3), $X(E_s-R) = \beta_{ua}(E_a-R)$, so $X = [\beta_{ua}(E_a-R)/(E_s-R)] = [\beta_{ua}(E_a-R)/\beta_{sa}(E_a-R)] = \beta_{ua}/\beta_{sa}$.

**Dividing by β_{ma} also allows the planner to draw on existing evidence of the size of the "market risk premium" (i.e., the excess return over the risk-free interest rate that investors require for stocks of average risk), usually taken to be 8 to 9 percent (10, 11), to calculate the discount rate itself. See below for more discussion of this point.

+More formally, $(\beta_{ua}/\beta_{sa}) = [(\rho_{ua}\sigma_u/\sigma_a)/(\rho_{sa}\sigma_s/\sigma_a)] = [(\rho_{ua}/\rho_{sa})(\sigma_u/\sigma_s)]$ while $\beta_{us} = \rho_{us}(\sigma_u/\sigma_s)$. Clearly, $(\beta_{ua}/\beta_{sa}) \gtrless \beta_{us}$ as $(\rho_{ua}/\rho_{sa}) \gtrless \rho_{us}$. In words, the beta of a stock on the augmented market will be relatively higher (lower) than its beta on the stock market if the stock's correlation with the augmented market is relatively higher (lower) than the stock market's correlation with the augmented market.

The results in Table 2-3 are striking. In every sample period the adjusted estimate of beta based on the augmented market index is greater than the conventional beta estimate. That is, these alternative estimates imply that electric utility stocks are riskier than the conventional market risk measures show. Moreover, this difference in risk is most pronounced in the last two sample periods: when the conventional beta estimates drop sharply, these adjusted estimates fall only slightly.

A Formal Test

We have found two important results thus far. First, assets other than common stocks have significant explanatory power for electric utility equity returns. Second, when an augmented market index is used, the systematic risk of electric utility stocks is found to be consistently higher than the conventional indexes imply. This could be taken as evidence that the CAPM is correct and that its only defect is the failure to use an appropriate proxy for the market portfolio. An alternative interpretation is that more is involved than specification of the market index. We might, rather, infer that the model itself is misspecified.

It is worth pausing here to consider the implications of alternative models of risk and return. We need not specify the exact form of the alternative model to draw an important conclusion. If the underlying model of capital market equilibrium itself is incorrect, then simply using a more comprehensive market index will not eliminate the bias inherent in conventional measures of investment risk. In order to derive unbiased estimates of risk, hence of the cost of capital, we need to identify the correct model. This is why understanding the underlying structure of market risk and return is important.

A rather general alternative to the CAPM is a multi-factor model of security returns. The idea is that a complete model of risk and return might very well involve two or more factors. The CAPM, in contrast, is a one-factor model, where that one factor is "the market."* Evidence for the hypothesis that the underlying model may involve more than one factor can also be developed with our data.

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*Equivalently, the CAPM permits many factors that are perfectly correlated, so that all systematic risk is captured by movements in "the market."

The logic of the following empirical tests can be demonstrated with the aid of a basic result from portfolio theory. We can decompose the market portfolio, or any other portfolio, into two or more component portfolios. The relationship between the orginal portfolio and the component portfolios can be summarized as follows:

$$R_m = w_1R_1 + w_2R_2$$

where w_1 and w_2 are the market value shares of the original portfolio represented by its two components. Thus the regression model

$$r_u = \alpha_u + \beta_u R_m + \varepsilon$$

can be thought of as

$$r_u = \alpha_u + \beta_u(w_1R_1 + w_2R_2) + \varepsilon$$

We can interpret the first component as "stocks" and the second component as "other assets." If the CAPM is the correct model, then the beta regression coefficients from the following model should be equal (not significantly different):

$$r_u = \alpha_u + \beta_1 w_1 R_1 + \beta_2 w_2 R_2 + \varepsilon$$

To apply this procedure to the electric utility industry portfolio, we split the augmented market index into two parts, stocks and other assets, where each part is weighted by its respective share of index value. Then we form the following regression model:

$$(r_u - r_b) = \alpha_u + \beta_s w_s(r_s - r_b) + \beta_o w_o(r_o - r_b) + \varepsilon$$

This model is identical to the previous two-variable regressions except that the two market indexes are weighted. The results of these regressions are reported in Table 2-4.

Both beta coefficients from these regressions are larger than the corresponding coefficients from the previous two-variable regressions. This is to be expected

Table 2-4

ELECTRIC UTILITY INDUSTRY
BETAS FOR COMMON STOCKS AND OTHER ASSETS

Years	Common Stocks Beta	Common Stocks t-statistic	Other Assets Beta	Other Assets t-statistic	F-Sign. Level for $\beta s=\beta o$ Test[a]
1962-1966	1.39	12.00	4.48	5.33	.0007
1963-1967	1.06	5.78	2.68	3.52	.0603
1964-1968	1.04	5.32	2.22	3.05	.1442
1965-1969	1.05	5.70	2.07	3.07	.1737
1966-1970	1.23	6.86	2.12	3.48	.2076
1967-1971	1.13	5.84	1.59	2.69	.5061
1968-1972	1.17	5.67	1.79	2.79	.4116
1969-1973	1.28	6.55	1.93	3.17	.3600
1970-1974	1.06	5.36	2.31	3.66	.1008
1971-1975	1.05	4.60	2.68	4.31	.0332
1972-1976	1.08	5.21	3.06	5.11	.0076
1973-1977	1.10	5.50	2.77	4.80	.0196
1974-1978	0.77	3.83	3.19	5.36	.0016
1975-1979	0.87	3.72	2.42	4.67	.0249
1976-1980	0.40	2.68	2.11	8.97	.0001
1977-1981	0.22	1.41	1.69	8.27	.0001

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[a]This column shows the probability that a difference as large as that observed between β_s and β_o could have occurred by chance. Since the periods overlap, successive values of this probability are not independent of one another.

Source: Charles River Associates, 1982.

since the returns are weighted by values that lie between zero and one.* The t-statistics are very similar to those obtained in the previous regressions, which is also not surprising since the weighted variables are not very different from the unweighted values.

The most important result is that the test of equality of the two coefficients in one half of the sample periods shows that the two coefficients are significantly different from one another at the 5 percent significance level.** This result indicates that our augmented model is still misspecified. Hypotheses that explain this finding include: (1) there still are other "missing" assets that need to be added to our augmented index; and (2) more than one factor underlies equity returns.#

EVIDENCE FROM OTHER INDUSTRY GROUPS

In order to validate our results, we applied these statistical tests to portfolios of common stocks from five additional industry groups.## Two of these are

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* The sum of the two weights is always equal to one.

**Since these tests are for overlapping periods, they are not independent of one another. However, the table readily shows that non-overlapping test periods in the 1970s and 1980s consistently indicate significant differences between β_S and β_O. The autocorrelation in the beta values themselves is similarly due in part to the overlapping periods.

#A third explanation is that our weights are seriously wrong. Since performing these tests, we have had some second thoughts about including Treasury bills in our portfolio of other risky assets. Longer-maturity bills have some risk (from fluctuating interest rates), but the shortest-maturity bills should probably be excluded. However, we doubt that making this change would seriously affect our results. Exploring alternative definitions of "other assets" would be a useful topic for future research.

##Construction of these portfolios is described in Appendix B.

regulated industries and three are unregulated. The results we expect based on our working hypothesis depend on whether the industry is or is not subject to traditional rate-of-return regulation. For industries that are subject to rate-of-return regulation, we expect that, like electric utilities, returns are sensitive to returns on other assets. We also expect that measures of risk (beta) based on the augmented market index will be higher than risk measures based on a stock index. For unregulated industries, we do not expect to find strong, consistent relationships between stock returns and returns on other assets. Risk measures based on the augmented market index are expected to be sometimes higher and sometimes lower than the stock market index shows.

The empirical results for the validation industry groups are consistent with our working hypotheses. For unregulated industry groups, the two-variable regression models show that "other assets" are not statistically significant in explaining stock returns.*,** For gas distribution and operating telephone stocks, the other

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*The other-assets beta for computers is always negative, significantly so in the early years. We can offer two heuristic explanations for this. First, throughout the sample period the computer industry was marked by substantial growth opportunities, which can be thought of as options to invest in valuable projects. The value of a call option is an increasing function of the interest rate, so the growth character of the computer industry may explain the negative correlation between computer stocks and the bond market. Alternatively, the observed beta may simply be spurious. That is, the industry did very well during a period in which the bond market happened to take a beating.

**One reason we might expect to find negative betas on other assets is that most corporations are leveraged by debt financing. Since an increase in the interest rate leads to a decline in the value of bonds, conservation of value implies that stockholders should receive a windfall. In fact, however, computer firms are not heavily leveraged. (IBM, the largest firm in the computer portfolio, had no debt outstanding for many years.) Moreover, the petroleum refining industry, which has a relatively high degree of financial leverage, does not have consistently negative other-asset betas. Note that this is consistent with the more general observation that the stock market, contrary to expectation, was not an inflation hedge during the past decade.

regulated industry groups, other assets are always statistically significant. Numerical results are reported in Tables 2-5 to 2-9.*

As shown in Tables 2-10 to 2-14, adjusted beta values are sometimes higher and sometimes lower than conventional beta values for unregulated industry groups. Petroleum refining and pharmaceuticals showed no clear distinction between conventional and adjusted beta values. In the computer industry, adjusted beta values were consistently lower than conventional betas. Gas distribution and operating telephone stocks, on the other hand, have consistently higher estimates of beta, consistent with electric utilities.

These results are as we would expect; using the augmented market index some betas are higher and some are lower. We know that whatever index we use, the mean beta value is equal to unity. Again, this follows from the definition of beta and the market portfolio. Since the beta of every market index measured with respect to itself is unity, the weighted average beta of the assets comprising the market index is unity.** What is striking about our results, however, is that the regulated industries' betas are <u>consistently</u> higher when other assets are considered. Conventionally calculated betas are plainly inappropriate risk measures for rate-regulated industries. On the other hand, the lack of explanatory power of fixed income securities for returns in the unregulated industry groups suggests why the missing assets problem has not been found to be significant in previous studies of security prices: bond returns simply do not matter for most stocks.

Finally, we replicate for the five comparison industries the formal test (see Table 2-4) of whether <u>this</u> augmented index is consistent with the existence of a one-factor model of asset pricing, such as the CAPM. The results (summarized for all five industries in Table 2-15) are revealing. Gas utilities' and telephone companies' betas for the two components of the augmented market are generally <u>not</u>

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*For convenience, the remaining tables are grouped at the end of this section.

**An issue that we have not explored is whether one would find <u>any</u> uniform pattern in (β_{ja}/β_{sa}) for unregulated companies -- such as may be present for computers -- if rate-regulated industries were first excluded from the stock market index.

significantly different from one another, while the unregulated industries' betas for these two components generally are significantly different from one another. (Again, the overlapping periods imply these tests are not independent.)

The basis of these results is readily seen in Tables 2-5 to 2-9: the three unregulated industries' betas for other assets are usually indistinguishable from zero, while their stock betas are highly significant. The two regulated industries' betas for both stocks and other assets are generally significant and (as indicated in Table 2-5) not significantly different from one another once the market-value weights are applied to the stock and other asset return indexes.

IMPLICATIONS OF THE RESULTS

A pattern emerges from these findings. Regulated industries' returns are sensitive to returns on fixed-income assets, especially for electric utilities,* while unregulated industries' returns are not. This is consistent with a multi-factor model of asset pricing, with stocks and fixed-income assets serving as proxies for two factors in our empirical results.**

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*The greater sensitivity of electric utilities is not unexpected, in part because this industry has been more constrained by regulation during the sample period than the other two. Electric costs have grown faster than inflation, because of oil price shocks and changes (often retroactive) in environmental and safety standards, which has placed extra pressure on regulatory commissions to hold electric rates down. (Natural gas prices were held well below market level by regulation during the period, while rapid technological change helped hold down telecommunications costs.) Also, electric utilities are more capital intensive than the other two regulated industries, so the effect of capital cost increases on electric rates (and hence on regulatory commissions' actions) is larger.

**We also suspect that this finding is important for the "dividend controversy," a debate in finance over whether high-dividend stocks offer too high a return on a risk-adjusted basis. Since regulated companies are a high fraction of the market value of high-dividend stocks, the systematic underestimation of their betas may significantly bias empirical tests of the dividend controversy.

It is natural to ask whether use of an adjusted utility beta (of the sort calculated in Table 2-3) with the estimated stock market risk premium is an acceptable empirical procedure if a multi-factor model in fact exists. Our answer is a tentative yes, at least under some assumptions. The chief requirement would seem to be that the empirical estimate of the risk premium on the stock market be a consistent estimate of the risk premium on a "stock market" risk factor that is orthogonal to a "fixed-income security" risk factor.*

Given the present results, this requirement might be better met if a risk premium on a stock index excluding rate-regulated stocks (e.g., the S&P 400) were used instead of the usual stock market risk premium estimated on the S&P 500. Note also that the estimated risk premium on the S&P 400 seems likely to be higher than the S&P 500 risk premium, which implies that multiplying an adjusted utility beta from Table 2-3 times the usual stock market risk premium may still understate the true utility risk premium. In any case, use of the adjusted utility betas with the usual estimates of the stock market risk premium is at least consistent with our results under some assumptions, which is more than can be said for use of conventional betas estimated on a stock index alone.**

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*Suppose a two-factor model exists, with the orthogonal factors "stock effects" (subscript s) and "fixed-income asset effects" (subscript o). If $P_j \equiv E_j - R$ is the risk premium on portfolio j, (2-1) becomes $P_j = \beta_{js}P_s + \beta_{jo}P_o$. Let P_j' indicate the risk premium on an empirically observable portfolio, and estimate β_{ja}, the beta on an augmented market, and β_{sa} using a weighted average of stock and other asset portfolios, as in Table 2-3. If an acceptable approximation during the sample period is that $E(P_j')/E(P_s') \equiv \beta_{ja}[wP_s'+(1-w)P_o']/\beta_{sa}[wP_s'+(1-w)P_o'] \simeq P_j/P_s$, then $X_j \equiv (\beta_{ja}/\beta_{sa}) \simeq \{(\beta_{js}P_s+\beta_{jo}P_o)/[wP_s'+(1-w)P_o']\}/\{(\beta_{ss}P_s+\beta_{so}P_o)/[wP_s'+(1-w)P_o']\} = [(\beta_{js}P_s+\beta_{jo}P_o)/(\beta_{ss}P_s+\beta_{so}P_o)] = P_j/P_s$ (since $[\beta_{ss}P_s+\beta_{so}P_o] = [(1)(P_s)+(0)P_o)] = P_s$). Then $X_jP_s' = P_j(P_s'/P_s)$. This equals P_j, the desired quantity, if $P_s' = P_s$. Another requirement for this approximation to work is that the weight, w, be close to correct (consider what happens if w=0, for example).

**An alternative would be to estimate the risk premium on the augmented market directly and use the unadjusted augmented market beta with this risk premium.

CONCLUSION

The principal conclusions of this study are as follows:

- Utility stock returns are very sensitive to the bond market. This relationship is due not to transient macroeconomic conditions, such as high inflation rates or Federal Reserve monetary policy, but is the result of a fundamental similarity between utility stock returns and bond returns.

- As a consequence of the relationship between utility stocks and the bond market, conventional methods of measuring risk yield biased estimates when applied to electric utility stocks. Specifically, conventional methods underestimate the beta risk measure of utility stocks.

- The evidence also suggests that utility stock returns are generated by a more complicated process than the Capital Asset Pricing Model, even when our augmented market index is used. A multi-factor model may provide a better explanation of utility stock returns. In other words, accurate risk measurement may require a different model of capital markets, not just a better market index.

- Overall, the finding that conventional risk measures are biased for electric utility stocks implies that discount rates based on those risk measures are too low. For example, with the usual stock market risk premium estimates of 8 to 9 percent, Table 2-3 implies that data for the five years ending in 1981 would lead to conventional CAPM estimates of the cost of equity that are about 3 percentage points too low for electric utilities.* The wrong discount rates are likely to lead to suboptimal investment decisions in the utility industry.

The new estimates of electric utility risk presented in this report represent a significant improvement over estimates derived from conventional methods. Further improvements in risk measurement, and hence in measurement of the cost of capital, require progress towards specifying the underlying structure of stock returns. CRA has explored more elaborate tests along these lines in Phase II of this project for EPRI, with mixed results. A report on this work is in progress.

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*For most of the periods examined, the implied CAPM discount rates are about 0.5 percentage points too low, but a major change seems to have occurred in 1979 or 1980.

Table 2-5

GAS DISTRIBUTION INDUSTRY
ESTIMATED BETAS FOR COMMON STOCKS AND OTHER ASSETS
(Unweighted)

Years	Common Stocks		Other Assets	
	Beta	t-statistic[a]	Beta	t-statistic[a]
1962-1966	0.54	7.34	0.91	2.61
1963-1967	0.61	4.96	1.16	3.30
1964-1968	0.66	5.25	0.68	2.21
1965-1969	0.65	5.78	0.56	2.18
1966-1970	0.62	6.14	0.71	3.15
1967-1971	0.58	5.58	0.45	2.07
1968-1972	0.54	5.61	0.35	1.72
1969-1973	0.56	6.58	0.53	2.85
1970-1974	0.50	5.16	0.66	2.68
1971-1975	0.52	5.01	0.63	2.35
1972-1976	0.51	5.14	0.98	3.43
1973-1977	0.52	4.96	0.90	3.00
1974-1978	0.44	3.93	0.97	2.86
1975-1979	0.52	4.81	0.83	3.13
1976-1980	0.75	7.23	0.54	3.07
1977-1981	0.81	6.76	0.29	1.81

[a]Since overlapping periods are used, successive values of these t-statistics are not independent of one another.

Source: Charles River Associates, 1982.

Table 2-6

TELEPHONE INDUSTRY
ESTIMATED BETAS FOR COMMON STOCKS AND OTHER ASSETS
(unweighted)

Years	Common Stocks: Beta	Common Stocks: t-Statistic[a]	Other Assets: Beta	Other Assets: t-Statistic[a]
1962-1966	0.76	8.60	0.48	1.15
1963-1967	0.62	5.28	0.39	1.17
1964-1968	0.47	4.13	0.63	2.24
1965-1969	0.48	4.81	0.66	2.86
1966-1970	0.46	5.25	0.63	3.22
1967-1971	0.40	4.66	0.67	3.69
1968-1972	0.42	4.51	0.78	3.99
1969-1973	0.51	6.19	0.66	3.72
1970-1974	0.40	4.71	0.67	3.12
1971-1975	0.46	5.11	0.72	3.09
1972-1976	0.48	5.12	0.76	2.84
1973-1977	0.47	5.42	0.62	2.49
1974-1978	0.38	4.18	0.82	2.92
1975-1979	0.42	4.45	0.87	3.78
1976-1980	0.24	2.35	0.73	4.31
1977-1981	0.17	1.45	0.53	3.43

[a]Since overlapping periods are used, successive values of these t-statistics are not independent of one another.

Source: Charles River Associates, 1983.

Table 2-7

PETROLEUM REFINING INDUSTRY
ESTIMATED BETAS FOR COMMON STOCKS AND OTHER ASSETS
(Unweighted)

Years	Common Stocks Beta	Common Stocks t-statistic[a]	Other Assets Beta	Other Assets t-statistic[a]
1962-1966	0.77	9.88	0.59	1.59
1963-1967	0.77	7.55	0.26	0.87
1964-1968	0.67	6.81	0.48	2.02
1965-1969	0.86	7.55	0.17	0.64
1966-1970	0.92	8.01	0.04	0.15
1967-1971	0.94	8.45	-0.26	-1.12
1968-1972	1.01	7.90	-0.23	-0.86
1969-1973	1.03	7.91	-0.32	-1.12
1970-1974	0.95	8.37	-0.08	-1.12
1971-1975	0.81	7.09	0.03	0.11
1972-1976	0.76	6.47	0.36	1.07
1973-1977	0.76	6.85	0.22	0.69
1974-1978	0.81	7.34	0.20	0.60
1975-1979	0.82	7.13	-0.38	-1.35
1976-1980	1.22	9.78	-0.56	-2.70
1977-1981	1.37	9.52	-0.35	-1.83

[a]Since overlapping periods are used, successive values of these t-statistics are not independent of one another.

Source: Charles River Associates, 1982.

Table 2-8

PHARMACEUTICALS INDUSTRY
ESTIMATED BETAS FOR COMMON STOCKS AND OTHER ASSETS
(Unweighted)

	Common Stocks		Other Assets	
Years	Beta	t-statistic[a]	Beta	t-statistic[a]
1962-1966	1.31	12.38	-0.56	-1.12
1963-1967	1.10	9.42	-0.27	-0.81
1964-1968	1.16	11.17	-0.39	-1.52
1965-1969	1.10	11.28	-0.29	-1.30
1966-1970	1.00	10.45	-0.22	-1.03
1967-1971	0.95	11.04	-0.11	-0.59
1968-1972	0.92	9.46	-0.11	-0.53
1969-1973	0.83	8.30	-0.10	-0.47
1970-1974	1.07	9.99	0.16	0.59
1971-1975	1.11	8.47	0.06	0.18
1972-1976	1.13	7.79	-0.11	-0.26
1973-1977	1.15	7.92	-0.04	-0.10
1974-1978	1.18	7.74	0.00	0.01
1975-1979	1.09	6.88	-0.48	-1.24
1976-1980	0.82	6.82	0.19	0.93
1977-1981	0.77	7.20	0.19	1.35

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[a]Since overlapping periods are used, successive values of these t-statistics are not independent of one another.

Source: Charles River Associates, 1982.

