


The Impact of Revenue Decoupling on the Cost of Capital for Electric Utilities: An Empirical Investigation

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I. OVERVIEW AND SUMMARY

Research into the costs and benefits of energy efficiency (EE) technologies has shown that the expected value of long-run savings frequently exceeds the costs, and EE programs have the additional benefit of producing no harmful emissions. From 2007 to the present, several more states have adopted long-term goals for EE and have designated utilities, and in a few cases third party entities, as the program administrators. Despite the programs being beneficial and cost-effective to society and to utility systems, traditional regulation creates a substantial disincentive for utilities to pursue EE programs.

Traditional cost-of-service ratemaking collects a utility's total costs, fixed and variable, largely through volumetric rates. A large portion of an electric, gas, or water utility's costs is fixed in the short run and does not vary with the quantity of the service provided (kWh, Therms, or Cubic feet). A successful EE program will reduce the volume of sales, which will simultaneously reduce the recovery of fixed costs. If sales are lower than expected when rates are set, a utility will not fully recover its authorized fixed-cost revenue requirement; and if sales are higher than expected, a utility will over-collect its revenue requirement. As a result, utilities have what is often called a "throughput incentive" that conflicts with the objectives of EE programs.

Decoupling is a form of regulated ratemaking that disconnects fixed cost recovery from changes in the utility's sales volume.¹ It originated as a policy response in the 1980s when utilities were first encouraged to develop EE programs that significantly reduced the consumption of regulated commodities, such as electricity, gas, or water.² Decoupling solves the throughput incentive. The Brattle Group's (Brattle) recent survey of new, alternative ratemaking policies listed 22 states that allowed gas industry decoupling, 12 states that had electric industry decoupling, and 5 states had water conservation adjustments.³ This report builds on several public surveys of alternative

¹ "Decoupling," as used in this report, means decoupling through symmetric revenue true-up mechanisms. An overall base revenue target is established for a future period. A periodic adjustment of volumetric rates is instituted to true up actual revenues to target revenues, whether actual revenues are above or below the target. Two other alternative ratemaking policies have some similarities but are not included in this study. One is the lost revenue adjustment mechanism (LRAM) for recovering only base revenues lost from validated EE volumetric savings. A second policy is the straight fixed-variable rate design that collects all or most fixed costs in non-volumetric charges.

² This report focuses on the electric utility industry. There are many similarities and common lessons for decoupling policy development in the electric, natural gas, and private water service industries. Prior research by The Brattle Group addressed the natural gas delivery industry, see footnote 5 below.

³ Joe Wharton, Bente Villadsen, and Heidi Bishop, *Alternative Regulation and Ratemaking Approaches for Water Companies - Supporting Capital Investment Needs of the 21st Century*, The Brattle Group, Prepared for the National Association of Water Companies, September 30, 2013. The number of

Continued on next page

ratemaking policies that include decoupling.⁴ In the last half dozen years, decoupling has grown rapidly in the electric industry coincident with the upsurge in expenditures for conservation programs, efficiency standards, and the general flattening of electricity sales growth.

Because of the potential effect on the cost of equity (COE), the adoption of EE programs accompanied by a decoupling policy is sometimes resisted by both regulated companies and interveners for opposite reasons. Some interveners and commission staffs have argued that the allowed return on equity (ROE) should be reduced because decoupling, by design, reduces the variability of revenues, which they believe translates directly into reduced business risk. If the allowed ROE is not reduced, those interveners may not support decoupling. Utilities fear that adoption of decoupling will result in a reduction in the allowed ROE even if there is no proof that decoupling actually reduces the cost of capital. Determining the actual, empirical effect of decoupling on the utility's cost of capital is critical to answering the question of whether the regulated company's allowed cost of capital should be reduced at the time of adoption.