Table 2-9

ELECTRONIC COMPUTER INDUSTRY
ESTIMATED BETAS FOR COMMON STOCKS AND OTHER ASSETS
(Unweighted)

Years	Common Stocks		Other Assets	
	Beta	t-statistic[a]	Beta	t-statistic[a]
1962-1966	1.53	12.29	-1.90	-3.23
1963-1967	1.34	8.40	-2.05	-4.46
1964-1968	1.21	7.51	-1.35	-3.42
1965-1969	1.07	7.17	-0.68	-1.96
1966-1970	1.14	8.20	-0.81	-2.62
1967-1971	1.16	8.99	-0.52	-1.94
1968-1972	1.10	8.71	-0.26	-0.96
1969-1973	0.86	5.85	-0.15	-0.47
1970-1974	1.03	8.40	-0.34	-1.11
1971-1975	1.02	8.19	-0.12	-0.36
1972-1976	1.05	8.53	-0.29	-0.82
1973-1977	1.04	8.62	-0.25	-0.72
1974-1978	1.18	11.49	-0.42	-1.33
1975-1979	1.06	8.40	0.01	0.05
1976-1980	1.02	9.53	-0.14	-0.79
1977-1981	0.91	7.92	-0.13	-0.87

[a]Since overlapping periods are used, successive values of these t-statistics are not independent of one another.

Source: Charles River Associates, 1982.

Table 2-10

GAS DISTRIBUTION INDUSTRY
ALTERNATIVE BETA ESTIMATES

Years	(1) Gas Distribution Beta on Augmented Index	(2) S & P Beta on Augmented Index	(3) Adjusted Gas Distribution Beta[a]	(4) Original Gas Distribution Beta (S & P)
1962-1966	0.98	1.63	0.60	0.57
1963-1967	1.25	1.50	0.83	0.75
1964-1968	1.16	1.47	0.79	0.72
1965-1969	1.09	1.44	0.76	0.71
1966-1970	1.14	1.40	0.81	0.75
1967-1971	0.99	1.39	0.71	0.66
1968-1972	0.89	1.39	0.64	0.60
1969-1973	1.00	1.41	0.71	0.65
1970-1974	1.01	1.47	0.69	0.63
1971-1975	1.06	1.56	0.68	0.62
1972-1976	1.20	1.60	0.75	0.67
1973-1977	1.19	1.59	0.75	0.67
1974-1978	1.09	1.60	0.68	0.62
1975-1979	1.22	1.54	0.80	0.71
1976-1980	1.35	1.36	0.99	0.84
1977-1981	1.20	1.20	1.00	0.89

[a]Column (1) divided by Column (2)

Source: Charles River Associates, 1982.

Table 2-11

TELEPHONE INDUSTRY ALTERNATIVE BETA ESTIMATES

Years	(1) Telephone Beta on Augmented Index	(2) S&P Beta on Augmented Index	(3) Adjusted Telephone Beta[a]	(4) Original Telephone Beta
1962-1966	1.29	1.63	0.79	0.77
1963-1967	1.05	1.50	0.70	0.67
1964-1968	0.87	1.47	0.59	0.53
1965-1969	0.89	1.44	0.61	0.55
1966-1970	0.89	1.40	0.64	0.58
1967-1971	0.84	1.39	0.61	0.53
1968-1972	0.91	1.39	0.65	0.57
1969-1973	0.98	1.41	0.70	0.62
1970-1974	0.87	1.47	0.59	0.53
1971-1975	0.99	1.56	0.64	0.58
1972-1976	1.04	1.60	0.65	0.60
1973-1977	0.99	1.59	0.62	0.58
1974-1978	0.93	1.60	0.58	0.54
1975-1979	1.07	1.54	0.70	0.61
1976-1980	0.79	1.36	0.58	0.35
1977-1981	0.63	1.20	0.53	0.30

[a]Column (1) divided by column (2).

Source: Charles River Associates, 1983.

Table 2-12

PETROLEUM REFINING INDUSTRY
ALTERNATIVE BETA ESTIMATES

Years	(1) Petroleum Refining Beta on Augmented Index	(2) S & P Beta on Augmented Index	(3) Adjusted Petroleum Refining Beta[a]	(4) Original Petroleum Refining Beta (S & P)
1962-1966	1.32	1.63	0.81	0.79
1963-1967	1.23	1.50	0.82	0.80
1964-1968	1.12	1.47	0.76	0.71
1965-1969	1.31	1.44	0.91	0.88
1966-1970	1.31	1.40	0.94	0.93
1967-1971	1.20	1.39	0.86	0.89
1968-1972	1.31	1.39	0.93	0.96
1969-1973	1.32	1.41	0.94	0.97
1970-1974	1.37	1.47	0.93	0.94
1971-1975	1.30	1.56	0.84	0.82
1972-1976	1.38	1.60	0.86	0.82
1973-1977	1.31	1.59	0.82	0.80
1974-1978	1.39	1.60	0.87	0.84
1975-1979	1.10	1.54	0.71	0.74
1976-1980	1.28	1.36	0.94	1.13
1977-1981	1.34	1.20	1.12	1.28

[a]Column (1) divided by Column (2)

Source: Charles River Associates, 1982.

Table 2-13

PHARMACEUTICAL INDUSTRY
ALTERNATIVE BETA ESTIMATES

Years	(1) Pharma-ceutical Beta on Augmented Index	(2) S & P Beta on Augmented Index	(3) Adjusted Pharma-ceutical Beta[a]	(4) Original Pharma-ceutical Beta (S & P)
1962-1966	2.08	1.63	1.27	1.29
1963-1967	1.57	1.50	1.05	1.07
1964-1968	1.60	1.47	1.09	1.12
1965-1969	1.50	1.44	1.04	1.07
1966-1970	1.31	1.40	0.94	0.96
1967-1971	1.28	1.39	0.92	0.93
1968-1972	1.24	1.39	0.89	0.90
1969-1973	1.13	1.41	0.80	0.81
1970-1974	1.63	1.47	1.11	1.11
1971-1975	1.76	1.56	1.13	1.12
1972-1976	1.77	1.60	1.11	1.12
1973-1977	1.82	1.59	1.14	1.14
1974-1978	1.91	1.60	1.19	1.18
1975-1979	1.45	1.54	0.94	0.99
1976-1980	1.24	1.36	0.92	0.85
1977-1981	1.09	1.20	0.91	0.82

[a]Column (1) divided by Column (2)

Source: Charles River Associates, 1982.

Table 2-14

ELECTRONIC COMPUTER INDUSTRY
ALTERNATIVE BETA ESTIMATES

Years	(1) Electronic Computer Beta on Augmented Index	(2) S & P Beta on Augmented Index	(3) Adjusted Electronic Computer Beta[a]	(4) Original Electronic Computer Beta (S & P)
1962-1966	2.30	1.63	1.41	1.47
1963-1967	1.39	1.50	0.93	1.08
1964-1968	1.39	1.47	0.95	1.08
1965-1969	1.33	1.44	0.92	1.00
1966-1970	1.27	1.40	0.91	0.99
1967-1971	1.38	1.39	0.99	1.06
1968-1972	1.42	1.39	1.02	1.06
1969-1973	1.15	1.41	0.82	0.84
1970-1974	1.37	1.47	0.93	0.97
1971-1975	1.52	1.56	0.98	1.00
1972-1976	1.54	1.60	0.96	1.00
1973-1977	1.54	1.59	0.97	1.00
1974-1978	1.73	1.60	1.08	1.10
1975-1979	1.64	1.54	1.07	1.07
1976-1980	1.29	1.36	0.95	0.99
1977-1981	0.98	1.20	0.82	0.88

[a]Column (1) divided by Column (2)

Source: Charles River Associates, 1982.

Table 2-15

SIGNIFICANCE LEVELS OF F TESTS FOR $\beta_S = \beta_O$
FOR COMPARISON INDUSTRIES[a]
(Weighted)

Years	Petroleum Refining	Pharmaceu-ticals	Computers	Gas Distribution	Telephones
1962-1966	.9818	.0047	.0001	.1710	.7701
1963-1967	.2958	.0067	.0001	.0661	.7548
1964-1968	.9356	.0001	.0001	.4178	.3617
1965-1969	.1780	.0002	.0005	.5166	.1945
1966-1970	.0533	.0009	.0001	.1991	.1706
1967-1971	.0010	.0010	.0001	.8437	.0645
1968-1972	.0041	.0041	.0031	.8881	.0257
1969-1973	.0018	.0098	.0536	.5968	.1203
1970-1974	.0287	.1088	.0045	.4089	.1748
1971-1975	.0463	.0271	.0382	.4424	.1712
1972-1976	.2727	.0263	.0233	.1270	.2154
1973-1977	.1462	.0297	.0241	.2273	.3548
1974-1978	.0691	.0191	.0004	.1767	.1306
1975-1979	.0005	.0015	.0138	.3857	.1067
1976-1980	.0001	.0083	.0001	.2772	.0504
1977-1981	.0001	.0030	.0001	.0304	.1321

[a]This table shows the probability that a difference as large as that observed between β_S and β_O for the weighted return regressions (not shown above) could have occurred by chance. Since the periods overlap, successive values of this probability are not independent of one another.

Source: Charles River Associates, 1983.

Appendix A

AN AUGMENTED MARKET INDEX

This appendix describes a market index used in this report to investigate electric utility equity risk. The index serves as a proxy for the market portfolio, which plays a central role in capital market theory. While most empirical studies use an index of common stocks for this purpose, the present study develops an augmented market index that includes corporate bonds and government securities as well as common stocks. Although this index is not exhaustive, it is substantially broader than an index comprised solely of common stocks.

THE MARKET PORTFOLIO

The purpose of the market index is to serve as a proxy for the "market portfolio." The market portfolio, a theoretical construct, consists of all of the assets in the economy. In the context of mean-variance capital asset pricing theory, the market portfolio represents a fully diversified holding of investments. It is, therefore, the standard by which the systematic risk of an asset is properly measured.

When one refers to the "market portfolio," one generally does not literally mean <u>the</u> market portfolio, but a replica of that portfolio. A replica of the market consists of a share of each asset in proportion to its market value. Such a portfolio is identical in composition to the "true" market portfolio, but differs by a scale factor. Because its composition is identical, this replica yields the same rate of return, or return per dollar invested, as the true market.

Composition of the Market Portfolio

Among other things, aggregate wealth includes corporate securities, government bonds, commodities, and real estate. If one were to construct a comprehensive market index, one might begin with the classification of assets presented in Table A-1. Care would have to be taken to avoid double-counting assets since, for example, corporations own real estate and commodities.

Some Market Indexes

Most empirical work on capital asset pricing uses an index of common stocks as a proxy for the market portfolio. This practice is due in part to the fact that stock price data are easy to obtain while prices of other classes of assets often are not. Furthermore, although common stocks in the aggregate represent only a fraction of total wealth, the stock market is the major locus of risk-bearing in the economy. For example, common stock returns were the most volatile of major classes of assets studied by Ibbotson and Siegel (12).*

Empirical research on capital asset pricing has typically used an index of common stocks as a proxy for the market portfolio. Two indexes are used especially often: the Standard & Poor's composite index (S & P) and the New York Stock Exchange index (NYSE). The S & P index consists of the common stocks of 500 of the largest companies traded in the United States, while the NYSE consists of all of the stocks listed on the New York Exchange. In each case the index is a value-weighted average of the underlying stocks. Although the NYSE includes almost all of the stocks in the S & P index plus many others, the S & P stocks represent most of the market value of the NYSE. Returns on the two indexes are highly correlated.

It is not possible to specify the market portfolio with complete accuracy since we cannot identify every asset. Furthermore, many of the assets we can observe are not traded in active markets, so value cannot be ascertained with accuracy. Our objective at present is more modest: we wish to expand the market index to include

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*Gold and silver had a higher volatility than stocks over the period 1960-1980, but they are far more volatile than most metals.

Table A-1

COMPOSITION OF THE MARKET PORTFOLIO

Real Assets	Financial Assets
Incorporated Business	Common Stocks
	Preferred Stocks
Unincorporated Business	Corporate Debt
	Straight Bonds
Commodities	Convertible Bonds
Gold	Commercial Paper
Silver	
	Federal Government Securities
Real Estate	Bonds
Residential	Notes
Commercial	Treasury Bills
Farm	Agency Bonds
	Savings Bonds
Consumer Durables	
Automobiles	Municipal Bonds
Appliances	State
Furniture	Local
	Authority
Collectibles	
Art	
Stamps	
Antiques	

Source: Charles River Associates, 1982.

assets in addition to common stocks. In particular, we are interested in including fixed-income securities since rate-of-return regulation makes electric utility equity returns similar to returns on such securities.

METHODOLOGY

The augmented market index developed for this report is built around a comprehensive data base of security returns constructed by Ibbotson and Sinquefield (10). Their work includes month-by-month returns on four classes of securities over the period 1926-1981. Market components are: common stocks, corporate bonds, government notes and bonds, and Treasury bills. This allowed us to expand the market index to include four classes of assets.

We wish to compute a time series of returns on the market portfolio (m). Our augmented market index will consist of the four components listed above: common stocks (s), corporate bonds (c), government bonds (g), and Treasury bills (b). The return on this index in period t is:

$$r_{mt} = w_{st}r_{st} + w_{ct}r_{ct} + w_{gt}r_{gt} + w_{bt}r_{bt}$$

where the r's and w's denote component returns and portfolio weights, respectively. Portfolio weights are equal to the proportion of each class of assets represented in the portfolio; for example:

$$w_{st} = M_{st}/(M_{st} + M_{ct} + M_{gt} + M_{bt})$$

where the M's denote the market value of each component of the portfolio and

$$1 = w_{st} + w_{ct} + w_{gt} + w_{bt}$$

Therefore, we need two things: component returns, provided by the Ibbotson and Sinquefield study, and component weights.

COMPONENT WEIGHTS

In order to derive component weights we needed estimates of component market values. Market values were developed on an annual rather than a monthly basis. Although we have monthly returns, the portfolio weights were fixed over each 12-month period beginning with January and ending with December. For example, the 1968 values will be used to weight returns for the 12 months ending December 1969.

The market value of Treasury bills posed no estimation problem. Because of the short maturities of Treasury bills, the face value of bills outstanding is a good estimate of market value. The amount of Treasury bills outstanding is reported in the Federal Reserve Bulletin.

Estimates of the market value of corporate bonds and common stocks were derived following a methodology used by Holland and Myers (13). The value of bonds was estimated by capitalizing net interest paid by non-financial corporations; the yield on Baa corporate bonds was used as the capitalization rate. The value of common stocks was estimated by capitalizing dividends paid by non-financial corporations; dividends were capitalized at the dividend yield on Standard & Poor's composite index.*

We were able to obtain estimates of the market value of government bonds from Robert Stambaugh (17) for the period 1952-1976. This left a five-year gap between 1977 and 1981. We used the following approach. Let M_t denote the market value at time t and let M_{t-1} denote the market value in the previous period. Then the relationship between period values is:

$$M_t = M_{t-1}(1 + r'_t) + N_t - R_t$$

where r'_t denotes the one-period component return, N_t denotes new issues of those assets, and R_t denotes retirements of those assets. The one-period return is the capital appreciation return, not the total return, on component assets; distributions (interest or dividends) are not included.

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*Dividends and net interest paid by non-financial corporations were obtained from the National Income and Product Accounts of the United States (14). Yields on Baa corporate bonds were obtained from Moody's Industrial Manual (15). Dividend yields were taken from Standard & Poor's (16).

The problem is somewhat simplified by the fact that the book value of securities is generally equal to the market value of securities at the time of issue. The book value of securities is also equal to the market value of securities at maturity. So long as securities are not retired prior to maturity, the market value of retirements is equal to the book value of retirements.

The capital gains component of the returns on government bonds is reported in Exhibit B-8 of Ibbotson and Sinquefield. Net new issues of government bonds can be computed by taking the year-to-year difference in book values of marketable government bonds and notes outstanding. The latter is reported in the Federal Reserve Bulletin. Thus, we are able to find weights for government bonds. Using this procedure we updated the Stambaugh estimates for the remaining years. Estimated market values are reported in Table A-2.

Clearly, these procedures involve some simplifying assumptions and do not produce a "perfect" set of weights. However, the procedures are at least objective and simple, and we believe that the derived weights are not seriously wrong.

Table A-2

ESTIMATED MARKET VALUES:
COMPONENTS OF AUGMENTED MARKET INDEX

(Billions of Dollars)

Year	Treasury Bills	Common Stocks	Corporate Bonds	Government Bonds
1961	43.4	386.52	82.35	148.2
1962	48.3	331.36	97.56	152.8
1963	51.5	427.63	103.09	151.8
1964	56.5	484.75	112.27	145.9
1965	60.2	581.63	129.48	147.6
1966	64.7	456.58	131.07	147.9
1967	69.9	551.16	134.20	144.4
1968	75.0	662.16	153.53	151.0
1969	80.6	559.77	166.47	135.3
1970	87.9	548.39	198.46	152.0
1971	97.5	578.07	219.57	157.9
1972	103.9	749.06	258.51	163.5
1973	107.8	618.50	297.17	156.0
1974	119.7	392.38	298.21	149.3
1975	157.5	649.51	287.88	195.1
1976	164.0	856.76	321.27	250.2
1977	161.1	865.58	393.77	271.8
1978	161.7	835.23	426.56	274.1
1979	172.6	730.40	407.13	279.6
1980	216.1	940.53	395.64	290.0

Source: Charles River Associates, 1982.

Appendix B

INDUSTRY SAMPLES

The various statistical tests described in this study were performed on common stock portfolios constructed to represent certain industry groups. Portfolios of common stocks were used because our objective was to investigate the risk of specific subsets of common stocks rather than individual common stocks. Individual stock prices and therefore individual stock returns, may respond to information that affects all stocks, to information that affects a subset of stocks, and to information that affects only a single stock. Federal Reserve monetary policy is an example of information that is likely to affect all stock returns. An example of information that would tend to affect only a subset of stocks is an announcement of new emission standards for the automobile industry. Information that is unique to a single company might be the settlement of a major litigation case. We are not interested in returns that are unique to a single stock, but rather in returns that influence a group of stocks, such as electric utilities or pharmaceutical manufacturers. The purpose of using a portfolio of stocks is that unique returns tend to "average out," leaving only returns that are common to a group of stocks.

All of the common stock data employed in this study were obtained from the Center for Research in Security Prices' (CRSP) Monthly Stock Returns file. The Monthly Stock Returns file includes the month-end return, price, and number of shares outstanding, as well as other identifying information, for every stock traded on the New York Stock Exchange. One piece of information provided by CRSP is a Standard Industrial Classification (SIC) code. Industry portfolios were formed by selecting every stock on the Monthly file that was classified by CRSP as belonging to the relevant industry. From these groups of stocks, the final industry samples were chosen by imposing the additional condition that the return series for each stock had to include at least five years of data during the twenty-year sample period (January 1962 to December 1981).*

In the case of the electric utility industry, only stocks for which the return series was complete for the entire 1962-1981 period were included in the industry sample. This more stringent condition was imposed because there were so many electric utility stocks on the Monthly Returns file. CRSP shows that there were 65 stocks classified as electric utilities on the New York Stock Exchange at one time or another during the sample period.

Each of the industry groups is represented by a value-weighted portfolio of the common stocks selected in the manner described above. Stock returns in a value-weighted portfolio receive a weight in proportion to the market value of the common stock outstanding. Thus, larger companies receive a relatively larger weight than do smaller companies. In symbols, the return on the portfolio (r_t) is

$$r_t = w_{1t}r_{it} + w_{2t}r_{2t} + \dots + w_{mt}r_{mt}$$

where the weights (w_{it}) are defined by

$$w_{it} = P_{it-1}N_{it-1}/(\Sigma P_{it-1}N_{it-1})$$

denoting stock price and number of shares outstanding as P_{it} and N_{it} respectively.

---

*American Telephone & Telegraph (AT&T) was omitted from the telephone portfolio because it is so large relative to the remaining telephone companies. All statistical tests reported for the telephone portfolio were applied to AT&T separately, however, which verified that our conclusions were not affected by the exclusion of AT&T.

A complete list of the stocks included in the five industry samples is reported in Tables B-1 through B-6. Summary information for these industry groups is reported below.

Industry Group	SIC Code	Sample Size
Electric Utilities	4911	45
Gas Distribution	4924	13
Telephones	4811	9
Petroleum Refining	2911	29
Pharmaceuticals	2834	26
Electronic Computers	3573	12

Table B-1

ELECTRIC UTILITY INDUSTRY SAMPLE

Company Name
Allegheny Pwr. Sys. Inc.
American Elec. Pwr. Inc.
Atlantic City Elec. Co.
Carolina Pwr. & Lt. Co.
Central & South West Corp.
Cleveland Elec. Illum. Co.
Commonwealth Edison Co.
Consumers Pwr. Co.
Dayton Pwr. & Lt. Co.
Duke Pwr. Co.
Duquesne Lt. Co.
Empire Dist. Elec. Co.
Florida Pwr. & Lt. Co.
Florida Pwr. Corp.
General Pub. Utils. Corp.
Gulf Sts. Utils. Co.
Idaho Pwr. Co.
Illinois Pwr. Co.
Indianapolis Pwr. & Lt. Co.
Interstate Pwr. Co.
Iowa Elec. Lt. & Pwr. Co.
Iowa Ill. Gas & Elec. Co.
Kansas City Pwr. & Lt. Co.
Kansas Gas & Elec. Co.
Louisville Gas & Elec. Co.
Middle South Utils. Inc.
Minnesota Pwr. & Lt. Co.
Montana Dakota Utils. Co.
New England Elec. Sys.
Niagara Mohawk Pwr. Corp.

Company Name
Ohio Edison Co.
Oklahoma Gas & Elec. Co.
Pacific Gas & Elec. Co.
Pennsylvania Pwr. & Lt. Co.
Potomac Elec. Pwr. Co.
Public Svc. Co. Ind. Inc.
Puget Sound Pwr. & Lt. Co.
San Diego Gas & Elec. Co.
South Carolina Elec. & Gas Co.
Southern Calif. Edison Co.
Southern Co.
Southwestern Pub. Svc. Co.
Texas Utils. Co.
Toledo Edison Co.
Utah Pwr. & Lt. Co.

SOURCE: Charles River Associates, 1982.

Table B-2

GAS DISTRIBUTION INDUSTRY SAMPLE

Company Name
Bay St. Gas Co.
Enserch Corp.
Entex Inc.
Equitable Gas Co.
Gas Svc. Co.
Indiana Gas Inc.
Michigan Energy Resources Co.
Minnesota Gas Co.
Nicor Inc.
Pacific Ltg. Corp.
Piedmont Nat. Gas Inc.
Washington Gas Lt. Co.
Wisconsin Pub. Svc. Corp.

Source: Charles River Associates, 1982.

Table B-3

TELEPHONE INDUSTRY SAMPLE

Central Tel. & Utils. Corp.
Cincinnati Bell Inc.
Continental Tel. Corp.
Mid Continent Tel. Corp.
Mountain Sts. Tel. & Teleg. Co.
New England Tel. & Teleg. Co.
Pacific Tel. & Teleg. Co.
Rochester Tel. Corp.
Southern New England Tel. Co.

Source: Charles River Associates, 1983.

Table B-4

PETROLEUM REFINING INDUSTRY SAMPLE

Company Name

Amerada Hess Corp.
Apco Oil Corp.
Ashland Oil Inc.
Atlantic Richfield Co.
Clark Oil & Refining Corp.
Commonwealth Oil Refining Inc.
Exxon Corp.
Getty Oil Co.
Gulf Oil Corp.
Kerr McGee Corp.
Leonard Refineries Inc.
Marathon Oil Co.
Mobil Corp.
Murphy Oil Corp.
OKC Corp.
Phillips Pete. Co.
Quaker St. Oil Refining Corp.
Reserve Oil & Gas Co.
Shamrock Oil & Gas Corp.
Shell Oil Co.
Sinclair Oil Corp.
Standard Oil Co. Calif.
Standard Oil Co. Ind.
Standard Oil Co. Ohio
Sun Inc.
Sunray DX Oil Co.
Tesoro Pete. Corp.
Tidewater Oil Co.
Union Oil Co. Calif.

Source: Charles River Associates, 1982.

Table B-5

PHARMACEUTICALS INDUSTRY SAMPLE

Company Name
Abbott Labs
American Home Prods. Corp.
Baxter Travenol Labs Inc.
Beech Nut Life Savers Inc.
Carter Wallace Inc.
Chesebrough Ponds Inc.
Cooper Labs Inc.
ICN Pharmaceuticals Inc.
Lilly Eli & Co.
Marion Labs Inc.
Miles Labs Inc.
Morton Norwich Prods. Inc. Del.
Parke Davis & Co.
Pfizer Inc.
Plough Inc.
Richardson Merrell Inc.
Robins A. H. Inc.
Rorer Group Inc.
Rucker Co.
Schering Plough Corp.
Searle G. D. & Co.
Smithkline Corp.
Squibb Corp.
Sterling Drug Inc.
Upjohn Co.
Warner Lambert Co.

Source: Charles River Associates, 1982.

Table B-6

ELECTRONIC COMPUTER INDUSTRY SAMPLE

Company Name
Centronics Data Computer Corp.
Control Data Corp. Del.
Data Gen. Corp.
Digital Equip. Corp.
Electronic Assoc. Inc.
International Business Machs.
Litton Inds. Inc.
Mohawk Data Sciences Corp.
Reliance Elec. Co.
Sperry Corp.
Storage Technology Corp.
Wang Labs Inc.

Source: Charles River Associates, 1982.

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EPRI EA-3392

Below are five index cards that allow for filing according to the four cross-references in addition to the title of the report. A brief abstract describing the major subject area covered in the report is included on each card.

EPRI

EPRI EA-3392
RP1920-1-1
Final Report
February 1984

Choice of Discount Rates in Utility Planning: A Critique of Conventional Betas as Risk Indicators for Electric Utilities

Contractor: Charles River Associates Incorporated

Conventional estimates of the financial market risk of utility investments—the basis for discount selection—are low. Utility planners can obtain more accurate information by using an augmented market index in their estimates. 78 pp.

EPRI Project Manager: S. Chapel

Cross-References:
1. EPRI EA-3392
2. RP1920-1-1
3. Energy Resources Program
4. Capital—Cost

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Post Office Box 10412, Palo Alto, CA 94303 415-855-2000

EPRI EA-3392

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September 1, 2023

Trisha Osborne
Assistant Commission Secretary
Public Utilities Commission of Nevada
1150 E. William Street
Carson City, NV 89701

Re: Docket Nos. 23-06007 and 23-06008

Dear Ms. Osborne:

Please find enclosed the Prepared Direct Testimony of Lance D. Kaufman on behalf of Wynn Las Vegas, LLC, Circus Circus Las Vegas, LLC, HR Nevada, LLC, Smart Energy Alliance, Caesars Enterprise Services, LLC, Southern Nevada Water Authority and MGM Resorts International, Inc. in the above-referenced docket.

If you have any questions regarding this filing, please do not hesitate to contact me.

Sincerely,

/s/ Curt R. Ledford
Curt R. Ledford, Esq.
Nevada Bar No. 9101
Davison Van Cleve, P.C.
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Very truly yours,

/s/ Laura K. Granier

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Enclosure

BEFORE THE PUBLIC UTILITIES COMMISSION OF NEVADA

Application of Nevada Power Company d/b/a NV Energy for authority to adjust its annual revenue requirement for general rates charged to all classes of electric customers and for relief properly related thereto.	Docket No. 23-06007
Application of Nevada Power Company d/b/a NV Energy for approval of new and revised depreciation and amortization rates for its electric and common accounts.	Docket No. 23-06008

PREPARED DIRECT TESTIMONY OF LANCE D. KAUFMAN

ON BEHALF OF

WYNN LAS VEGAS, LLC, SMART ENERGY ALLIANCE,

CIRCUS CIRCUS LAS VEGAS, LLC, HR NEVADA, LLC,

MGM RESORTS INTERNATIONAL, INC.,

CAESARS ENTERPRISE SERVICES, LLC, and

SOUTHERN NEVADA WATER AUTHORITY

September 1, 2023

TABLE OF CONTENTS TO THE PREPARED DIRECT TESTIMONY OF LANCE D. KAUFMAN

EXHIBIT LIST

I. INTRODUCTION AND SUMMARY

Q.1 PLEASE STATE YOUR NAME AND OCCUPATION.

A.1 My name is Lance D. Kaufman. I am a consultant representing utility customers before state public utility commissions in the Northwest, Southwest, and Intermountain West. My witness qualification statement can be found at Exhibit Kaufman-Direct-1.

Q.2 PLEASE IDENTIFY THE PARTY ON WHOSE BEHALF YOU ARE TESTIFYING.

A.2 I am testifying on behalf of the Smart Energy Alliance ("SEA"), Wynn Las Vegas, LLC ("Wynn"), Circus Circus Las Vegas, LLC ("CCLV"), HR Nevada, LLC ("The Mirage"), MGM Resorts International, Inc., ("MGM"), Caesars Enterprise Services, LLC ("Caesars") and Southern Nevada Water Authority ("SNWA"). SEA is a Nevada nonprofit trade association dedicated to advocating for the energy interests of its members. SEA members include large energy users and retail customers of Nevada Power Company ("NPC" or "Company") who will be directly affected by the rates established in this proceeding. Wynn, CCLV, The Mirage, MGM, Caesars, and SNWA are some of the largest energy users in Nevada.

Q.3 WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A.3 I am providing testimony on NPC's cost of capital application.

Q.4 PLEASE SUMMARIZE YOUR RECOMMENDATIONS.

A.4 I make the following recommendations:

- The Commission should adopt (i) a 49.94 percent equity, 50.06 percent debt hypothetical capital structure, (ii) a 9.0 percent cost of equity, and (iii) 4.95 percent cost of debt, and 6.97 percent weighted average cost of capital.

Q.5 HOW DO YOUR RECOMMENDATIONS COMPARE TO CURRENT AND PROPOSED COST OF CAPITAL?

A.5 NPC's current authorized rate of return is 7.14% and NPC has requested this be increased to 7.79% in its certification filing.[1] NPC's requested change increases revenue requirement by $46 million.[2] NPC's request increases its authorized ROE from 9.4% to 10.2%. My analysis shows that rather than an increase, a decrease is warranted for both ROE and NPC's overall rate of return.

Q.6 WHY DO YOU RECOMMEND A COST OF EQUITY OF 9.0 PERCENT?

A.6 This recommendation is based on the application of the Discounted Cash Flow ("DCF") model, the Capital Asset Pricing Model ("CAPM"), and the Empirical CAPM ("ECAPM"). I found that after updating NPC's assumptions to reflect current data and modern finance literature, these models support a reasonable ROE range from 8.5 to 9.5. I recommend 9.0 as the authorized ROE because it is the midpoint of the reasonable range, and because NPC has a similar risk profile as the proxy group.

Q.7 GIVEN CURRENT MARKET CONDITIONS, WHY DO YOU RECOMMEND A DECREASE IN THE COST OF EQUITY?

A.7 The only market conditions that are relevant to evaluating cost of equity are those that are inputs to the ROE estimation models. Outside of these, NPC's arguments about the condition of the market are speculative and irrelevant, in that the arguments are not theoretically or empirically linked to the models used to estimate ROE.

---

[1] Application at 7:11-13.

[2] This change only includes return on rate base and tax impacts. I have not calculated the impact on other revenue sensitive factors.

Rather than modify or weight ROE results based on market expectations, I suggest evaluating ROE results within the context of utility capital accumulation. The primary consideration in determining cost of equity is that it be commensurate with the returns on investments for other firms with similar risks and that it be sufficient to assure the financial integrity of the utility, to maintain credit, and to attract capital.[3] Utility and investor behavior indicate that utilities are accumulating excess capital. This is an indication that current ROEs are too high. I discuss Ms. Bulkley's market analysis and my capital accumulation analysis in more detail in the section of my testimony directly evaluating return on equity.

Q.8 WHAT ARE THE IMPACTS OF YOUR RECOMMENDATIONS ON NPC'S REVENUE REQUIREMENT?

A.8 My recommendations reduce NPC's revenue requirement by $54 million relative to the certification filing.[4] The table below identifies the composition of this change.

Table LK-1: Revenue Requirement Impacts

Parameters	Cost of Capital	Return on Rate Base	Change	Change in Tax Expense	Total Revenue Requirement Reduction
F-Cert	7.88%	$434,352.54			
ROE @ 9%	7.23%	$398,486.20	($35,866)	($4,086)	($39,952)
Cap Structure 50-50	7.05%	$388,706.37	($9,780)	($512)	($10,292)
Cost of Debt	6.97%	$384,298.24	($4,408)		($4,408)
Total			($50,054)	($4,598)	($54,652)

[3] *Federal Power Commission v. Hope Natural Gas Co.*, 320 US 591, 602 (1944).

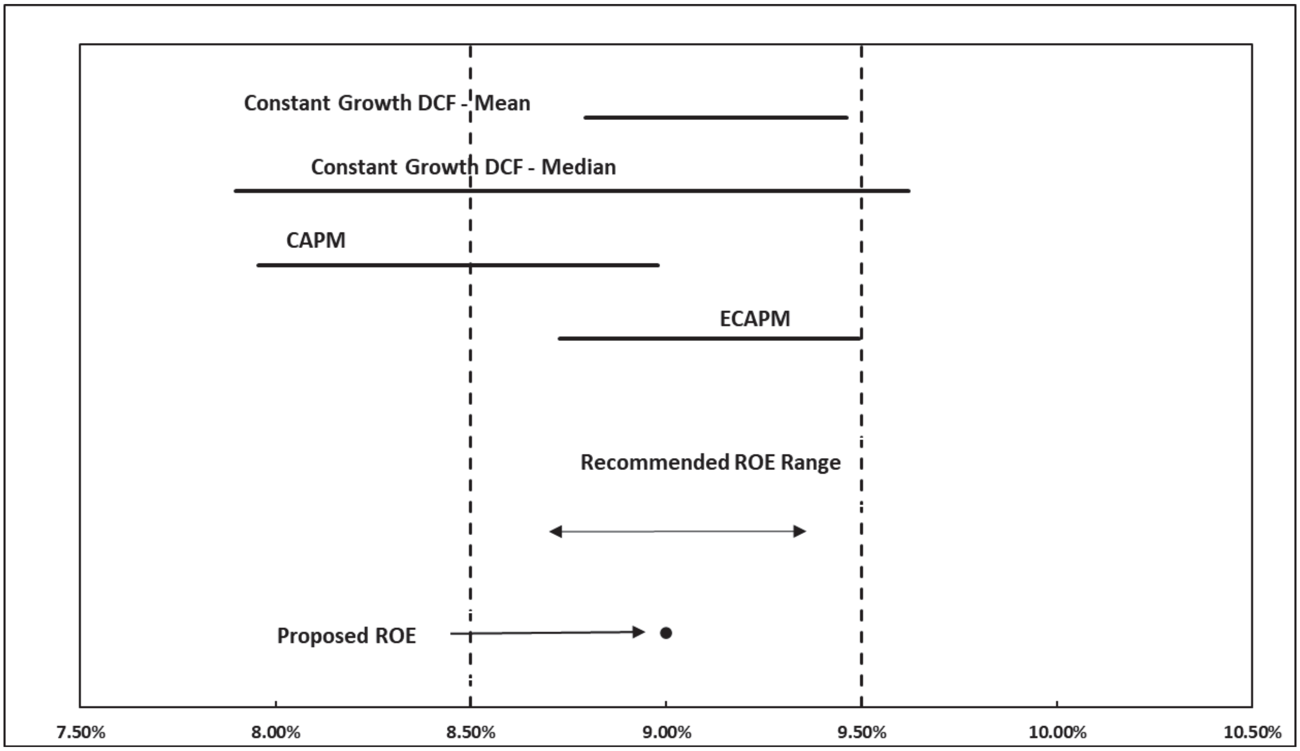
[4] This change is approximate and may not include all revenue sensitive factors.

II. COST OF EQUITY

Q.9 PLEASE SUMMARIZE YOUR COST OF EQUITY TESTIMONY.

A.9 I analyzed NPC's cost of capital using constant growth discounted cash flows models, capital asset pricing models, and empirical capital asset pricing models. These models employ similar methodologies as those found in NPC's direct testimony. However, for each model I update inputs to reflect present market conditions, and I use alternate forecasts of growth rates and model parameters. For each model I examined a range of inputs, and I used this variation to establish that a reasonable range for NPC's ROE is 8.5 percent to 9.5 percent. This range captures one or more variants of each ROE model that I evaluated. I recommend NPC's authorized ROE be set in the midpoint of this range, at 9.0 percent. The figure below provides an update to Bulkley's ROE estimations to illustrate my estimates, recommended range, and recommended ROE.

Figure LK-1: Return on Equity Summary



Q.10 WHAT DRIVES THE DIFFERENCES BETWEEN YOUR ROE RESULTS AND NPC'S?

A.10 The primary difference between NPC's approach to ROE and my approach to ROE is that I focus on the ROE required by the Company to attract capital and I favor data-driven forecasts.

Q.11 HOW DOES YOUR FOCUS ON EXPECTED RETURN DIFFER FROM NPC'S?

A.11 Many of NPC's models focus on what returns analysts expect to realize in the market rather than on what capital investors require as compensation to incentivize them to invest capital in physical assets. NPC's models rely heavily on analyst forecasts from Value Line, Yahoo, and Zachs. The use of analyst forecasts alone is not problematic. However, analyst forecasts have been found to be overly optimistic and statistically biased.[5] NPC combines these forecasts in a manner that filters out a greater share of low forecasts, which exacerbates the bias inherent in analyst forecasts. In addition to filtering out low forecasts, NPC presents "high" scenarios, which presumably represent the potential for market outcomes to exceed expectations.

The optimism inherent in analyst forecasts, and the windfall returns that occur when market returns exceed expectations, do not accurately represent the return that is required by investors to attract equity.

Q.12 AS AN ANALYST YOURSELF, HOW DO YOU AVOID THE RISK OF BIASED ESTIMATES?

A.12 I avoid bias by placing greater weight on data. I also rely on modern finance and forecasting literature to support my methodologies.

Q.13 HOW IS THIS SECTION ORGANIZED?

A.13 I first present the results of the DCF, CAPM, and ECAPM models in sequence. The discussion of each model includes a description of the differences between my method and NPC's method. After presenting the models I provide additional commentary on Ms. Bulkley's ROE testimony.

a. <u>Discounted Cash Flows</u>

Q.14 WHAT ARE THE RESULTS OF YOUR DISCOUNTED CASH FLOW ANALYSIS?

A.14 My discounted cash flow models estimate an ROE range from 7.8 percent to 9.65 percent. The low value results from using the mean ROE estimates across the proxy group and earnings per share growth rates based on historical rates. The maximum value results from using median

[5] Szakmary, Andrew; Conover, C. Mitchell; and Lancaster, Carol, "An Examination of Value Line's Long-term Projection" (2008). *Finance Faculty Publications*. 30. https://scholarship.richmond.edu/finance-faculty-publications/30.

ROE estimates across the proxy group and earnings per share growth rates based on Value Line forecasts.

Q.15 HOW DO YOUR DCF MODELS DIFFER FROM NPC'S DCF MODELS?

A.15 I update prices and dividends to reflect information available as of August 26, 2023. This update modestly increases ROE estimates because dividend yields increased. The primary difference is our treatment of earnings per share ("EPS") growth rate. I modified the "high" scenario to reflect Value Line estimates, I introduced a "low" scenario based on historical earnings per share growth rates, and I used the average of these values to reflect the "mean" estimate.

Table LK-2: Discounted Cash Flow ROE Estimates

Constant Growth DCF ROE Estimate			
	Mean Monte Carlo	Mean	Mean ValueLine
30-Day Average	8.85%	9.24%	9.53%
90-Day Average	8.79%	9.17%	9.46%
180-Day Average	8.73%	9.10%	9.39%
Constant Growth Average	8.79%	9.17%	9.46%
	Median Monte Carlo	Median	Median ValueLine
30-Day Average	7.99%	8.75%	9.65%
90-Day Average	7.90%	8.51%	9.63%
180-Day Average	7.80%	8.44%	9.58%
Constant Growth Average	7.90%	8.57%	9.62%

Q.16 WHY DO YOU TREAT THE VALUE LINE GROWTH FORECAST AS A HIGH FORECAST?

A.16 The Value Line constitutes a high forecast for two reasons. First, the forecast is a five-year growth forecast, not a long-term forecast. It is only appropriate to apply it in a constant growth model if the 5-year growth rate is expected to continue. However, due to the current state of the economy, the near-term growth rates likely exceed the long-term growth rates. Bond yield curves are currently inverted. This is an indication that inflation is expected to decrease over the next five to ten years. In the long term, earnings growth rates are expected to converge to GDP growth rates. Constant growth equal to the Value Line forecast is a high scenario because after the five-year forecast horizon, growth is expected to decrease.

A second reason for treating Value Line estimates as "high" is that financial analysts tend to be optimistic and overestimate growth. Recent academic research finds "that Value Line's long-term stock return projections are extremely overoptimistic and have no predictive power."[6] Constant growth equal to the Value Line forecast is a high scenario because they are overoptimistic forecasts.

Q.17 HOW DO YOU FORECAST EARNINGS PER SHARE GROWTH WITHOUT RELYING ON ANALYST FORECASTS?

A.17 I use historic, 28-year earnings-per-share growth rates of the proxy group to estimate long-term earnings per share growth.[7] For each company in the proxy group, I estimate the geometric mean return using a Monte Carlo simulation.

Q.18 WHY DO YOU USE GEOMETRIC MEAN?

A.18 The geometric mean provides a more accurate estimate of long-term growth, particularly when short-term growth can be both positive and negative. The table below provides a simple illustration of why arithmetic averages are misleading. In this table, $100 is invested over two years. The first year's return is a 50 percent loss, and the second year's return is a 50 percent gain. The arithmetic mean incorrectly represents the two-year return of the portfolio as zero percent, when in fact the investment declined over two years. The use of mean return may be

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[6] Szakmary, Andrew; Conover, C. Mitchell; and Lancaster, Carol, "An Examination of Value Line's Long-term Projection" (2008). *Finance Faculty Publications*. 30. https://scholarship.richmond.edu/finance-faculty-publications/30

[7] The 28-year period represents the full history of data available to me.

appropriate to evaluate expected values for single periods, but it is a biased measure of long run returns.

Table LK-3 Arithmetic and Geometric Mean

Year	Growth	nvestment
1		100
2	-50%	50
3	50%	75
Arithmatic Mean	0%	
Geometric Mean	-13%	

Q.19 WHAT IS THE MONTE CARLO SIMULATION THAT YOU PERFORM.

A.19 The Monte Carlo simulation involves performing repeated sampling in order to determine statistical characteristics of an estimator. I use the following steps for each proxy company:

1. Sample with replacement from historic annual growth of earnings per share.
2. Calculate 20-year geometric mean growth rate from sample.
3. Repeat steps 1 and 2 many times, recording each mean growth rate.[8]
4. Calculate the mean across all growth rates from step 3.

Q.20 HOW DO THE RESULTS OF THE MONTE CARLO FORECAST COMPARE TO THE VALUE LINE EPS FORECAST?

A.20 Generally, EPS growth rates from the Monte Carlo simulation were lower than the corresponding Value Line forecast. The table below summarizes the Monte Carlo results for different historic sampling periods, from the last ten years to the full 28 years available from my data source. All three time periods show mean and median growth rates are lower than the Value Line forecast. I recommend using all years of data to reflect long-term growth expectations. When calculating ROE in the DCF model, I replace negative EPS growth

[8] I conducted 290,000 iterations in this step.

forecasts with zero growth forecasts. While this may bias the mean ROE upwards, it does not affect median results.