The Brattle authors have considerable experience with the issues of decoupling rate policy and the frequently asked question as to whether it has a measurable impact on the cost of capital (COC) of regulated companies, as assessed in financial markets. In 2010 and again in 2013, the authors empirically tested the hypothesis in the natural gas delivery industry and found that there was no statistically measurable effect on the COC with decoupling.⁵ In this report, we test

Continued from previous page

companies and states with decoupling changes relatively frequently. For example, Washington State returned to decoupling in mid-2013, a change that was not in the Brattle survey, *Op. Cit.*

⁴ Sources of information on decoupling and other alternative regulatory policies beyond the Brattle survey *Op. Cit.* include Pamela Morgan, *A Decade of Decoupling for U.S. Energy Industries: Rate Impacts, Designs, and Observations*, Dec. 2012; Edison Electric Institute (EEI), *Alternative Regulation for Evolving Utility Challenges: An Updated Survey*, Pacific Economics Group Research LLC, Jan. 2013; Institute of Electric Efficiency (IEE), *State Electric Efficiency Regulatory Frameworks*, July 2013; and American Gas Association (AGA), *Natural Gas Innovative Rates, Non-Volumetric Rates, and Tracking Mechanisms Current List*, Cynthia J. Marple, power point presentation, Sept. 2012. For this study, Brattle reviewed many of the sources and updated the periods that decoupling policies have been in place for different states.

⁵ In the previous research, the authors analyzed a sample of 12 natural gas delivery holding companies (HCs) and their 31 regulated gas subsidiaries over the period 2005 to 2012. The number of gas subsidiary companies operating under decoupling grew from 8 to 22 over the period. This analysis made accurate measurements of the cost of capital and developed consistent measurements of the degree of decoupling of each HC for a decoupling "metric". The findings were that decoupling shows no statistically significant impact on the COC either up or down. See J. Wharton, M. Vilbert, C. Gibbons, and S. Lagos, *An Empirical Study of Impact of Decoupling on Cost of Capital*, Power Point presentation to the Western Conference of the Rutgers University Center for Research in Regulated Industries (CRRI), June 21, 2013.

the same hypothesis for a different set of utilities which are predominantly in the electric utility business.

Theoretical arguments for reducing the cost of capital are frequently offered by interveners in decoupling regulatory proceedings for electric and natural gas companies and have been accepted in a small number of commission decisions.⁶ In some proceedings, different interveners have suggested that the effect of decoupling on ROE is anywhere from 25 basis points (bps) to 300 bps.⁷ In the past, the Brattle authors have testified that in these regulated, high fixed cost industries, the determinants of the cost of capital are complicated,⁸ and there should be no presumption that decoupling automatically lowers the cost of capital. Adoption of decoupling policies could be coincident with other influences that may be increasing non-diversifiable risk.⁹ Any reduction in the allowed return on equity should be based upon evidence that decoupling reduces the cost of capital.

The results of our empirical analysis of decoupling in the electric industry do not support the hypothesis that utilities with decoupling have a lower cost of capital than utilities without decoupling. Our study finds that decoupling is not associated with a statistically significant decrease in the estimated cost of capital. This result is consistent with our previous findings for the natural gas distribution industry.

⁶ Pamela Morgan reports that the return on equity (ROE) was not reduced in 78% of the Commission decisions adopting decoupling. The remaining decisions reduced the allowed ROE by 10 and 50 basis points. In settlements, 85% had no ROE reductions and the remaining 15% were between 10 and 25 basis points. See “A Decade of Decoupling for U.S. Energy Industries: Rate Impacts, Designs, and Observations”, Dec. 2012, p. 14.

⁷ For example, see pp. 19-20 of “Phase 1B Testimony of Terry L. Murray on behalf of the Division of Ratepayer Advocates on Return on Equity Adjustments” before the California Public Utilities Commission, filed October 19, 2007 in Docket No. I. 07-01-022. Also see a recent discussion on p. 44 of Washington Utilities and Transportation Commission, *Puget Sound Energy, Final Order Granting Petition*, Docket UE-121697, Section D.2.b “Decoupling – Cost of Capital,” June 25, 2013.

⁸ See Chapters 7-9, Brealey, Myers and Allen, *Principles of Corporate Finance*, 11th edition, McGraw Hill Irwin, 2014 for a discussion of the cost of capital.