Table LK-4: Earnings Per Share Growth Forecasts

Ticker	Monte Carlo Growth Rates by Historic Selection Period: 10-Year	20-Year	All Years	Value Line Growth Rate
AEE	15.1%	5.0%	4.1%	6.5%
AEP	1.7%	16.8%	15.5%	6.0%
ALE	2.5%	-1.3%	1.2%	6.0%
AVA	2.2%	12.4%	-6.6%	3.5%
CMS	5.7%	6.5%	-3.8%	6.5%
DUK	-1.0%	-5.0%	-1.4%	5.0%
ETR	6.6%	7.9%	7.6%	0.5%
EVRG	5.1%	5.1%	5.1%	7.5%
IDA	3.7%	2.2%	3.4%	4.5%
LNT	6.5%	1.4%	1.7%	6.5%
NEE	5.9%	6.5%	6.6%	10.0%
NWE	2.3%	4.2%	4.2%	3.5%
OGE	1.5%	6.1%	3.9%	6.5%
OTTR	19.4%	4.5%	4.9%	4.5%
POR	2.8%	3.4%	3.4%	5.0%
SO	3.0%	3.2%	3.1%	6.5%
XEL	5.7%	4.1%	5.0%	6.0%
Mean	5.2%	4.9%	3.4%	5.6%
Median	3.7%	4.5%	3.9%	6.0%

b. <u>Capital Asset Pricing Model</u>

Q.21 WHAT ARE THE RESULTS OF YOUR CAPITAL ASSET PRICING MODEL ANALYSIS?

A.21 My CAPM models estimate an ROE range from 7.96 percent to 8.98 percent. The low value results from using the regression beta estimates and the mean of the current implied risk premium and the Value Line risk premium.[9] The maximum estimated ROE results from using the Bloomberg Unadjusted beta estimates and NPC's proposed Value Line risk premium estimate. The table below summarizes my estimates.

Table LK-5: CAPM ROE Estimates

CAPM ROE Estimate		
	Regression Beta	Bloomberg Unadjusted Beta
Mean Premium	7.96%	8.98%

Q.22 HOW DO YOUR CAPM MODELS DIFFER FROM NPC'S DCF MODELS?

A.22 I use the risk-free rate to reflect the three-month average 30-year Treasury bond rate. This update increases the risk-free rate from 3.81 percent to 4.03 percent. I also update the estimates of beta for each stock. I estimate beta by performing linear regression on five years of monthly returns. I use S&P 500 as the basis for market returns. I also introduce an alternate measure of the equity risk premium based on modern finance research.

Q.23 HOW DO YOUR ESTIMATES OF BETA DIFFER FROM NPC'S?

A.23 NPC selects beta from Bloomberg and Value Line. Bloomberg reports "adjusted" and "raw" betas. The coefficients used by Ms. Bulkley are likely the "adjusted" betas. Bloomberg's "adjusted" beta "uses the historical data of the stock but assumes that a security's beta moves toward the market average over time. It weights the historic raw beta and the market beta." The weights appear to be 67 percent of the raw beta and 33 percent of the market beta, which is assumed to be 1.

Value Line beta is poorly documented, but it appears to use the New York Stock Exchange Composite Index as the basis for market return. This results in betas that are

[9] Beta is a parameter unique to each stock that represents the relationship between the stock's return and the market return.

inconsistent with NPC's equity risk premium which is estimated based on S&P 500 stocks. Value Line betas appear to be rounded to five percent, and have some form of undisclosed upward adjustment. The table below compares my current beta estimate with that of Zach's. My estimates of beta are generally smaller than the Company's estimates, but more accurately reflect the relationship between utility stock returns and market returns than the Company's adjusted betas.

Table LK-6: Comparison of Betas Estimates

				Bloomberg	
	Regression	Zach's	Value Line	Adjusted	Unadjusted
AEE	0.54	0.43	0.85	0.76	0.64
AEP	0.57	0.45	0.75	0.77	0.65
ALE	0.70	0.72	0.90	0.83	0.75
AVA	0.45	0.49	0.90	0.76	0.64
CMS	0.42	0.36	0.80	0.76	0.64
DUK	0.50	0.43	0.85	0.72	0.59
ETR	0.79	0.64	0.95	0.86	0.79
EVRG	0.58	N/A	0.90	0.79	0.68
IDA	0.57	0.60	0.80	0.80	0.71
LNT	0.61	0.55	0.85	0.80	0.70
NEE	0.57	0.46	0.95	0.82	0.73
NWE	0.47	0.43	0.90	0.86	0.80
OGE	0.72	0.72	1.00	0.93	0.89
OTTR	0.50	0.52	0.85	0.88	0.82
POR	0.51	0.55	0.85	0.79	0.69
SO	0.57	0.50	0.90	0.78	0.67
XEL	0.44	0.41	0.80	0.75	0.63
Average	0.56	0.52	0.87	0.80	0.71

Q.24 IS IT APPROPRIATE TO ADJUST UTILITY BETAS TO THE MARKET AVERAGE?

A.24 No, this adjustment is not appropriate. While it is correct that beta changes over time, adjusting betas for utility stocks towards the market average will overrepresent the risk of the utility industry. It is well known that utility stocks, after addressing diversifiable risk, are less risky than the market, on average. If anything, adjustment should be made to the industry average, not the market average. This position is supported by Nobel Laureate William F. Sharpe:

> Information of the type shown in Table 13-4 [industry average betas] can be used to "adjust" historic beta values. For example, the knowledge that a corporation is in the air transport [*68] industry suggests that a reasonable estimate of the beta value of its stock is greater than 1.0. It thus makes more sense to adjust a historic beta value toward a value above 1.0 than to the average for all stocks.[10]

Furthermore, adjusting betas to an average is unnecessary when using proxy group analysis, as done by myself and Ms. Bulkley. In the context of this case, the "industry" is the group of proxy utilities and moving the beta of individual companies in the group towards the group average would not materially change the results. This is because the ROE that is used to develop the CAPM models ROE ranges are averages already.

Q.25 WHAT HAVE OTHER COMMISSIONS DETERMINED REGARDING THE USE OF ADJUSTED BETAS?

A.25 The Oregon Public Utility Commission ("OPUC") has ruled against adjusting betas to the market average.[11]

Q.26 WHAT IS THE IMPACT OF YOUR LOWER ESTIMATE OF BETA ON ROE?

A.26 All else equal, a lower beta estimate for a company lowers the forecasted return for the company. This reduces the estimation of NPC's required ROE.

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[10] *Investments*, 2d ed., Prentice-Hall, Inc., Englewood Cliffs, 1981, p. 344. As quoted in OPUC Docket Nos. UT 125/UT 80, Order No. 00-191 at ¶ 3, 2000 Ore. PUC LEXIS 401 at *67-*68 (Apr. 14, 2000).

[11] OPUC Docket Nos. UT 125/UT 80, Order No. 00-191, 2000 Ore. PUC LEXIS 401 (Apr. 14, 2000). The use of adjusted betas was disputed in this case. The Commission noted that "Thus, if any adjustment to the raw beta is appropriate, it should be toward the industry average rather than toward a generic average of all stocks."

Q.27 WHY DO YOUR ESTIMATES OF BETA DIFFER FROM NPC'S?

A.27 This is not clear. NPC was unable to provide any workpaper documenting how its betas were derived.

Q.28 ARE YOUR ESTIMATES OF BETA CONSISTENT WITH OTHER FINANCE SOURCES?

A.28 Yes, my estimates are consistent with Yahoo Finance, Zachs, and Stock Analysis.

Q.29 WHAT ESTIMATES ARE AVAILABLE FOR THE EQUITY RISK PREMIUM?

A.29 The table below summarizes estimates for the equity using a variety of methods. The Value Line approach in the first row of the table is the method proposed by NPC. Notice that it is more than 30 to 100 percent higher than the other estimates.

Table LK-7: Recent Equity Risk Premium Estimates

Approach Used	*ERP*	*Additional information*
Valueline (With Assmetric Bounds)	8.31%	S&P Weighted Growth Forecast Between 0 and 20%
Survey: CFOs	4.42%	Campbell and Harvey survey of CFOs (2018); Average estimate. Median was 3.63%.
Survey: Global Fund Managers	4.60%	Merrill Lynch (January 2020) survey of global managers
Historical - US	5.06%	Geometric average - Stocks minus T.Bonds: 1928-2022
Historical - Multiple Equity Markets	5.00%	Average premium across 20 markets from 1900-2022: Dimson, Marsh and Staunton (2022)
Current Implied premium	5.94%	From S&P 500 - January 1, 2023
Average Implied premium (1960-2022)	4.21%	Average of implied equity risk premium
Average Implied premium (2012-2022)	5.37%	Average of implied equity risk premium
Default spread based premium	4.24%	Baa Default Spread on 1/1/23 * Median value of (ERP/ Default Spread)
Survey: Gobal Finance	5.60%	Finance and economics professors, analysts and managers of companies (2023)

Q.30 DO YOU HAVE ANY CONCERNS ABOUT THE VALUE LINE ESTIMATED RISK PREMIUM OTHER THAN ITS ABNORMAL VALUE?

A.30 Yes, this methodology is subject to the same optimism and subsequent bias as the Value Line EPS forecasts used in the DCF models. To illustrate the illogicality of the Value Line forecasts, the 5-year average annual growth for three stocks (Disney, Host Hotels & Resorts, and Fidelity National Information Services) exceed 50 percent per year, but all three of these stocks have declined in value since the forecast was produced.

Q.31 DOES NPC USE THE VALUE LINE FORECASTS DIRECTLY?

A.31 No. Possibly due to the unrealistic nature of the forecasts, NPC implements a 0% floor and 20% ceiling for stocks.[12] Those stocks with forecasts outside this band are excluded from the analysis. As a result, 20 percent of all S&P 500 stocks are excluded from the "S&P Expected Return" calculation. Conditional on using the Value Line forecast, it is reasonable to exclude or otherwise modify the forecasts to account for these abnormalities. However, it is unclear what the basis is for the 20% cap. Alternate caps, such as 10% or 30%, yield risk premiums of 9.57% and 13.47%, respectively.

Q.32 HOW DO YOU MOVE NPC'S EQUITY RISK PREMIUM TOWARDS A DATA-DRIVEN METHODOLOGY?

A.32 I estimate an alternate model that averages NPC's risk premium with the current implied risk premium. The implied risk premium is a forward-looking risk premium based on current market prices, yields, and growth rates. This premium has been shown to be a strong predictor of the actual risk premium.[13] My proposed premium is summarized below.

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[12] Bulkley-Direct at 54.

[13] Damodaran, Aswath, Equity Risk Premiums (ERP): Determinants, Estimation and Implications - The 2023 Edition (March 23, 2023). Available at SSRN: https://ssrn.com/abstract=4398884 or http://dx.doi.org/10.2139/ssrn.4398884

Table LK-8: Average Equity Risk Premium

Approach	ERP
Valueline (With Assmetric Bounds)	8.09%
Current Implied premium (January 1, 2023)	5.94%
Average	7.01%

Q.33 THE AVERAGE THAT YOU PROPOSE REMAINS SIGNIFICANTLY HIGHER THAN THE OTHER RISK PREMIUMS IN TABLE LK-8. CAN YOU PROVIDE MORE DETAIL ON THE VARIOUS METHODS OF ESTIMATING THE EQUITY RISK PREMIUM?

A.33 There are three broad approaches to estimating the equity risk premium:

1) Survey of investors or other experts regarding expectations for future returns;

2) Historical premium of equities over riskless investments; and

3) Forward looking premiums based on current market prices.[14]

Q.34 WHAT DO SURVEYS OF INVESTORS OR OTHER EXPERTS REVEAL ABOUT THE EQUITY RISK PREMIUM?

A.34 Recent survey-based estimates of the equity risk premium are available from institutional investors, corporate management, and academics. The table below summarizes these data.

Table LK-9: Summary of Investor and Finance Professional Surveys

Date	Survey	Estimate
Feb-2007	Merryll Lynch survey of institutional investors[15]	3.5
Mar-2007	Merryll Lynch survey of institutional investors[16]	4.1
2010	Merryll Lynch survey of institutional investors[17]	3.76 to 3.9
Jan-2012	Merryll Lynch survey of institutional investors[18]	4.08
Feb-2014	Merryll Lynch survey of institutional investors[19]	4.6
June 2020	Merryll Lynch survey of institutional investors[20]	2.5

[14] Damodaran, Aswath, Equity Risk Premiums (ERP): Determinants, Estimation, and Implications – The 2022 Edition (March 23, 2022). Available at SSRN: https://ssrn.com/abstract=4066060 or http://dx.doi.org/10.2139/ssrn.4066060.
[15] Global Fund Manager Survey, cited in Damodaran (2022).
[16] Global Fund Manager Survey, cited in Damodaran (2022).
[17] Global Fund Manager Survey, cited in Damodaran (2022).
[18] Global Fund Manager Survey, cited in Damodaran (2022).
[19] Global Fund Manager Survey, cited in Damodaran (2022).
[20] Global Fund Manager Survey, Bank of America Merrill Lynch, January 2022. Cited in Damodaran (2022).

Dec-2017	Graham and Harvey survey of CFOs[21]	3.63
Jan-2016	Graham and Harvey survey of CFOs[22]	3.55
2000 to 2017	Graham and Harvey survey of CFOs[23]	2.42 to 4.56, 3.63 average
2011	Fernandes et al. survey of Academics[24]	5.6
2022	IESE Business School survey of Academics, investors, and executives[25]	5.5
2021	CFA Institute Research Foundation[26]	3 to 6

Market surveys show that the average risk premium required by investors is materially lower than the forecast produced by NPC.

Q.35 WHAT RISK PREMIUM EXISTS IN HISTORIC MARKET DATA?

A.35 The historical risk premium depends on the time period studied, method of averaging, and basis for risk free rate. Damodaran, a widely published and well-respected finance researcher, provides persuasive rationale for using an extended time horizon, geometric averaging, and Treasury bills as the risk-free rate.[27] This results in an equity risk premium of 4.47 to 5.13 percent.[28] Historic risk premiums have an advantage over surveys in that they are market-driven, and thus are not subjective or exposed to other drawbacks of surveys. However, unlike

[21] Graham, J.R. and C.R. Harvey, 2018, *The Equity Risk Premium in 2018*, Working paper, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3151162. Cited in Damodaran (2022).
[22] Graham, J.R. and C.R. Harvey, 2018, *The Equity Risk Premium in 2018*, Working paper, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3151162. Cited in Damodaran (2022).
[23] Graham, J.R. and C.R. Harvey, 2018, *The Equity Risk Premium in 2018*, Working paper, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3151162. Cited in Damodaran (2022).
[24] Fernandez, P., J. Aguirreamalloa and L. Corres, 2011, Equity Premium used in 2011 for the USA by Analysts, Companies and Professors: A Survey, Working Paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1805852&rec=1&srcabs=1822182. Cited in Damodaran (2022).
[25] Fernandez, Pablo and García de Santos, Teresa and Fernández Acín, Javier, Survey: Market Risk Premium and Risk-Free Rate Used for 95 Countries in 2022 (May 23, 2022). Available at SSRN: https://ssrn.com/abstract=3803990 or http://dx.doi.org/10.2139/ssrn.3803990
[26] Laurence B. Siegel and Paul McCaffrey, Editors (2023) Revisiting the Equity Risk Premium. https://www.cfainstitute.org/-/media/documents/article/rf-brief/Revisiting-the-Equity-Risk-Premium.pdf.
[27] Damodaran, Aswath, Equity Risk Premiums (ERP): Determinants, Estimation, and Implications – The 2022 Edition (March 23, 2022). Available at SSRN: https://ssrn.com/abstract=4066060 or http://dx.doi.org/10.2139/ssrn.4066060.
[28] Damodaran (2022), page 38.

surveys, historic risk premiums are not forward looking. Implied risk premiums provide a market-based approach to estimating a forward-looking risk premium.

Q.36 WHAT FORWARD RISK PREMIUMS CAN BE IMPLIED FROM MARKET DATA?

A.36 A forward-looking risk premium can be implied from current market prices and expected cash flows. The risk premium is implied by current market value for a representative index and the expected cash flows from that index. Damodaran finds that the implied equity premium of the trailing 12 months is the best predictor of the actual implied premium.[29] The January 2023 trailing 12-month implied equity risk premium is 5.94 percent.[30]

Q.37 WHAT DOES THE RANGE OF SURVEY RESULTS FOR THE EQUITY RISK PREMIUM SAY ABOUT THE USE OF GEOMETRIC VS. ARITHMETIC AVERAGING OF HISTORIC RATES?

A.37 The surveys of investors and finance professionals report that the equity risk premium is between 3 and 6 percent. This is consistent with the current implied risk premium of 5.94 percent, but substantially less than the Value Line forecast of 8.3. The surveys are also consistent with historical risk premium when geometric averaging is used, but are well below historical risk premium when arithmetic averaging is used. This confirms that geometric averaging should be used when evaluating investor expectations.

Q.38 WHAT MEASURE OF THE EQUITY RISK PREMIUM IS RECOMMENDED FOR USE IN SETTING RATES?

A.38 There is no one approach to estimating equity risk premiums that is appropriate for all analyses. However, generally, the current trailing 12-month implied equity risk premium is more appropriate when equity markets are assumed to be functioning efficiently, when

[29] Damodaran (2022).

[30] https://pages.stern.nyu.edu/~adamodar/New_Home_Page/home.htm Trailing 12-month cash yield for September 1, 2022.

predictive power is important, or when current equity needs of investors are being considered. A historical risk premium or a long-term average of implied premiums is appropriate when evaluating long-term capital investment decisions or when there is reason to believe that current markets are over- or under-valued. Survey results are appropriate when markets are assumed to be functioning poorly over an extended time.

In setting utility rates, the primary function of estimating the cost of equity is to provide a fair return to equity investors that is sufficient to attract capital. However, utilities also use approved cost of capital in long-term planning and when making capital investment decisions. In an environment of well-functioning capital markets, greatest weight should be placed on the current implied equity risk premium. However, it is also appropriate to consider long-term average implied risk premium and the historic risk premium and current survey results due to unstable equity market conditions and the capital planning functions of the authorized cost of equity.

In my models, I take a conservative approach by using the average of the current implied risk premium (5.94 percent), which has high forward-looking explanatory power, and the method used by NPC (8.09 percent), which can be thought of as an upper bound on future risk premium because it exceeds all other forecasted risk premium estimates. This results in a risk premium of 7.01.

c. <u>Empirical CAPM</u>

Q.39 PLEASE SUMMARIZE THE RESULTS OF YOUR EMPIRICAL CAPM MODELS.

A.39 My ECAPM models estimate an ROE range from 8.73 percent to 9.49 percent. The low value results from using the regression beta estimates. The maximum estimated ROE results from using the unadjusted Bloomberg beta estimates. I recommend against placing material weight on this model because it contains questionable assumptions. The table below summarizes my estimates.

Table LK-10: ECAPM ROE Estimates

ECAPM ROE Estimate		
	Regression Beta	Bloomberg Unadjusted Beta
Mean Premium	8.73%	9.49%

Q.40 HOW DO YOUR ESTIMATES OF BETA DIFFER FROM NPC'S?

A.40 I apply the same updates to betas and equity risk premium performed for the CAPM model above.

Q.41 WHY DO YOU CHARACTERIZE THE ECAPM AS HAVING QUESTIONABLE ASSUMPTIONS?

A.41 The formula Ms. Bulkley uses, and which I adopt, for the ECAPM relies on statistical analysis performed in 1989.[31] It is not clear that this relationship persists in the markets today. Furthermore, the analysis underlying the ECAPM model relies on industry averages, rather than utility averages. Thus, it is likely that the adjustment does not reflect any real characteristics of the utility industry. While I report ECAPM for informational purposes, I do not recommend giving the model results material weight or consideration because it over-represents the risk of utility companies. I also do not apply the excessive Value Line risk premium forecasts to this model because that would exacerbate the problems with the model.

[31] Morin, R. A. (2006). New Regulatory Finance. Austria: Public Utilities Reports, page 190, footnote 12.

d. <u>Market Analysis</u>

Q.42 GIVEN CURRENT MARKET CONDITIONS, WHY DO YOU RECOMMEND A DECREASE IN THE COST OF EQUITY?

A.42 The only market conditions that are relevant to evaluating cost of equity are those that are inputs to the ROE estimation models. Outside of these, NPC's arguments about the condition of the market are speculative and irrelevant, in that the arguments are not theoretically or empirically linked to the models used to estimate ROE.

Furthermore, speculation about current market conditions does not directly address whether the currently approved ROE is too high or too low. The primary consideration in determining cost of equity is that it be commensurate with the returns on investments for other firms with similar risks and that it be sufficient to assure the financial integrity of the utility, to maintain credit, and to attract capital.[32] My recommendations are supported by various mathematical models that can be used to estimate a return on equity that meets these criteria. However, the judgement applied in evaluating these models is grounded in observing utility and investor behavior.

NPC has not faced any difficulties in attracting capital, and NPC is not aware of any other utilities that have been unable to.[33] In fact, not only has NPC been able to attract capital, NPC is seeking to increase its capital ratio above its historic levels. This indicates an investor appetite for NPC's existing ROE. This investor appetite occurs when an investor's expected ROE exceeds that required by the investor, and the tendency for regulated utilities to over-capitalize is known academically as the Averch–Johnson effect, and informally, as "gold-

[32] *Federal Power Commission v. Hope Natural Gas Co.*, 320 US 591, 602 (1944).

[33] Exhibit Kaufman-Direct-2 (NPC Resp to Joint Petitioners' Data Request ("DR") No.13).

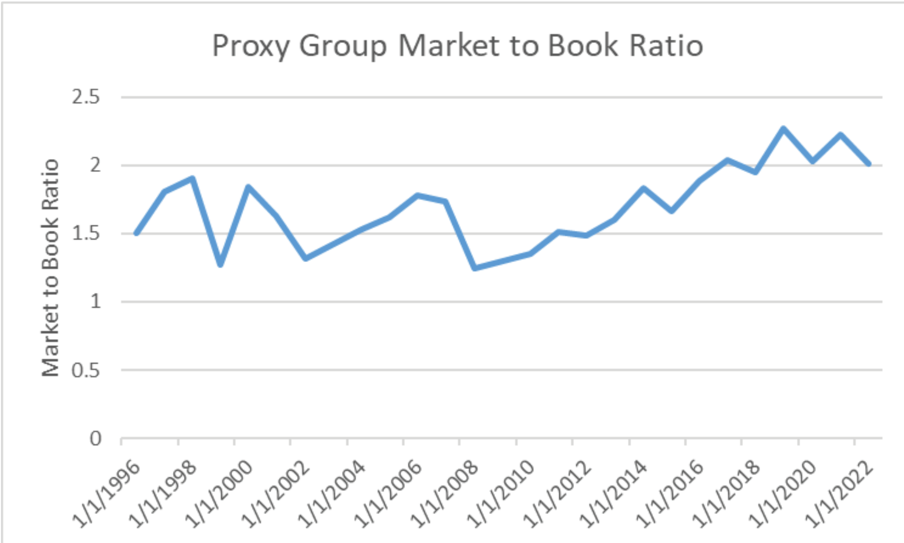
plating." The Averch–Johnson effect is the tendency of regulated companies to engage in excessive capitalization in order to increase net income.

The cause of the Averch-Johnson effect is excessive ROE, and the symptoms of the Averch–Johnson effect are 1) actions that increase equity, and 2) market valuations of equity above the book value of equity. Examples of increasing equity include requesting an equity-heavy capital structure, discouraging competitive energy service, and acquiring owned generation rather than power purchase agreements. In most proceedings that I have participated in across the U.S., I have observed a utility actively arguing against actions that would decrease the utility's opportunity for increased investment.

The second key factor indicating that current return on equity is excessive is that utilities are experiencing excessive market to book ratios. If return on equity for the utility industry is sufficient but not excessive, the market to book ratio for the utility industry should be at or near one.[34] A market-to-book ratio above one indicates that return on equity exceeds that which is necessary for an investment of comparable risk.[35] The figure below presents the mean market-to-book ratio for the proxy utilities. The average market-to-book ratios have exceeded one since 1996 and are currently at their highest levels. These data indicate that the proxy group, on average, earns returns on equity substantially higher than necessary.

[34] Morin, R. A. (2006). New Regulatory Finance. Austria: Public Utilities Reports, page 360.
[35] Morin, R. A. (2006). New Regulatory Finance. Austria: Public Utilities Reports, page 360.

Figure LK-2: Market-to-Book Ratio



Q.43 OTHER THAN GENERAL INDUSTRY OBSERVATIONS, WHAT SPECIFIC BEHAVIOR OF NPC INDICATES THAT THE CURRENT AUTHORIZED ROE OF 9.4 PERCENT IS EXCESSIVE?

A.43 My exposure to NPC's behavior is limited to reviewing its cost of capital and its rate design. NPC's effort to increase its equity ratio indicates the current ROE is excessive. NPC also mistreated partial requirements customers by using biased methodologies to unfairly shift costs to these customers. In its recent application to update it's 2021 Integrated Resource Plan, the company specifically asks that $1.5 billion in new generation be company owned, rather than be contracted through a third party.[36] This indicates a preference for owned generation, which is consistent with the Averch-Johnson effect.[37] I also understand that in the 2021 Nevada legislative session, the utility advocated in support of a bill requiring it to construct the

[36] Docket No. 23-08015, Joint Application of Nevada Power Company d/b/a NV Energy and Sierra Pacific Power Company d/b/a NV Energy for approval of the Fifth Amendment to the 2021 Joint Integrated Resource Plan, Transmittal Letter at 1 and Application Exh. A at 97.

[37] *See,* Docket 23-08015, wherein the Company is seeking to rate-base over $1.5 billion in new renewable generation, instead of choosing a PPA to meet the RPS.

Greenlink West and Greenlink North transmission lines with CEO Doug Cannon testifying to the Nevada legislature that the utility would bring $2 billion of private money to the state for these projects.[38]

Q.44 WHAT MARKET COMMENTARY DOES MS. BULKLEY OFFER?

A.44 Ms. Bulkley makes the following assertions:

- interest rates may remain at the current rates.[39]
- Utility share prices are inversely correlated with interest rates.[40]
- Utilities are expected to underperform in current market conditions.[41]

Q.45 WHAT IS YOUR RESPONSE TO MS. BULKLEY'S MARKET OBSERVATIONS?

A.45 These observations are flawed and do not inform ROE estimates, other than through the impact of inputs to the return on equity models. Ms. Bulkely did not analyze the correlation of utility stock prices with interest rates, and a closer examination shows that there is no fixed relationship. Decreasing stock prices can reflect decreased expected earnings, and thus it is incorrect to conclude that decreasing stock prices imply increased ROE requirements. Finally, to the extent that utilities are expected to underperform, and that this expectation is public, the efficient market hypothesis demonstrates that current market prices will reflect this underperformance.

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[38] Testimony of Doug Cannon, Assm. Cmte. on Growth & Infrastructure Hearing on S.B. 448 (May 25, 2021), at 9-10. Available at: https://www.leg.state.nv.us/App/NELIS/REL/81st2021/Bill/8201/Meetings; *see also* Testimony of Doug Cannon, NV Energy CEO, Nevada Legislature Senate Committee on Growth and Infrastructure (May 17, 2021), at 32. Available at: https://www.leg.state.nv.us/App/NELIS/REL/81st2021/Bill/8201/Meetings

[39] Bukley-Direct at 15-20.

[40] Bukley-Direct at 14, 15, and 21.

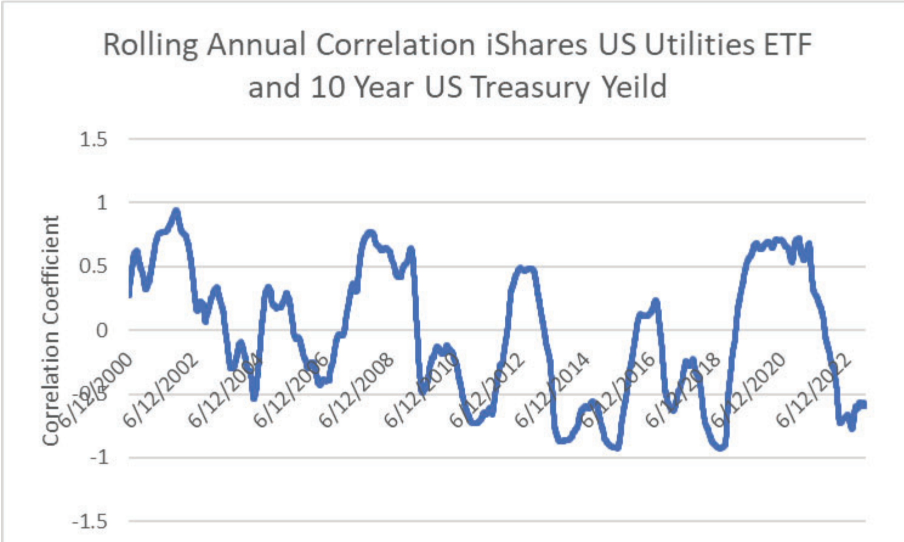
[41] Bulkley-Direct at 21-25.

Q.46 WHY DO YOU CLAIM THAT THERE IS NO FIXED RELATIONSHIP BETWEEN UTILITY STOCK PRICE AND INTEREST RATES?

A.46 Ms. Buckley did not calculate the correlation between utility stock prices and interest rates, and instead relied on a news article.[42] However, the referenced article did not study the correlation between Treasury yields and utility stock prices. Instead, it reports the "beta" by industry group, where beta appears to be expressed as the difference from unity. The study is focused on the tech industry rather than the utility industry; however, it does report that the "beta" of utilities is negative without providing detail on how that determination was made. I analyzed the correlation of utility stock prices with Treasury yields, and utility stock price growth with Treasury yields. I used the iShares U.S. Utilities ETF to measure utility prices. Neither measure shows a consistent inverse correlation. The figure below shows that the rolling one-year correlation between utility stock price and 10-year Treasury yield is cyclical and varies from negative to positive.

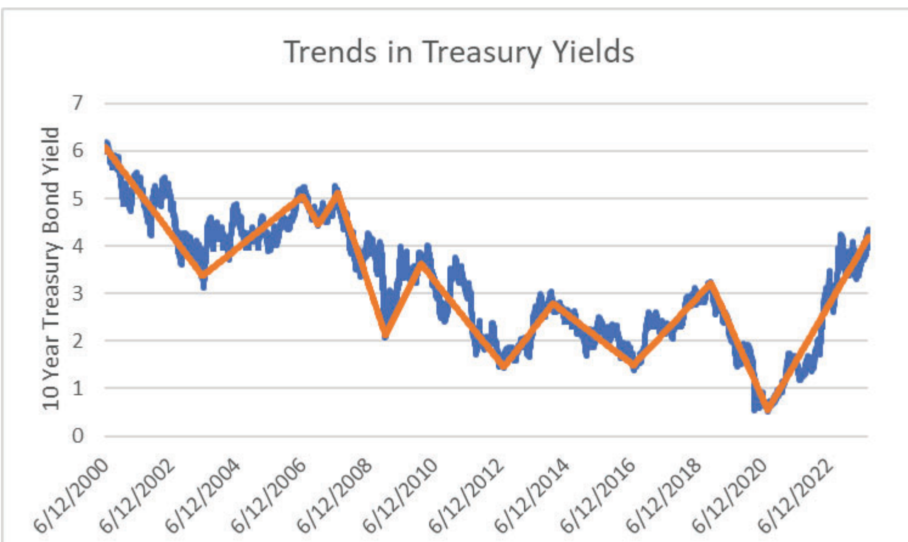
[42] Exhibit Kaufman-Direct-2 (NPC's Response to Joint Petitioners' DR 8, with Attachment).

Figure LK-3: Rolling Annual Correlation Between Utility Share Price and Treasury Yield



In addition to evaluating rolling annual correlation, I investigated whether the correlation is affected by whether Treasury yields are declining or increasing. The figure below identifies my determination of whether yields are decreasing or increasing.

Figure LK-4: Break Points in Treasury Trends



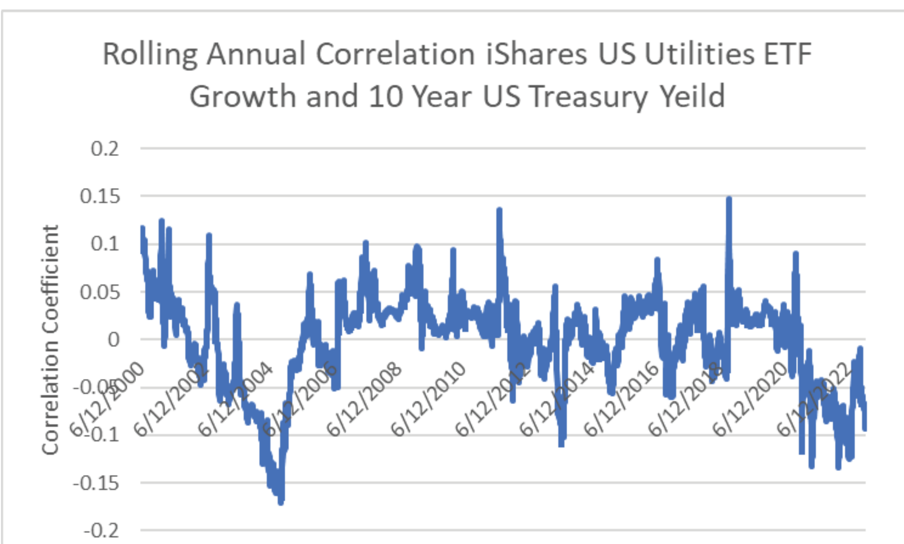
I calculated the correlation between the utility index price and Treasury yields within each straight-line segment of the figure above. I found the correlation to be positive in eight of 12 segments, as shown in the table below.

Table LK-11: Correlation Between Stock Price and 10-year Treasure Bond Yields

Start Date	End Date	Correlation
6/12/2000	5/30/2003	0.81
5/30/2003	6/14/2006	0.33
6/14/2006	12/5/2006	-0.87
12/5/2006	7/13/2007	0.22
7/13/2007	12/19/2008	0.54
12/19/2008	1/21/2010	0.44
1/21/2010	7/26/2012	-0.77
7/26/2012	1/23/2014	0.47
1/23/2014	6/30/2016	-0.82
6/30/2016	11/7/2018	0.21
11/7/2018	7/30/2020	-0.13
7/30/2020	8/23/2023	0.48

I also investigated the one-year rolling correlation between utility price growth and Treasury yields. There is no consistent relationship, as shown in the figure below.

Figure LK-5: Rolling Annual Correlation Between Stock Price Growth and Treasury Yield



Q.47 EVEN IF A NEGATIVE RELATIONSHIP IS ASSUMED BETWEEN TREASURY YIELDS AND UTILITY SHARE PRICE, HOW IS THIS RELEVANT TO ROE ESTIMATES?

A.47 Ms. Bulkley incorrectly concludes that a negative relationship between share price and Treasury yields implies a negative relationship between ROE and equity. While investor ROE requirements can drive stock price, so can investor expectations. For example, in the discounted cash flow model, if ROE is held constant but earnings expectations are decreased, the stock price will decrease.

Q.48 IF STOCK PRICES ARE EXPECTED TO UNDERPERFORM, IS THAT A BASIS FOR PLACING LESS WEIGHT ON DISCOUNTED CASH FLOW RESULTS?

A.48 No, reliable ROE models such as the DCF and CAPM models assume efficient markets. This means that current market prices reflect all known information about the respective companies and markets. Ms. Bulkley makes a key assertion that is inconsistent with this, specifically that "the share prices of utilities are likely to decline."[43] Ms. Bulkley makes this assertion by isolating a single market factor (Treasury yields), forecasting the factor to remain constant, and assuming the relationship between that factor and utility prices (that utility stock yields must exceed Treasury yields.) This approach to forecasting stock prices is not academically rigorous because it essentially assumes the result. Furthermore, if the relationships are real, market traders would short sell utility stock in the current market, driving down the stock price until there is no opportunity for inter-temporal arbitrage.

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[43] Bulkley-Direct at 28:16-17.

Q.49 HOW DO CURRENT MARKET CONDITIONS FACTOR INTO ROE ESTIMATES?

A.49 Current market conditions are inputs to the DCF and CAPM models. These models automatically account for the impact of current and expected market conditions. It is unnecessary to make further adjustments.

Q.50 PLEASE SUMMARIZE YOUR COST OF EQUITY ANALYSIS AND RECOMMENDATION.

A.50 The DCF, CAPM, and ECAPM models result in a broad range of ROE estimates. However, all models overlap with some portion of the range of 8.5 to 9.5, which I recommend as a reasonable ROE range. I recommend an ROE of 9.0 percent. This provides a return on equity sufficient to attract capital given the risk and returns of the NPC and the Proxy group. This recommendation reduces return on rate base by $36 million and tax expense by $4 million relative to the certification filing.

III. CAPITAL STRUCTURE

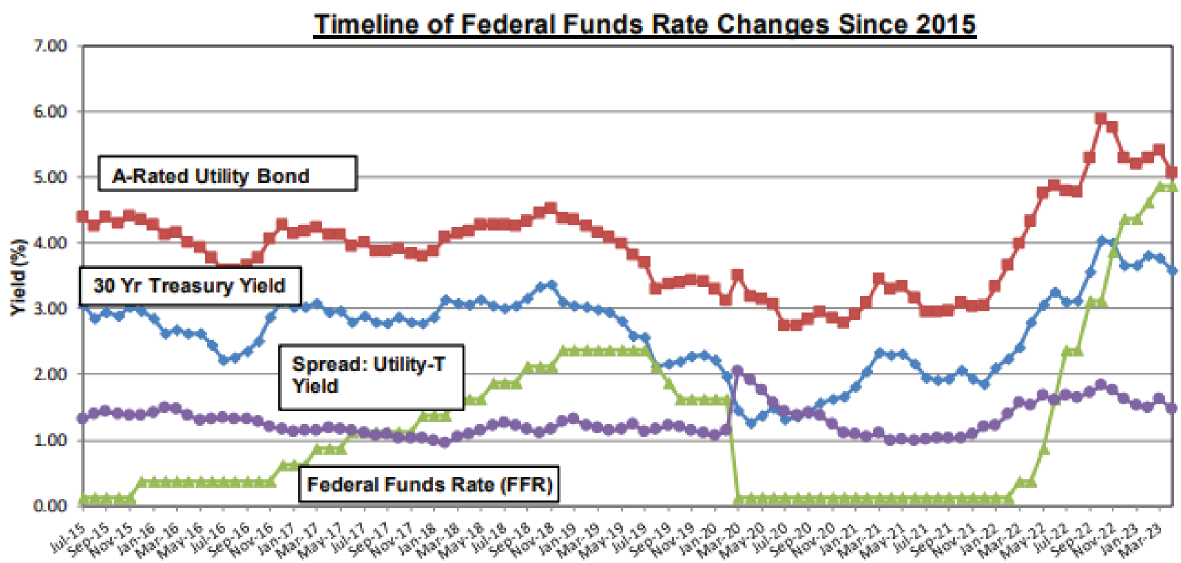
Q.51 PLEASE SUMMARIZE YOUR CAPITAL STRUCTURE TESTIMONY.

A.51 I recommend the use of a hypothetical capital structure with 49.94 percent common equity, 1.44 percent short-term debt, 0.80 percent customer deposits, and 47.83 percent long-term debt. This structure is based on NPC's actual capital structure modified to reflect the issuance of $300 million in long-term debt in 2021 and $300 million in dividend distributions in 2021. This recommendation is also based on the observation that NPC issued no debt or dividends in 2021, despite the fact that interest rates in 2021 were relatively low and that NPC's net income was sufficient to fund a dividend. Finally, this recommendation is based upon the observation that NV Energy has systematically increased its equity percentage since 2013, when Berkshire Hathaway Energy acquired both NPC and Sierra Pacific Power Company ("Sierra").

Q.52 WHAT INDICATIONS ARE THERE THAT INTEREST RATES WERE AT AN ALL TIME LOW IN 2021?

A.52 The federal funds rate was zero between March 2020 and March 2022. The federal funds rate is a key driver of corporate bond rates. This resulted in relatively low corporate bonds yields over the same period, as seen in the figure below.[44]

Figure LK-6: Interest Rates and Yields Over Time



[44] OPUC Docket No. UE 416, Opening Testimony of Christopher C. Walters on Behalf of Alliance of Western Energy Consumers and Oregon Citizens' Utility Board, at 10 (Jun. 13, 2023).

Q.53 WHAT DEBT DID NPC ISSUE WHILE INTEREST RATES WERE LOW?

A.53 NPC issued a 10-year, $424 million bond, and a 30-year, $300 million bond in 2020.[45] The interest rate of these bonds are 2.4 percent and 3.13 percent respectively.[46] NPC issued no debt in 2021.

Q.54 WHAT WERE NPC'S DIVIDENDS DURING THIS PERIOD?

A.54 NPC issued lower-than-average dividends during 2020, 2021, and 2022. The table below summarizes NPC's changes in equity from 2014 to 2022. The average annual dividend from 2020 to 2021 was only $114 million, only one third of NPC's typical dividend. This reduction in dividend is not due to low earnings, however. NPC's net income over the same time period was $299 million per year, $42 million higher than the average from 2014 to 2019.

Table LK-12: NPC Income, Dividends, and Equity 2014 to Present

Year End Balance	Net Income	Dividends	Equity
2014	$227	($230)	$2,888
2015	$288	($13)	$3,163
2016	$279	($469)	$2,972
2017	$255	($548)	$2,678
2018	$226		$2,904
2019	$264	($371)	$2,797
2020	$295	($155)	$2,939
2021	$303	($213)	$3,030
2022	$298	$25	$3,354
2014-2019 Avg	$257	($326)	$2,900
2020-2021 Avg	$299	($114)	$3,108

Q.55 COULD NPC HAVE ISSUED DEBT OR DIVIDENDS IN 2021?

A.55 Yes, NPC's operating income is sufficient to cover additional debt. NPC's debt coverage ratio in 2021 exceeded both the median and mean debt coverage ratio for members of the Proxy

[45] Statement F-1 for Certification Period Ending May 31, 2023, Statement F workpapers, page 4.
[46] Statement F-1 for Certification Period Ending May 31, 2023, Statement F workpapers, page 4.

group. NPC incurred $449 million in capital expenditures in 2021. If NPC had financed these expenditures with debt, NPC would have had sufficient cash to continue issuing dividends consistent with its practice from 2014 to 2019. NPC's 2020 to 2022 income and retained earnings also indicate NPC had the ability to issue an average level of dividend.

Q.56 ALL ELSE EQUAL, WHAT WOULD NPC'S CAPITAL EXPENDITURE BE IF NPC HAD ISSUED $300 MILLION IN BOTH BONDS AND DIVIDENDS?

A.56 These changes increase long-term debt and reduce equity. The table below summarizes NPC's capital structure if long-term debt is increased by $300 million and equity is reduced by $300 million.

Table LK-13: Hypothetical Capital Structure

Description		Capital Amount	Capital Ratio%
Debt			
Short-Term Debt	$	100,000	1.44%
Customer Deposits		55,505	0.80%
Long-Term Debt		3,332,845	47.83%
Total Debt	$	3,488,350	50.06%
Equity			
Preferred Equity	$	-	0.00%
Common Equity 3		3,479,619	49.94%
Total Equity	$	3,479,619	49.94%
Total Capital	$	6,967,968	100.00%

Q.57 HOW WOULD ISSUING ADDITIONAL DEBT IMPACT NPC'S COST OF DEBT?

A.57 I use NPC's 2020 30-year, $300 million issuance as the basis for both issuance cost and interest rate. When NPC's actual debt is modified to include an additional $300 million with similar characteristics, NPC's cost of debt decreases from 5.12 percent to 4.95 percent.

Q.58 WHAT TRENDS HAVE YOU SEEN WITH RESPECT TO NPC'S EQUITY PERCENTAGE?