⁹ Diversifiable risks, such as weather, do not affect the cost of capital because diversifiable risks can be eliminated by investing in a portfolio of unrelated assets.

II. DEVELOPMENTS IN THE POLICY OF REVENUE DECOUPLING

Adoption of a revenue decoupling policy¹⁰ severs the link between recoveries of base or fixed revenues¹¹, from volumetric sales of kWh, which would normally be the case under traditional cost-of-service regulation. Cost recovery is not based upon actual kWh sales, but instead on a revenue target. Revenues are adjusted to achieve the target. For example, the percent growth in revenues relative to the base period could be set at actual net percentage growth in the numbers of customers over the base period. Over a pre-established period, such as a year, there is an adjustment of rates that will true-up the actual revenues to the target, whether actual sales are higher or lower than expected.

Current decoupling policies frequently evolve from the same policy basis as the earliest version, which was instituted in California in 1980 for natural gas utilities and in 1982-83 for electric utilities.¹² California policy makers determined that decoupling would be “in the public interest” in part because it provided relief for differences in actual revenues compared to forecast revenues when utilities carried out policy directives to pursue aggressive energy efficiency goals. Customers are protected if sales are greater than forecast, and utilities recover their fixed costs if EE programs are more effective than expected.¹³

Figure 1 illustrates the substantial increase in EE expenditures by electric utilities since 2007 as well as two projections of expenditures in 2025.¹⁴ The growth of EE programs, the consequent installation of efficiency measures (equipment and structures), and the concurrent decline in

¹⁰ The treatment of decoupling in this study is straight forward: at a given time for a given state-regulated electric company, a decoupling policy is in place, or it is not. Beyond what is discussed in footnote 1, we recognize but do not attempt to differentiate the several different kinds of decoupling mechanisms. Decoupling policies can vary in several dimensions: the companion revenue adjustment mechanism, the coverage and independence of rate classes; the inclusiveness of causes of demand fluctuation (weather fluctuations may be excluded); the adjustment over time using revenue target adjustment mechanism (numbers of customers and certain cost categories can be used to adjust targets over time).

¹¹ Lost revenues for the recovery of variable costs, such as fuel and purchased power, are not included in decoupling true-ups because variable costs are avoided with the reduction in kWh consumption. Fixed costs only change in the long-term when depreciation and conservation leads to less system investment.

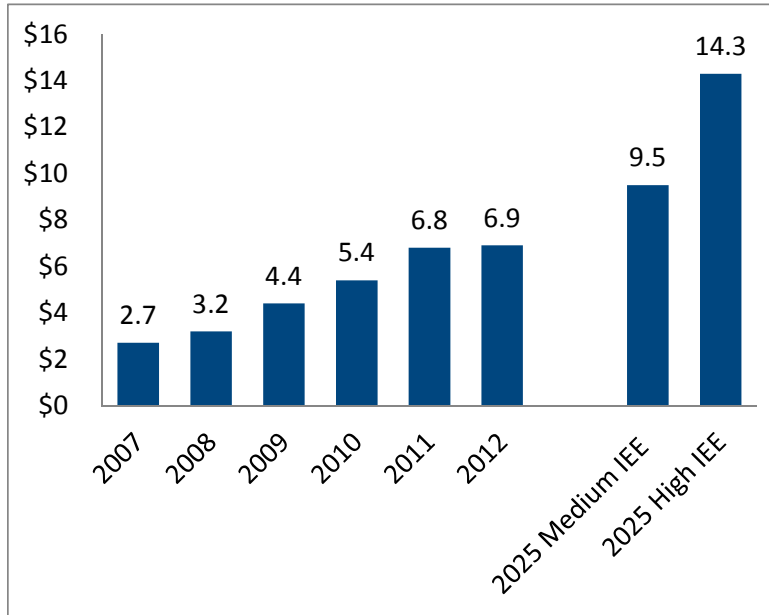
¹² Dr. John L. Jurewitz, *Decoupling and Energy Efficiency Incentives: The California Experience*, EEI 2007 Spring Legal Conference, Charleston, SC, April 16, 2007.