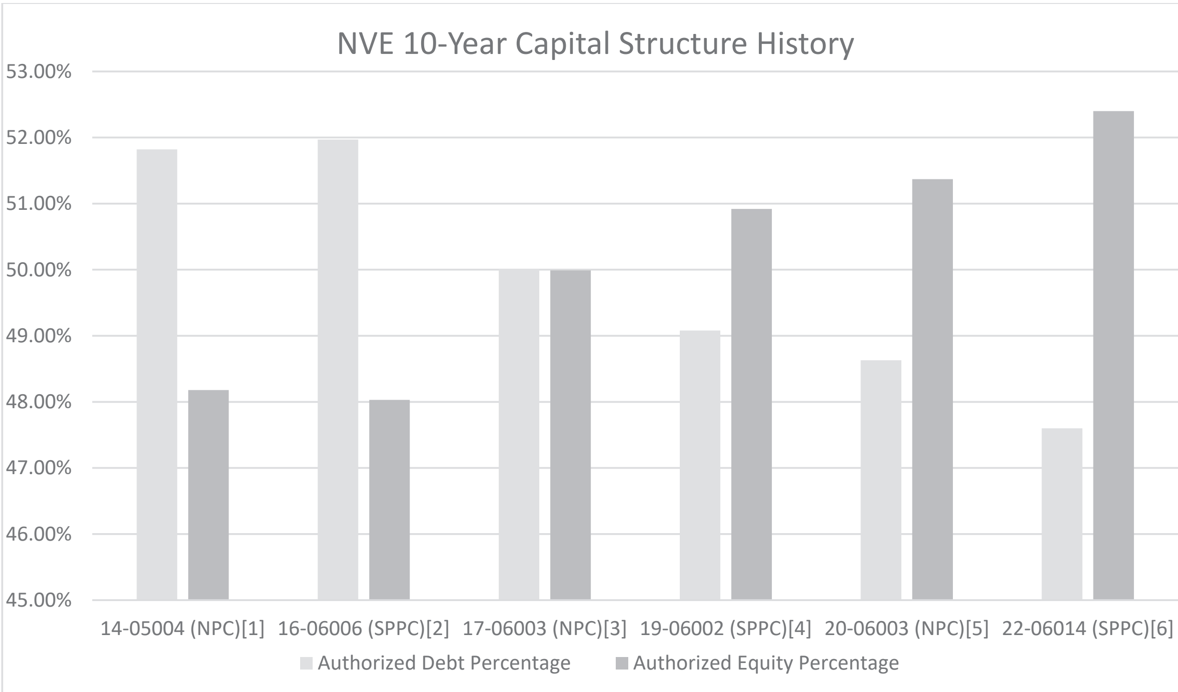
A.58 Since Berkshire Hathaway Energy ("BHE") acquired both Sierra and NPC, the equity ratios have been steadily increasing. Table LK-14 and Figure LK-7 below shows the equity increases that have occurred for the last ten years since the BHE acquisition occurred.

Table LK-14: 10-Year Capital Structure History

Docket	Year	Authorized Debt Percentage	Authorized Equity Percentage
14-05004 (NPC)[47]	2014	51.82%	48.18%
16-06006 (SPPC)[48]	2016	51.97%	48.03%
17-06003 (NPC)[49]	2017	50.01%	49.99%
19-06002 (SPPC)[50]	2019	49.08%	50.92%
20-06003 (NPC)[51]	2020	48.63%	51.37%
22-06014 (SPPC)[52]	2022	47.6%	52.4%

[47] Stipulation accepting Certification Statement F, approved in Docket No. 14-05004, Order (Oct. 15, 2014).
[48] Stipulation accepting Certification Statement F, approved in Docket No. 16-06006, Order (Dec. 28, 2016).
[49] Docket No. 17-06003, Modified Final Order (Dec. 19, 2018).
[50] Stipulation accepting Certification Statement F, approved in Modified Final Order (Apr. 2, 2020).
[51] Docket No. 20-06003, Certification Statement F. The Order issued on Jan 28, 2021 approving the stipulation does not make specific reference to an approved capital structure, but this represents what was included in Certification Statement F.
[52] Docket No. 22-06014, Modified Order ¶ 164 (Feb .16, 2023), imputing Staff's hypothetical capital structure.

Figure LK-7: 10-year Capital Structure History



Q.59 WHAT IS THE CAPITAL STRUCTURE OF NPC'S HOLDING COMPANY?

A.59 BHE's capital structure was 53 percent debt 47 percent equity in 2021 and 2022.[53] BHE is an intermediate holding company, which is in turn held by other investors. This means that equity investors in NPC can increase their equity ratio in NPC without increasing their equity at risk by acquiring debt through the intermediate holding company, BHE, rather than directly through NPC. Ms. Bulkley calls on the "stand-alone" principal to assert that the Commission should evaluate NPC as an individual company. However, BHE's capital structure is evidence that NPC could cost effectively operate at a lower equity level. BHE equity investors would be exposed to similar risk and would have the same equity investment in the holding company if

[53] Berkshire Hathaway Energy Company FORM 10-K for fiscal year ending December 31, 2022.

debt held by NPC rather than BHE. The fact that BHE's capital structure has substantially less equity than NPC means that the Commission is not disadvantaging BHE shareholders by applying a 50-50 capital structure. If my proposed hypothetical issuance of $300 million of debt and dividends were paired with a $300 million reduction in BHE debt, BHE's capital structure and equity investment would remain unchanged.

Q.60 WHAT EQUITY PERCENTAGE DID NPC ASK FOR IN THE ORIGINALLY FILED APPLICATION?

A.60 In its initially filed application, NPC requested a capital structure of 46.7% debt and 53.3% equity.

Q.61 DID THE EQUITY PERCENTAGE INCREASE IN THE CERTIFICATION FILING?

A.61 Yes. NPC's certification filing now requests that this Commission approve a capital structure with 45.8% debt and 54.2% equity, representing a 90-basis point increase from the case that was originally filed in June, less than four months ago.

Q.62 IS NPC'S CAPITAL STRUCTURE REASONABLE?

A.62 No. A capital structure that is weighted at over 54% equity is unreasonable and not in line with other similarly situated utilities. The average authorized equity ratio for utilities ranged from 48.9 percent to 49.98 percent between 2017 and Q1 of 2021[54] Furthermore, a 90-basis point increase in four months is also not reasonable. Such an increase only exacerbates the upward trend on equity levels for NV Energy's two utilities in Nevada, as shown above. Given that equity is more expensive in debt, and given the rapid increase in NPC's overall energy rate in

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[54] Illinois Commerce Commission RRA Regulatory Focus Major Rate Case Decisions - January - March 2021, Docket No. 23-0066, Nicor Gas Ex. 28.5

the past three years,[55] Nevada's ratepayers should not be asked to bear an unreasonable cost burden associated with a 54% equity ratio.

Q.63 WHAT CAN THE COMMISSION DO TO MITIGATE THESE COSTS FOR RATEPAYERS?

A.63 The Commission has the power to impute a hypothetical capital structure that is more reasonable, as was done in the 2022 Sierra General Rate Case. In Docket 22-06014, at the request of Staff and other parties, the Commission issued an order imputing a hypothetical 52.4% equity ratio, notwithstanding the fact that the actual equity ratio was 54.76%.[56] I am not an attorney, but the Commission is not limited by either *Hope* or *Bluefield* in the ability to impute a hypothetical capital structure, and such is not barred under NRS 704.110(3) either, as the Commission correctly concluded in the 2022 Sierra General Rate Case.[57] The Commission used this tool last year to mitigate against unusual circumstances, and I recommend that it do so here again to protect ratepayers from an unreasonably high equity ratio. Given the fact that ratepayers are experiencing abnormally high energy rates, and given the $300 million issuance described above, this would be the most equitable solution for all.

Q.64 PLEASE SUMMARIZE YOUR RECOMMENDATION ON NPC'S CAPITAL STRUCTURE TESTIMONY.

A.64 I recommend the use of a hypothetical capital structure with 49.94 percent common equity, 1.44 percent short term debt, 0.80 percent customer deposits, and 47.83 percent long-term debt. This recommended capital structure reduces return on rate base by $9.7 million and tax expense by $500,000. My recommended capital structure is based on a hypothetical debt

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[55] NV Energy shocked by energy bills from hottest July on record | Las Vegas Review-Journal (reviewjournal.com)
[56] Docket No. 22-06014, Modified Order ¶ 164 (Feb. 16, 2023).
[57] *Id.* at ¶¶ 166-170.

issuance during low interest rate periods in 2022. I recommend the cost of debt be calculated consistent with this hypothetical issuance, at 4.95 percent. The recommended cost of debt reduces NPC's return on rate base by $4.4 million.

IV. COST OF CAPITAL

Q.65 WHAT IS NPC'S COST OF CAPITAL UNDER YOUR PROPOSALS?

A.65 My proposals reduce NPC's weighted average cost of capital from 7.88 percent to 6.97 percent, as shown in the table below.

Table LK-15: NPC Weighted Average Cost of Capital

Description		Capital Amount	Capital Ratio%	Cost of Capital%	Weighted Cost of Capital%
Debt					
Short-Term Debt	$	100,000	1.44%	6.32%	0.09%
Customer Deposits		55,505	0.80%	4.55%	0.04%
Long-Term Debt		3,332,845	47.83%	4.92%	2.35%
Total Debt	$	3,488,350	50.06%	4.95%	2.48%
Equity					
Preferred Equity	$	-	0.00%	0.00%	0.00%
Common Equity 3		3,479,619	49.94%	9.00%	4.49%
Total Equity	$	3,479,619	49.94%	9.00%	4.49%
Total Capital	$	6,967,968	100.00%		6.97%

Q.66 WHAT ARE THE IMPACTS OF YOUR RECOMMENDATIONS ON NPC'S REVENUE REQUIREMENT?

A.66 My recommendations reduce NPC's revenue requirement by $54 million relative to the certification filing.[58] The table below identifies the composition of this change.

[58] This change is approximate and may not include all revenue sensitive factors.

Table LK-16: Revenue Requirement Impacts of Cost of Capital Recommendations

Parameters	Cost of Capital	Return on Rate Base	Change	Change in Tax Expense	Total Revenue Requirement Reduction
F-Cert	7.88%	$434,352.54			
ROE @ 9%	7.23%	$398,486.20	($35,866)	($4,086)	($39,952)
Cap Structure 50-50	7.05%	$388,706.37	($9,780)	($512)	($10,292)
Cost of Debt	6.97%	$384,298.24	($4,408)		($4,408)
Total			($50,054)	($4,598)	($54,652)

Q.67 DOES THIS CONCLUDE YOUR TESTIMONY?

A.67 Yes.

EXHIBIT KAUFMAN-DIRECT-1

QUALIFICATION STATEMENT OF
LANCE D. KAUFMAN

CURRICULUM VITAE

LANCE KAUFMAN
Western Economics, LLC
2623 NW Bluebell Place
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EDUCATION:

University of Oregon	Ph.D.	Economics	2008 – 2013
University of Oregon	M.S.	Economics	2006 – 2008
University of Anchorage Alaska	B.B.A.	Economics	2001 – 2004

CERTIFICATIONS:

Certified Depreciation Professional	Society of Depreciation Professionals	2018

PROFESSIONAL EXPERIENCE:

Consultant	Lance Kaufman Consulting	2014 – Present
Senior Economist	Oregon Public Utility Commission	2015 – 2018
Public Utility Advocate	Alaska Department of Law	2014 – 2015
Senior Economist	Oregon Public Utility Commission	2013 – 2014
Instructor	University of Oregon	2008 – 2012
Research Assistant	University of Alaska Anchorage	2003 – 2008

PROFESSIONAL MEMBERSHIPS:

Society of Depreciation Professionals	2015 – Present
American Economics Association	2017 – Present

RESEARCH, CONSULTING, AND ECONOMETRIC ANALYSIS:

- The Municipality of Cedar Falls, Iowa, Cedar Falls, IA 2023
  Retained as a consultant for Cedar Falls Utilities to conduct a depreciation study of their electric, gas, water, and telecommunications utilities.
- Davison Van Cleve, PC, Portland, OR 2023
  Retained as an expert witness for Alliance of Western Energy Consumers regarding revenue requirement, rate spread, and rate design in Portland General Electric Company, Request for a General Rate Revision, Public Utility Commission of Oregon, Docket No. UE 416.
- Davison Van Cleve, PC, Portland, OR 2023
  Retained as an expert witness for Alliance of Western Energy Consumers regarding cost of capital, rate spread, and rate design in PacifiCorp Request for a General Rate Revision, Washington Utilities and Transportation Commission, Docket No. UE-230172.
- Alliance for Retail Energy Markets, La Jolla, CA 2023
  Retained as an expert witness for Alliance for Retail Energy Markets regarding resource adequacy of generation service providers in Arizona Public Service Company, Request

for a General Rate Revision, Arizona Public Utilities Commission, Docket No. E-01345A-22-0144.

- North Carolina Sustainable Energy Association, Raleigh, NC 2023
  Retained as an expert witness forNorth Carolina Sustainable Energy Association regarding depreciation rates and coal plant securitization in Duke Energy Carolinas, Request for a General Rate Revision, North Carolina Utility Commission Docket No. E-7 Sub 1276.
- Deep Blue Pacific Wind, Portland, OR 2023
  Retained as an expert witness for Deep Blue Pacific Wind regarding least cost planning in Portland General Electric Company, 2023 Integrated Resource Plan, Public Utility Commission of Oregon, Docket No. LC 80.
- Davison Van Cleve, PC, Portland, OR 2022
  Retained as an expert witness for Alliance of Western Energy Consumers regarding revenue requirement, rate spread, and rate design in Portland General Electric Company, Request for a General Rate Revision, Public Utility Commission of Oregon, Docket No. UE 394.
- Davison Van Cleve, PC, Portland, OR 2022
  Retained as an expert witness for Alliance of Western Energy Consumers regarding depreciation rates in Portland General Electric Company Detailed Depreciation Study of Electric Utility Properties, Public Utility Commission of Oregon, Docket No. UM 2152.
- Davison Van Cleve, PC, Portland, OR 2022
  Retained as an expert witness for Alliance of Western Energy Consumers regarding revenue requirement, rate spread, and rate design in Pacific Power Request for a General Rate Revision, Public Utility Commission of Oregon, Docket No. UE 399.
- Davison Van Cleve, PC, Portland, OR 2022
  Retained as an expert witness for Alliance of Western Energy Consumers regarding revenue requirement, rate spread, and rate design in Puget Sound Energy General Rate Case to Update Base Rates, Washington Utility and Transportation Commission, Docket No. UE-220066, UG-220067, UE-210918.
- Davison Van Cleve, PC, Portland, OR 2022
  Retained as an expert witness for Alliance of Western Energy Consumers competitive energy service in AWEC's Investigation into Long-Term Direct Access Programs, Public Utility Commission of Oregon, Docket No. UM 2024.
- Davison Van Cleve, PC, Portland, OR 2021
  Retained as an expert witness for Alliance of Western Energy Consumers competitive energy service in Direct Access Rulemaking, Public Utility Commission of Oregon, Docket No. AR 651.
- Davison Van Cleve, PC, Portland, OR 2022
  Retained as an expert witness for Smart Energy Alliance regarding revenue requirement, rate spread, and rate design in Sierra Pacific General Rate Case to Update Base Rates, Public Utility Commission of Nevada, Docket No. 22-06014.
- Davison Van Cleve, PC, Portland, OR 2022
  Retained as an expert witness for Alliance of Western Energy Consumers regarding revenue requirement, rate spread, and rate design in Avista Corp General Rate Case to

Update Base Rates, Washington Utility and Transportation Commission, Docket No. UE-220053 & UG-220054.

- Georgia Public Service Commission, OR 2022
  Retained as an expert witness for Georgia Public Service Commission depreciation rates and decommissioning costs in Georgia Power Company's 2022 General Rate Case, Georgia Public Service Commission, Docket No. 44280.
- Cable Huston, LLP, Portland, OR 2020
  Retained as an expert witness for Alliance of Western Energy Consumers regarding revenue requirement, rate spread and rate design in Cascade Natural Gas Corporation Request for General Rate Revision, Public Utility Commission of Oregon, Docket No. UG 390.
- Davison Van Cleve, PC, Portland, OR 2020
  Retained as an expert witness for Alliance of Western Energy Consumers regarding net power costs in Portland General Electric Company 2021 Annual Power Cost Update Tariff, Public Utility Commission of Oregon, Docket No. UE 377.
- Davison Van Cleve, PC, Portland, OR 2020
  Retained as an expert witness for Alliance of Western Energy Consumers regarding net power costs in Portland General Electric Company 2021 Annual Update Tariff, Public Utility Commission of Oregon, Docket No. UE 381.
- Davison Van Cleve, PC, Portland, OR 2020
  Retained as an expert witness for Alliance of Western Energy Consumers regarding revenue requirement, rate spread and rate design in Nevada Power Company 2021 General Rate Case, Public Utility Commission of Nevada, Docket No. 20-06003
- Frank & Salahuddin LLC, Denver, Colorado, 2020
  Retained as an expert witness for plaintiffs regarding calculation of lost earnings.
- ba, Denver, Colorado, 2020
  Retained as an expert witness for plaintiffs regarding calculation of lost earnings.
- Level Development Group, LLC, Denver, Colorado, 2020
  Develop real estate valuation model for establishing sale price of newly constructed residential housing.
- Hagens Berman Sobol Shapiro LLP, Phoenix, Arizona, 2020
  Deposed as an expert witness for plaintiffs re calculation of economic harm due to breach of contract in Jeff Olberg v. Allstate Insurance Company, Case No. C18-0573-JCC, United States District Court, Western District of Washington at Seattle.
- Hagens Berman Sobol Shapiro LLP, Phoenix, Arizona, 2020
  Deposed as an expert witness for plaintiffs re calculation of economic harm due to breach of contract in re Cameron Lundquist v. First National Insurance Company of America, Case No. 18-cv-05301-RJB, United States District Court, Western District of Washington at Tacoma.
- Killmer, Lane, and Newman, LLP, Denver, Colorado, 2020
  Deposed as expert witness for plaintiff re racial disparities in police use of force re Brandon Washington V. City Of Aurora, Colorado, Case No. 1:19-cv-01160-RM-MEH, United States District Court, District of Colorado.
- Davison Van Cleve, PC, Portland, OR 2020

Retained as an expert witness for Alliance of Western Energy Consumers regarding coal plant pollution control investments, coal plant decommissioning costs, rate spread and rate design re PacifiCorp 2020 Request for a General Rate Revision, Public Utility Commission of Oregon Docket No. UE 374.

- Davison Van Cleve, PC, Portland, OR and Washington Attorney General, 2020
  Retained as an expert witness for Packaging Company of America and Washington Public Council regarding decommissioning costs and rate design re PacifiCorp 2020 Request for a General Rate Revision, Washington Utility and Transportation Commission.
- Sanger Law, PC, Portland, OR, 2019
  Retained as a consultant for Renewable Energy Coalition and for Northwest & Intermountain Power Producers Coalition to provide analysis of PacifiCorp avoided costs in a Utility PURPA Compliance Filing at the Washington Utility and Transportation Commission Docket, No. UE-190666.
- Sanger Law, PC, Portland, OR, 2019
  Retained as a consultant for Northwest & Intermountain Power Producers Coalition to provide analysis of Portland General Electric avoided costs in support of testimony to the Oregon Legislature.
- Powder River Basin Resource Council, Laramie, Wyoming, 2019.
  Testified as an expert witness for Powder River Basin Resource Council regarding coal plant closures re PacifiCorp 2019 Integrated Resource Plan, Wyoming Public Service Commission Docket No. 90000-147-XI-19.
- The Law Office of Ralph Lamar, Arvada, CO 2019
  Deposed as an expert witness for plaintiffs regarding lost profits of a Farmers insurance agency
- Jester, Gibson & Moore, Denver, CO 2019
  Retained as an expert witness for plaintiffs regarding lost earnings in an ADEA wrongful termination matter.
- Albrechta & Coble, Ltd. Fremont, OH 2019
  Retained as an expert witness for plaintiff regarding lost earnings in a race related wrongful termination matter.
- Conrad Law, PC, Salt Lake City, UT 2019
  Retained as an expert witness for Ellis-Hall Consultants, LLC. regarding economic damages in Ellis-Hall Consultants, LLC. et. al. v. George B. Hofmann IV, United States District Court, District of Utah, Central Division.
- Davison Van Cleve, PC, Portland, OR 2019
  Retained as an expert witness for Alliance of Western Energy Consumers regarding net variable power cost calculations in PORTLAND GENERAL ELECTRIC COMPANY, 2020 Annual Power Cost Update Tariff Public Utility Commission of Oregon Docket No. UE 359.
- Sanger Law, PC, Portland, OR, 2019
  Testified as an expert witness for Renewable Energy Coalition and Rocky Mountain Coalition for Renewable Energy regarding Qualified Facility avoided costs in Application of Rocky Mountain Power for a Modification of Avoided Cost Methodology

and Reduced Term of PURPA Power Purchase Agreements Public Service Commission of Wyoming Docket No. 20000-545-ET-18

- Sanger Law, PC, Portland, OR, 2019
  Retained as an expert witness for Cafeto Coffee Company regarding the necessity, design, and location of transmission lines in SPRINGFIELD UTILITY BOARD Petition for Certificate of Public Convenience and Necessity Public Utility Commission of Oregon Docket No. PCN 3.
- Baumgartner Law, LLC, Denver, CO, 2018
  Retained as an expert witness for plaintiffs re calculation of economic harm due to injury in re Eric Bowman, v. Top Tier Colorado, LLC,, Case No. 18CV31359, United States District Court, District of Colorado.
- Cohen Milstein Sellers & Toll PLLC, Washington DC, 2018
  Retained as an expert witness for plaintiffs re calculation of economic harm due to breach of contract in re Isaac Harris et al. v. Medical Transportation Management, Inc., Civil Action No. 17-1371, United States District Court, District of Columbia.
- Davison Van Cleve, PC, Portland, OR 2020
  Retained as an expert witness for Alliance of Western Energy Consumers regarding depreciation rates in re PacifiCorp Application for Authority to Implement Revised Depreciation Rates, Public Utility Commission of Oregon Docket No. UM 1968.
- Davison Van Cleve, PC, Salem, OR and Washington Attorney General, OR 2020
  Retained as an expert witness for Packaging Company of America and Washington Public Council regarding depreciation rates in re Pacific Power 2018 Depreciation Study, Washington Utility and Transportation Commission, Docket No. UE-180778.
- Hagens Berman Sobol Shapiro LLP, Phoenix, Arizona, 2018
  Deposed as an expert witness for plaintiffs re calculation of economic harm due to breach of contract in re Vicky Maldonado and Carter v. Apple Inc., AppleCare Services Company, Inc., and Apple CSC, Inc., Case No. 3:16-cv-04067-WHO, United States District Court, District of California.
- Hagens Berman Sobol Shapiro, LLP, Phoenix, Arizona, 2018
  Deposed and testified as an expert witness for plaintiffs re calculation of unpaid mileage for truck drivers in re Swift Transportation Co., Inc., Civil Action No. CV2004-001777, Superior Court of the State of Arizona, County of Maricopa.
- Killmer, Lane, and Newman, LLP, Denver, Colorado, 2018
  Retained as expert witness for plaintiffs re reasonable attorney fees in re Jeanne Stroup and Ruben Lee, v. United Airlines, Inc., Case No. 15-cv-01389-WYD-STV, United States District Court, District of Colorado.
- Klein and Frank, PC, Denver, Colorado, 2018
  Retained as expert witness for plaintiffs re potential jury bias in re Gail Goehrig and Chris Goehrig v. Core Mountain Enterprises, LLC, Case No. 2016CV030004, San Juan County District Court.
- Robert Belluso, Pennsylvania, 2017
  Retained as expert witness for plaintiff re lost profit in re Robert Belluso D.O. v Trustees of Charleroi Community Park, PHRC Case No. 201505365, Pennsylvania Human Relations Commission.
- Lowery Parady, LLC, Denver, Colorado, 2017

Analyzed payroll data and calculated unpaid overtime and unpaid hours for plaintiff class action in re Violeta Solis, et al. v. The Circle Group, LLC, et al., Case No. 1:16-cv-01329-RBJ, United States District Court, District of Colorado.

- Sawaya & Miller Law Firm, Denver, Colorado, 2017
  Provided data processing and analysis of employment records.
- Financial Scholars Group, Orinda, California, 2017
  Provided analysis of risk profile in bundled real estate and personal loans in re Old Republic Insurance Company v. Countrywide Bank et al., Circuit Court of Cook County, Illinois, Chancery Division.
- Financial Scholars Group, Orinda, California, 2017
  Provided consultation and analysis of financial market transactions in preparation of settlement claims filings in re Laydon v. Mizuho Bank, Ltd., et al. and Sonterra Capital Master Fund Ltd., et al v. UBS AG et al.
- Clean Energy Action, Boulder, Colorado, 2016 – 2017
  Provided consultation on the appropriate discounting methodology used in energy resource planning in the Public Service Company of Colorado application for approval of the 2016 Electric Resource Plan, Proceeding No. 16A-0396E, Public Utilities Commission of the State of Colorado.
- Confidential Client, 2016
  Provided analysis and report on the probability that distinct crimes are independent events based on geographical analysis of crime rates.
- Christine Lamb and Kevin James Burns, Denver, Colorado, 2016
  Provided data analysis for defendant of the impact of ethnicity on termination decisions in re Aragon et al v. Home Depot USA, Inc., Case No. 1:15-cv- 00466-MCA-KK, United States District Court, District of New Mexico.
- Steptoe & Johnson LLP, Washington, DC, 2015 – 2016
  Programmed analysis of internet traffic data for plaintiffs applying a proprietary probability model developed to identify and verify accounts responsible for repeated infringements of asserted copyrights by defendants' internet subscribers in re BMG Rights Management (US) LLC, and Round Hill Music LP v. Cox Enterprises, Inc., et al., Case No. 1:14-cv-1611(LOG/JFA), United States District Court Eastern District of Virginia, Alexandria Division.
- Padilla & Padilla, PLLC, Denver, Colorado, 2014 – 2016
  Provided research and analysis for plaintiffs re the impact on minority applicants from use of the AccuPlacer Test by the City and County of Denver, and estimated damages in re Marian G. Kerner et al. v. City and County of Denver, Civil Action No. 11-cv-00256-MSK-KMT, United States District Court, District of Colorado.
- U.S. Equal Employment Opportunity Commission, 2013
  Provided statistical analysis of EEOC filings.

OTHER REGULATORY PROCEEDINGS:

- Portland General Electric 2018 AUT UE 335
- Portland General Electric 2016 Annual Power Cost Variance Docket No. UE 329.
- PacifiCorp 2016 Power Cost Adjustment Mechanism Docket No. UE 327.

- Public Utility Commission of Oregon Staff Investigation into the Treatment of New Facility Direct Access Charges Docket No. UM 1837
- PacifiCorp Oregon Specific Cost Allocation Investigation Docket No. UM 1824.
- PacifiCorp 2018 Transition Adjustment Mechanism Docket No. UE 323.
- Portland General Electric 2018 General Rate Case Docket No. UE 319.
- Avista Corp. 2017 General Rate Case Docket No. UG 325.
- Portland General Electric Affiliated Interest Agreement with Portland General Gas Supply Docket No. UI 376.
- Portland General Electric 2017 Automated Update Tariff Docket No. UE 308
- PacifiCorp 2017 Transition Adjustment Mechanism Docket No. UE 307
- Portland General Electric 2017 Reauthorization of Decoupling Adjustment Docket No. UE 306
- Northwest Natural Gas Investigation of WARM Program Docket No. UM 1750.
- PacifiCorp Investigation into Multi-Jurisdictional Allocation Issues Docket No. UM 1050.
- Idaho Power Company 2015 Power Supply Expense True Up Docket No. UE 305
- Homer Electric Association 2015 Depreciation Study U-15-094
- Submitted prefiled testimony regarding the depreciation study.
- Chugach Electric Association 2015 Rate Case U-15-081
- Developed staff position regarding margin calculations.
- ENSTAR 2014 Rate Case U-14-111
- Submitted prefiled testimony regarding sales forecast.
- Alaska Pacific Environmental Services 2014 Rate Case U-14-114/115/116/117/118
  Submitted prefiled testimony regarding cost allocations, cost of service, cost of capital, affiliated interests, and depreciation.
- Alaska Waste 2014 Rate Case U-14-104/105/106/107
  Submitted prefiled testimony regarding cost of service study, cost of capital, operating ratio, and affiliated interest real estate contracts.
- Fairbanks Natural Gas 2014 Rate Case U-14-102
  Submitted prefiled testimony regarding cost of service study and forecasting models.
- Avista 2015 Rate Case U-14-104
  Submitted analysis supporting OPUC Staff settlement positions regarding Avista's sales and load forecast, decoupling mechanisms and interstate cost allocation methodology. Represented Staff in settlement conferences on November 21, November 26, and December 4, 2013.
- Portland General Electric 2015 Rate Case
  Submitted pre-filed opening testimony addressing PGE's sales forecast, printing and mailing budget forecast, mailing budget, marginal cost study, line extension policy and reactive demand charge. Represented OPUC Staff in settlement conferences on May 20, May 27, and June 12, 2014.
- Portland General Electric 2014 General Rate Case
  Submitted analysis supporting OPUC Staff settlement positions regarding PGE's sales and load forecast, revenue decoupling mechanism, and cost of service study. Represented OPUC Staff in settlement conferences on May 29, June 3, June 6, July 2, and July 9 of 2013. Submitted testimony in support of partial stipulation, pre-filed opening testimony

addressing PGE's decoupling mechanism, and testimony in support of a second partial stipulation.

- PacifiCorp 2014 General Electric Rate Case
  Submitted analysis supporting OPUC Staff settlement positions regarding PacifiCorp's sales and load forecast and cost of service study. Represented Staff in settlement conferences on June 12 through June 14, 2013.

EXHIBIT KAUFMAN-DIRECT-2

RESPONSES TO DISCOVERY REQUESTS

NV Energy

RESPONSE TO INFORMATION REQUEST

DOCKET NO:	23-06007	**REQUEST DATE:**	08-15-2023
REQUEST NO:	Joint 08	**KEYWORD:**	Bulkley Direct Testimony Q&A 24
REQUESTER:		**RESPONDER:**	Bulkley, Ann

REQUEST:

Reference: Bulkley Direct Testimony Q&A 24

Question: Please refer to Ms. Bulkley's Direct Testimony Q&A 24.

a. Please provide the basis for the assertion that there is a strong historical inverse correlation between interest rates and the share prices of utility stocks. Please include all supporting workpapers and sources.
b. Does NPC expect interest rates to remain at their current level, increase, or decrease during 2024?

RESPONSE CONFIDENTIAL (yes or no): No

ATTACHMENT CONFIDENTIAL (yes or no): No

TOTAL NUMBER OF ATTACHMENTS: One (Zipped)

RESPONSE:

a. The utility sector is considered a defensive sector due to utilities having relatively stable demand that is less affected by changes in economic conditions relative to other sectors. As a result, defensive sectors are viewed as “bond proxies” (i.e., are considered an investment alternative to U.S. Treasury bonds by investors). This means that the share prices of utilities tend to increase when the yields on long-term government bonds are decreasing and decrease when the yields on long-term government bonds are increasing (i.e., inverse relationship). For example, as shown in 23-06007 - Joint 008 - Attach 01, when examining market data over a recent five-year period, both Goldman Sachs and Deutsche Bank found that utilities had a strong negative relationship with bond yields (i.e., increase in bond yields results in a decline in the share prices of utilities and vice versa).

b. As discussed on page 20 lines 16-20 of Ms. Bulkley's Direct Testimony, equity analysts expect the yields on long-term Treasuries to remain at the current elevated levels over the near-term. The recent increase in interest rates has resulted in utilities underperforming the broader market since July 2022 as shown in Figure Bulkley-Direct-5 on page 25 of Ms. Bulkley's Direct Testimony. Moreover, as discussed on page 21 line 15 through page 22 line 18 of Ms. Bulkley's Direct Testimony, the expectation that interest rates will remain elevated is also why equity analysts continue to expect the sector to underperform and thus recommend underweighting the utility sector.

Markets

Wall Street Is Rethinking the Treasury Threat to Big Tech Stocks

By Justina Lee
March 11, 2021, 10:08 AM EST

- Investors fear sector has morphed into a big bet on low rates
- Yet history shows tech's link with bonds is far more complex

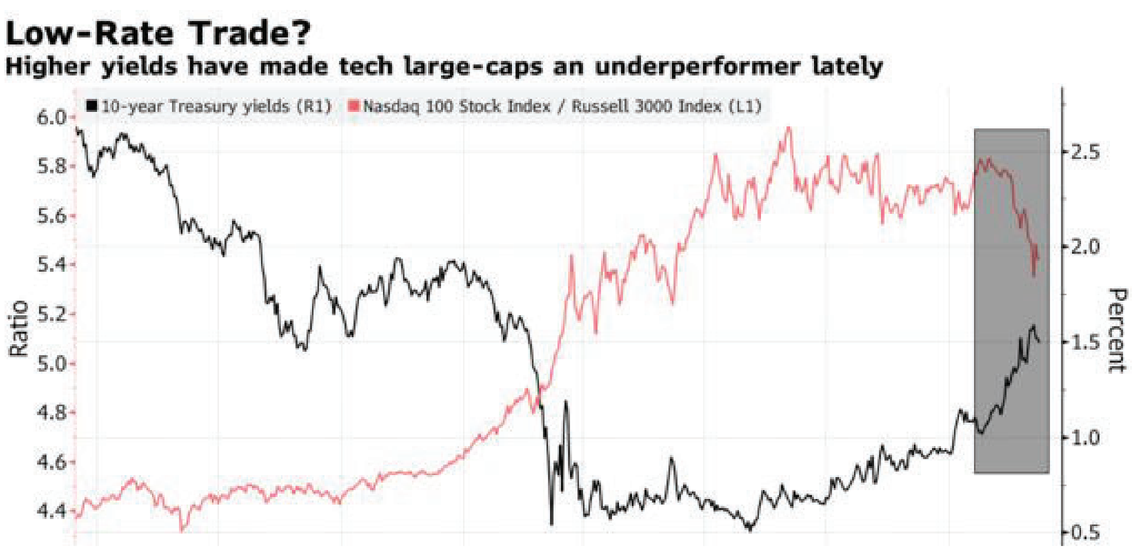
Don't fear Treasury yields killing off the stock market's golden goose just yet.

As the Nasdaq 100 Index recovers from a $1.5 trillion rout, there's good reason to think technology shares can defy machinations in U.S. bonds.

Studies from Deutsche Bank AG and Goldman Sachs Group Inc. show the world's biggest equity sector has a fickle relationship with Treasuries, if it has one at all. Quant powerhouse AQR Capital Management has found little evidence that yields drive how expensive megacaps trade relative to their cheaper counterparts.

And of course, secular economic trends have been powering the likes of Facebook Inc. and Amazon.com Inc. for years now -- when benchmark rates were far higher than current levels.

All that makes the Treasury-stock link more complex than it seems.



Source: Bloomberg

Put another way, while the recent Treasury selloff has pummeled Big Tech, that doesn't mean bonds are a natural foe for a sector hitched to secular trends from 5G to automation.

"Many tech companies will continue to benefit for many years from very strong themes that will result in outsized earnings growth," said Terry Ewing, head of equities at Mediolanum International Funds, which oversees about $54 billion. "The dilemma for portfolio managers running a balanced mandate is that actually the de-rating we've seen in growth stocks has put them at a much more attractive level."

Ewing's funds began offloading a handful of tech stocks for cyclical names from the third quarter, just as rising expectations for an economic re-opening pushed yields higher in the world's biggest bond market.

As the U.S. yield curve steepened last month, $1.5 trillion of value was wiped off tech shares, while assets deemed less sensitive to duration risk like value stocks -- banks, oil drillers and commodity producers -- surged.

The Nasdaq 100 jumped nearly 2% on Thursday morning in New York, as 10-year Treasury yields traded little changed around 1.5%.

Quant Perspective

From the perspective of quants who dissect equities by their factors, there are a few ways to explain the last month's rotation.

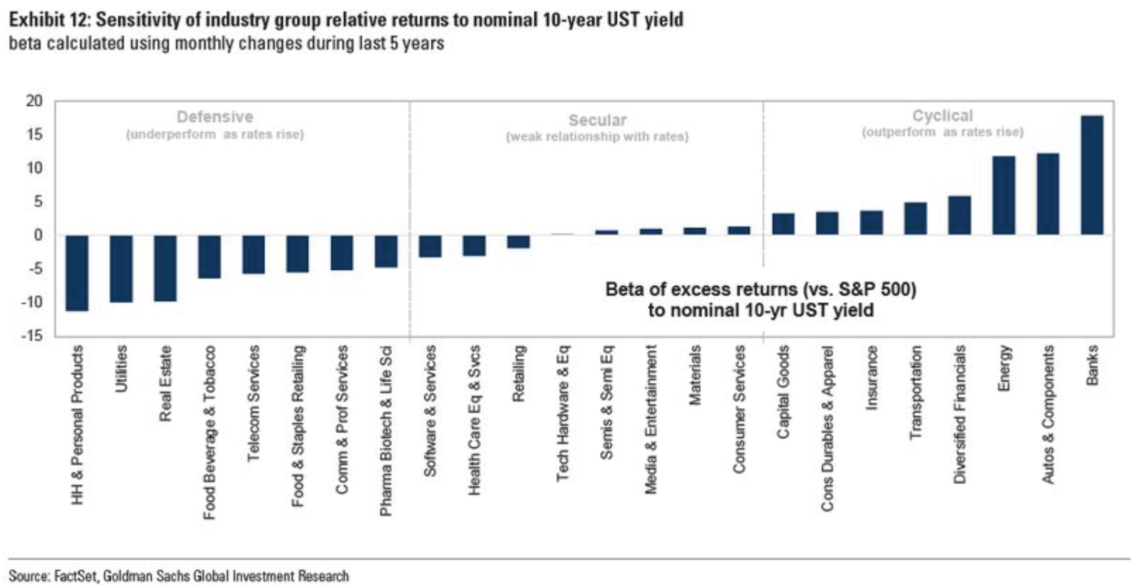
Technology companies are typically dubbed growth stocks thanks to their strong expected profit expansion, often far into the future. That's in contrast to value shares, which trade with lower multiples due to their riskier businesses.

When rates fall, economic growth is typically muted. That makes a company like Netflix Inc. look like a a safer bet since it's riding the secular trend of streaming rather than ups and downs of the business cycle. Meanwhile the likes of Exxon Mobil Corp., tied to oil demand, look riskier.

In the post-crisis era of monetary easing, that's how the valuation dynamic played out: Netflix's long-term earnings were discounted at lower rates -- making it more expensive.

Now, opposing forces are in play. Rising yields are making the near-term cash flows of cheaper equities like Exxon Mobil more attractive.

"Sooner or later we will see pretty decent economic growth," said Georg Elsaesser, a quant portfolio manager at Invesco. "I would be more than surprised if that wouldn't be favorable for high-risk factors like value."



Source: Goldman Sachs

Yet all these relationships are volatile -- and have far less explanatory power than commonly asserted.

Interest-rate changes only explain 19% of the returns posted by the growth factor versus value since 2018, Goldman Sachs strategists wrote in a note last month. That compares with 54% for cyclicals versus defensive.

In other words, industry-specific trends, not bonds, seem to be driving this tech-heavy part of the market.

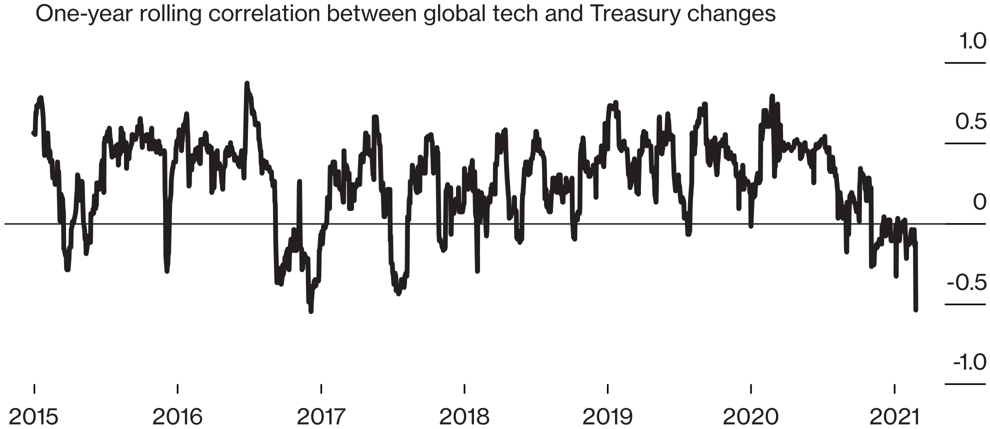
Similarly Deutsche Bank's quants find a zero beta, or sensitivity, between bonds and tech since 2015. In contrast, financials and energy had the most positive links with yields, and utilities and real estate the most negative.

According to Andreas Farmakas, a quantitative strategist at Deutsche Bank, this shows how the tech sector and Treasuries lack a direct and consistent link. In fact, these stocks in the past often rose with rates, with the latter seen as a sign of economic strength that could benefit corporate earnings.

It's Complicated

Tech stocks' relationship with Treasuries has been volatile in the short run

One-year rolling correlation between global tech and Treasury changes



Source: Deutsche Bank
Data show one-year rolling correlation between daily moves in global tech and in 10-year Treasury yields

That's not to say there isn't reason to fret recent co-movements.

"Given the ties between technology, the overbought Covid trade and ultimately equity indices -- they take up a large chunk -- the correlation flipped," Farmakas said.

In other words, bonds have lately turned from friend to foe -- and that's why quants like Invesco's Elsaesser are so reluctant to time markets.

For its part, AQR last year called the link between interest rates and value -- which involves a bet against growth -- "suspect" since it varies greatly depending on the period, the markets and measurements studied.

All this suggests that once the initial reflation frenzy settles, there's no reason to fear bond yields will necessarily doom the tech trade. In fact Ewing at Mediolanum is eyeing some bargains in the months ahead.

"Somewhere along the second-half of this year going into next year it'll be prudent for investors to start considering moving to higher-quality names rather than cyclical recovery," he said.

In this article

GS
GOLDMAN SACHS GP
343.12 USD ▲ +1.10 +0.32%

DBK
DEUTSCHE BANK-RG
10.52 EUR ▼ -0.20 -1.88%

CL1
WTI Crude
65.45 USD/bbl. ▲ +1.01 +1.57%

NFLX
NETFLIX INC
512.64 USD ▲ +8.10 +1.60%

XOM
EXXON MOBIL CORP
62.46 USD ▲ +0.69 +1.11%

NV Energy

RESPONSE TO INFORMATION REQUEST

DOCKET NO:	23-06007	**REQUEST DATE:**	08-15-2023
REQUEST NO:	Joint 13	**KEYWORD:**	Bulkley Direct Testimony, pg 10, lines 4-6
REQUESTER:		**RESPONDER:**	Bulkley, Ann

REQUEST:

Reference: Bulkley Direct Testimony, pg 10, lines 4-6

Question: Please refer to Ms. Bulkley's Direct Testimony, page 10, lines 4 to 6.

a) Please identify each instance where NPC was unable to attract sufficient capital on reasonable terms. For each instance, provide the amount of capital sought, the amount of capital that was acquired, and the terms of the capital and the terms that would have been considered reasonable.

b) Is NPC aware of any investor-owned electric utility that has been unable to attract sufficient capital on reasonable terms? If yes, identify each such utility and provide the basis for determining that the utility was not able to attract sufficient capital.

RESPONSE CONFIDENTIAL (yes or no): No

TOTAL NUMBER OF ATTACHMENTS: None

RESPONSE:

a) Lines 4 to 6 do not suggest or infer that Nevada Power was unable to secure capital on reasonable terms. Therefore, Ms. Bulkley has no responsive data.

b) Nevada Power is unaware of information on other utilities inability to attract capital. This is not public information; and believe only the banks would have this information.

EXHIBIT KAUFMAN-DIRECT-3

COST OF CAPITAL CALCULATIONS

30-DAY CONSTANT GROWTH DCF -- NEVADA POWER PROXY GROUP

Company	Ticker	[1] Annualized Dividend	[2] Stock Price	[3] Dividend Yield	[4] Expected Dividend Yield	[5] 20-Year Monte Carlo Simulation	[6] Value Line EPS Growth	[7] Average Growth Rate	[8] Monte Carlo ROE	[9] Mean ROE	[10] Value Line ROE
ALLETE, Inc.	ALE	$2.71	$56.16	4.82%	4.91%	1.21%	6.00%	3.60%	6.11%	8.51%	10.91%
Alliant Energy Corporation	LNT	$1.81	$51.86	3.49%	3.56%	1.70%	6.50%	4.10%	5.27%	7.66%	10.06%
Ameren Corporation	AEE	$2.52	$82.15	3.07%	3.15%	4.11%	6.50%	5.31%	7.26%	8.45%	9.65%
American Electric Power Company, Inc.	AEP	$3.32	$81.18	4.09%	4.31%	15.45%	6.00%	10.73%	19.76%	15.03%	10.31%
Avista Corporation	AVA	$1.84	$35.66	5.16%	5.25%		3.50%	3.50%		8.75%	8.75%
CMS Energy Corporation	CMS	$1.95	$58.26	3.35%	3.46%		6.50%	6.50%		9.96%	9.96%
Duke Energy Corporation	DUK	$4.02	$91.19	4.41%	4.52%		5.00%	5.00%		9.52%	9.52%
Entergy Corporation	ETR	$4.28	$97.48	4.39%	4.48%	7.60%	0.50%	4.05%	12.08%	8.53%	4.98%
Evergy, Inc.	EVRG	$2.45	$57.61	4.25%	4.39%	5.14%	7.50%	6.32%	9.53%	10.71%	11.89%
IDACORP, Inc.	IDA	$3.16	$98.03	3.22%	3.29%	3.43%	4.50%	3.96%	6.72%	7.25%	7.79%
NextEra Energy, Inc.	NEE	$1.87	$69.69	2.68%	2.79%	6.56%	10.00%	8.28%	9.35%	11.07%	12.79%
NorthWestern Corporation	NWE	$2.56	$53.80	4.76%	4.85%	4.16%	3.50%	3.83%	9.01%	8.68%	8.35%
OGE Energy Corporation	OGE	$1.66	$34.85	4.75%	4.88%	3.88%	6.50%	5.19%	8.75%	10.06%	11.38%
Otter Tail Corporation	OTTR	$1.75	$86.08	2.03%	2.08%	4.91%	4.50%	4.70%	6.99%	6.78%	6.58%
Portland General Electric Company	POR	$1.81	$46.11	3.93%	4.01%	3.42%	5.00%	4.21%	7.43%	8.22%	9.01%
Southern Company	SO	$2.72	$68.88	3.95%	4.04%	3.09%	6.50%	4.79%	7.13%	8.84%	10.54%
Xcel Energy Inc.	XEL	$2.08	$60.18	3.46%	3.55%	5.01%	6.00%	5.50%	8.56%	9.06%	9.55%
Mean				3.87%	3.97%	4.98%	5.56%	5.27%	8.85%	9.24%	9.53%
Median				3.95%	4.04%	4.14%	6.00%	4.79%	7.99%	8.75%	9.65%

Notes:
[1] Source: Yahoo Finance
[2] Source:Yahoo Finance, equals 30-day, average as of August 26, 2023
[3] Equals [1] / [2]
[4] Equals [3] x (1 + 0.50 x [7])
[5] Source: Stock Analysis
[6] Source: Value Line
[7] Equals Average ([5], [6])
[8] Equals [4] + [5]
[9] Equals [4] + [7]
[10] Equals [4] + [6]

90-DAY CONSTANT GROWTH DCF -- NEVADA POWER PROXY GROUP

		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Company	Ticker	Annualized Dividend	Stock Price	Dividend Yield	Expected Dividend Yield	Monte Carlo Simulation	Value Line EPS Growth	Average Growth Rate	Monte Carlo ROE	Mean ROE	Value Line ROE
ALLETE, Inc.	ALE	$2.71	$57.55	4.71%	4.79%	1.21%	6.00%	3.60%	6.00%	8.39%	10.79%
Alliant Energy Corporation	LNT	$1.81	$52.26	3.46%	3.53%	1.70%	6.50%	4.10%	5.24%	7.64%	10.03%
Ameren Corporation	AEE	$2.52	$82.60	3.05%	3.13%	4.11%	6.50%	5.31%	7.24%	8.44%	9.63%
American Electric Power Company, Inc.	AEP	$3.32	$82.73	4.01%	4.23%	15.45%	6.00%	10.73%	19.68%	14.95%	10.23%
Avista Corporation	AVA	$1.84	$37.91	4.85%	4.94%		3.50%	3.50%		8.44%	8.44%
CMS Energy Corporation	CMS	$1.95	$58.87	3.31%	3.42%		6.50%	6.50%		9.92%	9.92%
Duke Energy Corporation	DUK	$4.02	$90.36	4.45%	4.56%		5.00%	5.00%		9.56%	9.56%
Entergy Corporation	ETR	$4.28	$97.98	4.37%	4.46%	7.60%	0.50%	4.05%	12.06%	8.51%	4.96%
Evergy, Inc.	EVRG	$2.45	$58.04	4.22%	4.35%	5.14%	7.50%	6.32%	9.50%	10.68%	11.85%
IDACORP, Inc.	IDA	$3.16	$101.22	3.12%	3.18%	3.43%	4.50%	3.96%	6.61%	7.15%	7.68%
NextEra Energy, Inc.	NEE	$1.87	$72.24	2.59%	2.70%	6.56%	10.00%	8.28%	9.25%	10.98%	12.70%
NorthWestern Corporation	NWE	$2.56	$55.92	4.58%	4.67%	4.16%	3.50%	3.83%	8.83%	8.50%	8.17%
OGE Energy Corporation	OGE	$1.66	$35.38	4.68%	4.80%	3.88%	6.50%	5.19%	8.68%	9.99%	11.30%
Otter Tail Corporation	OTTR	$1.75	$80.64	2.17%	2.22%	4.91%	4.50%	4.70%	7.13%	6.92%	6.72%
Portland General Electric Company	POR	$1.81	$47.11	3.84%	3.92%	3.42%	5.00%	4.21%	7.34%	8.13%	8.92%
Southern Company	SO	$2.72	$69.51	3.91%	4.01%	3.09%	6.50%	4.79%	7.09%	8.80%	10.51%
Xcel Energy Inc.	XEL	$2.08	$62.12	3.35%	3.44%	5.01%	6.00%	5.50%	8.45%	8.94%	9.44%
Mean				3.80%	3.90%	4.98%	5.56%	5.27%	8.79%	9.17%	9.46%
Median				3.91%	4.01%	4.14%	6.00%	4.79%	7.90%	8.51%	9.63%

Notes:
[1] Source: Yahoo Finance
[2] Source:Yahoo Finance, equals 90-day, average as of August 26, 2023
[3] Equals [1] / [2]
[4] Equals [3] x (1 + 0.50 x [7])
[5] Source: Stock Analysis
[6] Source: Value Line
[7] Equals Average ([5], [6])
[8] Equals [4] + [5]
[9] Equals [4] + [7]
[10] Equals [4] + [6]

180-DAY CONSTANT GROWTH DCF -- NEVADA POWER PROXY GROUP

Company	Ticker	[1] Annualized Dividend	[2] Stock Price	[3] Dividend Yield	[4] Expected Dividend Yield	[5] 20-Year Monte Carlo Simulation	[6] Value Line EPS Growth	[7] Average Growth Rate	[8] Monte Carlo ROE	[9] Mean ROE	[10] Value Line ROE
ALLETE, Inc.	ALE	$2.71	$59.49	4.55%	4.63%	1.21%	6.00%	3.60%	5.84%	8.24%	10.63%
Alliant Energy Corporation	LNT	$1.81	$52.43	3.45%	3.52%	1.70%	6.50%	4.10%	5.23%	7.63%	10.02%
Ameren Corporation	AEE	$2.52	$84.05	3.00%	3.08%	4.11%	6.50%	5.31%	7.19%	8.38%	9.58%
American Electric Power Company, Inc.	AEP	$3.32	$85.82	3.87%	4.08%	15.45%	6.00%	10.73%	19.53%	14.80%	10.08%
Avista Corporation	AVA	$1.84	$39.77	4.63%	4.71%		3.50%	3.50%		8.21%	8.21%
CMS Energy Corporation	CMS	$1.95	$59.30	3.29%	3.40%		6.50%	6.50%		9.90%	9.90%
Duke Energy Corporation	DUK	$4.02	$92.32	4.35%	4.46%		5.00%	5.00%		9.46%	9.46%
Entergy Corporation	ETR	$4.28	$100.77	4.25%	4.33%	7.60%	0.50%	4.05%	11.93%	8.38%	4.83%
Evergy, Inc.	EVRG	$2.45	$58.72	4.17%	4.30%	5.14%	7.50%	6.32%	9.45%	10.63%	11.80%
IDACORP, Inc.	IDA	$3.16	$103.72	3.05%	3.11%	3.43%	4.50%	3.96%	6.54%	7.07%	7.61%
NextEra Energy, Inc.	NEE	$1.87	$73.77	2.53%	2.64%	6.56%	10.00%	8.28%	9.20%	10.92%	12.64%
NorthWestern Corporation	NWE	$2.56	$56.62	4.52%	4.61%	4.16%	3.50%	3.83%	8.77%	8.44%	8.11%
OGE Energy Corporation	OGE	$1.66	$35.78	4.63%	4.75%	3.88%	6.50%	5.19%	8.63%	9.94%	11.25%
Otter Tail Corporation	OTTR	$1.75	$76.56	2.29%	2.34%	4.91%	4.50%	4.70%	7.25%	7.04%	6.84%
Portland General Electric Company	POR	$1.81	$47.79	3.79%	3.87%	3.42%	5.00%	4.21%	7.29%	8.08%	8.87%
Southern Company	SO	$2.72	$69.17	3.93%	4.03%	3.09%	6.50%	4.79%	7.11%	8.82%	10.53%
Xcel Energy Inc.	XEL	$2.08	$64.49	3.23%	3.31%	5.01%	6.00%	5.50%	8.32%	8.82%	9.31%
Mean				3.74%	3.83%	4.98%	5.56%	5.27%	8.73%	9.10%	9.39%
Median				3.87%	4.03%	4.14%	6.00%	4.79%	7.80%	8.44%	9.58%

Notes:
[1] Source: Yahoo Finance
[2] Source:Yahoo Finance, equals 180-day, average as of August 26, 2023
[3] Equals [1] / [2]
[4] Equals [3] x (1 + 0.50 x [7])
[5] Source: Stock Analysis
[6] Source: Value Line
[7] Equals Average ([5], [6])
[8] Equals [4] + [5]
[9] Equals [4] + [7]
[10] Equals [4] + [6]

CAPITAL ASSET PRICING MODEL -- Value Line ERP, Regression Betas, and NPC Model

$K = Rf + \beta (Rm - Rf)$
$K = Rf + 0.25 \times (Rm - Rf) + 0.75 \times \beta \times (Rm - Rf)$

Company	Ticker	[1] Current 30-day average of 30-year U.S. Treasury bond yield	[2] Beta (β)	[3] Market Return (Rm)	[4] Risk Premium (Rm − Rf)	[5] ROE (K)
ALLETE, Inc.	ALE	4.03%	0.70	12.11%	8.09%	9.69%
Alliant Energy Corporation	LNT	4.03%	0.61	12.11%	8.09%	8.97%
Ameren Corporation	AEE	4.03%	0.54	12.11%	8.09%	8.40%
American Electric Power Company, Inc.	AEP	4.03%	0.57	12.11%	8.09%	8.64%
Avista Corporation	AVA	4.03%	0.45	12.11%	8.09%	7.70%
CMS Energy Corporation	CMS	4.03%	0.42	12.11%	8.09%	7.45%
Duke Energy Corporation	DUK	4.03%	0.50	12.11%	8.09%	8.07%
Entergy Corporation	ETR	4.03%	0.79	12.11%	8.09%	10.42%
Evergy, Inc.	EVRG	4.03%	0.58	12.11%	8.09%	8.75%
IDACORP, Inc.	IDA	4.03%	0.57	12.11%	8.09%	8.61%
NextEra Energy, Inc.	NEE	4.03%	0.57	12.11%	8.09%	8.60%
NorthWestern Corporation	NWE	4.03%	0.47	12.11%	8.09%	7.84%
OGE Energy Corporation	OGE	4.03%	0.72	12.11%	8.09%	9.82%
Otter Tail Corporation	OTTR	4.03%	0.50	12.11%	8.09%	8.10%
Portland General Electric Company	POR	4.03%	0.51	12.11%	8.09%	8.15%
Southern Company	SO	4.03%	0.57	12.11%	8.09%	8.67%
Xcel Energy Inc.	XEL	4.03%	0.44	12.11%	8.09%	7.60%
Mean						8.56%
Median						8.60%
						8.66%

Notes:
[1] Source: U.S. DEPARTMENT OF THE TREASURY
[2] Source: Regression
[3] Source: Value Line
[4] Equals [3] - [1]
[5] Equals [1] + [2] x [4]

CAPITAL ASSET PRICING MODEL -- Mean ERP, Regression Betas, and NPC Model

$K = Rf + \beta (Rm - Rf)$
$K = Rf + 0.25 \times (Rm - Rf) + 0.75 \times \beta \times (Rm - Rf)$

Company	Ticker	[1] Near-term projected 30-year U.S. Treasury bond yield (Q3 2023 - Q3 2024)	[2] Beta (β)	[3] Market Return (Rm)	[4] Market Risk Premium (Rm − Rf)	[5] ROE (K)	[6] ECAPM ROE (K)
ALLETE, Inc.	ALE	4.03%	0.70	11.04%	7.01%	8.94%	9.46%
Alliant Energy Corporation	LNT	4.03%	0.61	11.04%	7.01%	8.31%	9.00%
Ameren Corporation	AEE	4.03%	0.54	11.04%	7.01%	7.82%	8.62%
American Electric Power Company, Inc.	AEP	4.03%	0.57	11.04%	7.01%	8.02%	8.78%
Avista Corporation	AVA	4.03%	0.45	11.04%	7.01%	7.21%	8.17%
CMS Energy Corporation	CMS	4.03%	0.42	11.04%	7.01%	6.99%	8.00%
Duke Energy Corporation	DUK	4.03%	0.50	11.04%	7.01%	7.54%	8.41%
Entergy Corporation	ETR	4.03%	0.79	11.04%	7.01%	9.57%	9.94%
Evergy, Inc.	EVRG	4.03%	0.58	11.04%	7.01%	8.13%	8.85%
IDACORP, Inc.	IDA	4.03%	0.57	11.04%	7.01%	8.00%	8.76%
NextEra Energy, Inc.	NEE	4.03%	0.57	11.04%	7.01%	7.99%	8.76%
NorthWestern Corporation	NWE	4.03%	0.47	11.04%	7.01%	7.34%	8.26%
OGE Energy Corporation	OGE	4.03%	0.72	11.04%	7.01%	9.05%	9.55%
Otter Tail Corporation	OTTR	4.03%	0.50	11.04%	7.01%	7.56%	8.43%
Portland General Electric Company	POR	4.03%	0.51	11.04%	7.01%	7.60%	8.46%
Southern Company	SO	4.03%	0.57	11.04%	7.01%	8.05%	8.80%
Xcel Energy Inc.	XEL	4.03%	0.44	11.04%	7.01%	7.13%	8.11%
Mean						7.96%	8.73%
Median						7.99%	8.76%

Notes:
[1] Source: U.S. DEPARTMENT OF THE TREASURY
[2] Source: Regression
[3] Source: Mean of Value Line and Current Implied Risk Premium
[4] Equals [3] - [1]
[5] Equals [1] + [2] x [4]
[6] Equals [1] + 0.25 x ([4]) + 0.75 x ([2] x [4])

CAPITAL ASSET PRICING MODEL -- Value Line ERP, Unadjusted Bloomberg Betas, and NPC Model

$K = Rf + \beta\ (Rm - Rf)$

		[1]	[2]	[3]	[4]	[5]
Company	Ticker	Projected 30-year U.S. Treasury bond yield (2024 - 2028)	Beta (β)	Market Return (Rm)	Market Risk Premium (Rm − Rf)	ROE (K)
ALLETE, Inc.	ALE	4.03%	0.75	12.11%	8.09%	10.08%
Alliant Energy Corporation	LNT	4.03%	0.71	12.11%	8.09%	9.75%
Ameren Corporation	AEE	4.03%	0.70	12.11%	8.09%	9.66%
American Electric Power Company, Inc.	AEP	4.03%	0.64	12.11%	8.09%	9.20%
Avista Corporation	AVA	4.03%	0.65	12.11%	8.09%	9.30%
CMS Energy Corporation	CMS	4.03%	0.64	12.11%	8.09%	9.17%
Duke Energy Corporation	DUK	4.03%	0.64	12.11%	8.09%	9.17%
Entergy Corporation	ETR	4.03%	0.59	12.11%	8.09%	8.79%
Evergy, Inc.	EVRG	4.03%	0.79	12.11%	8.09%	10.39%
IDACORP, Inc.	IDA	4.03%	0.68	12.11%	8.09%	9.53%
NextEra Energy, Inc.	NEE	4.03%	0.73	12.11%	8.09%	9.96%
NorthWestern Corporation	NWE	4.03%	0.80	12.11%	8.09%	10.46%
OGE Energy Corporation	OGE	4.03%	0.89	12.11%	8.09%	11.25%
Otter Tail Corporation	OTTR	4.03%	0.82	12.11%	8.09%	10.70%
Portland General Electric Company	POR	4.03%	0.69	12.11%	8.09%	9.57%
Southern Company	SO	4.03%	0.67	12.11%	8.09%	9.44%
Xcel Energy Inc.	XEL	4.03%	0.63	12.11%	8.09%	9.08%
Mean						9.74%
Median						9.57%

Notes:
[1] Source: U.S. DEPARTMENT OF THE TREASURY
[2] Source: Unadjusted Bloomberg
[3] Source: Value Line
[4] Equals [3] - [1]
[5] Equals [1] + [2] x [4]

CAPITAL ASSET PRICING MODEL -- Mean ERP, Unadjusted Bloomberg Betas, and NPC Model

$K = Rf + \beta\ (Rm - Rf)$
$K = Rf + 0.25 \times (Rm - Rf) + 0.75 \times \beta \times (Rm - Rf)$

		[1]	[2]	[3]	[4]	[5]	[6]
Company	Ticker	Current 30-day average of 30-year U.S. Treasury bond yield	Beta (β)	Market Return (Rm)	Market Risk Premium (Rm − Rf)	ROE (K)	ECAPM ROE (K)
Alliant Energy Corporation	LNT	4.03%	0.71	11.04%	7.01%	8.99%	9.50%
Ameren Corporation	AEE	4.03%	0.70	11.04%	7.01%	8.92%	9.45%
American Electric Power Company, Inc.	AEP	4.03%	0.64	11.04%	7.01%	8.51%	9.14%
Avista Corporation	AVA	4.03%	0.65	11.04%	7.01%	8.60%	9.21%
CMS Energy Corporation	CMS	4.03%	0.64	11.04%	7.01%	8.49%	9.12%
Duke Energy Corporation	DUK	4.03%	0.64	11.04%	7.01%	8.49%	9.12%
Entergy Corporation	ETR	4.03%	0.59	11.04%	7.01%	8.16%	8.88%
Evergy, Inc.	EVRG	4.03%	0.79	11.04%	7.01%	9.55%	9.92%
IDACORP, Inc.	IDA	4.03%	0.68	11.04%	7.01%	8.80%	9.36%
NextEra Energy, Inc.	NEE	4.03%	0.73	11.04%	7.01%	9.18%	9.64%
NorthWestern Corporation	NWE	4.03%	0.80	11.04%	7.01%	9.60%	9.96%
OGE Energy Corporation	OGE	4.03%	0.89	11.04%	7.01%	10.29%	10.47%
Otter Tail Corporation	OTTR	4.03%	0.82	11.04%	7.01%	9.81%	10.12%
Portland General Electric Company	POR	4.03%	0.69	11.04%	7.01%	8.84%	9.39%
Southern Company	SO	4.03%	0.67	11.04%	7.01%	8.72%	9.30%
Xcel Energy Inc.	XEL	4.03%	0.63	11.04%	7.01%	8.41%	9.07%
Mean						8.98%	9.49%
Median						8.84%	9.39%

Notes:
[1] Source: U.S. DEPARTMENT OF THE TREASURY
[2] Source: Unadjusted Bloomberg
[3] Source: Mean of Value Line and Current Implied Risk Premium
[4] Equals [3] - [1]
[5] Equals [1] + [2] x [4]
[6] Equals [1] + 0.25 x ([4]) + 0.75 x ([2] x [4])

<u>AFFIRMATION</u>

I, Lance D. Kaufman, do hereby swear under penalty of perjury the following:

That I am the person identified in the foregoing Direct Testimony and that such testimony was prepared by me or under my direct supervision; that the answers and information set forth therein are true to the best of my knowledge and belief as of the date of this Affirmation; that I have reviewed and approved any modifications after the date of this Affirmation; and that if asked the questions set forth therein, my answers thereto would, under oath, be the same.

Dated this 1st day of September, 2023.

Lance D. Kaufman

LANCE D. KAUFMAN

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that I have this day served the foregoing **Prepared Direct Testimony of Lance D. Kaufman on behalf of Wynn Las Vegas, LLC, Circus Circus Las Vegas, LLC, HR Nevada, LLC, Smart Energy Alliance, Caesars Enterprise Services, LLC, Southern Nevada Water Authority and MGM Resorts International, Inc.** upon each of the parties on the attached service list in this proceeding via electronic mail.

DATED this 1st day of September, 2023.

/s/ Jesse O. Gorsuch
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