¹³ In addition, disputes over sales forecasts may be reduced because the earnings of the regulated company are not affected by differences in forecasts.

¹⁴ Institute of Electric Efficiency (IEE); *State Electric Efficiency Regulatory Frameworks*, July 2013, p. 2. The values are spending and budgets for customer-funded electric efficiency programs.

kWh sales growth, especially for small customers on volumetric rates, highlights the importance of addressing the throughput incentive of regulated utilities.

Figure 1: U.S. Energy Efficiency Expenditures (Customer Funded, in \$ Billions)



Source: Institute for Electric Efficiency, 2013

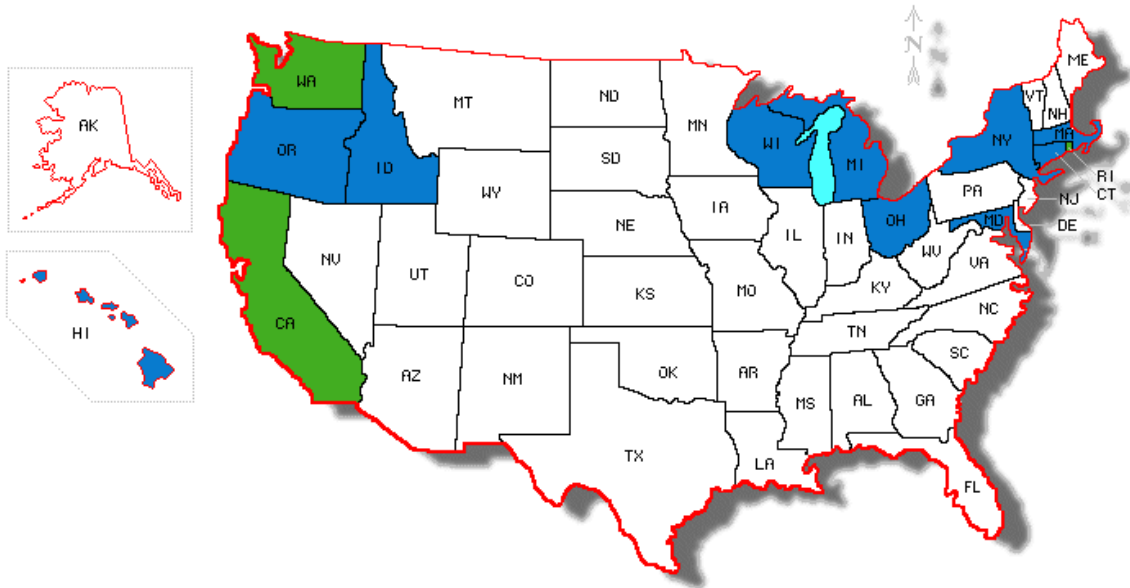
Figure 2 displays a map of the states that at present or in the recent past have had a policy of decoupling.¹⁵ This is the starting point of the analysis. Utilities in California, Washington, and Rhode Island (shown in green) were not used in our sample. National Grid is the holding company for Narragansett Electric in Rhode Island. Observations were removed in the financial data screening because National Grid is a company based in the United Kingdom, so capital market information may not be compatible.¹⁶ The major California utilities had the policy of decoupling or its equivalent across the entire study period 2005 – 2012, and saw no change in policy, so there was no way to compare the cost of capital before and after adoption of

¹⁵ In principle and practice, decoupling can be ended. Our sample includes utilities in Michigan where decoupling for electric utilities was instituted by the commission for several electric companies and later determined to be illegal under state law.

¹⁶ National Grid is traded as an American Depository Receipt (ADR) and so is excluded from the analysis.

decoupling. Washington state regulators approved decoupling for Puget Sound Energy in June 2013, after the study period ended.¹⁷

Figure 2: States with a Policy of Decoupling for Electric Utilities at Some Point in Time from 2005 to the Present

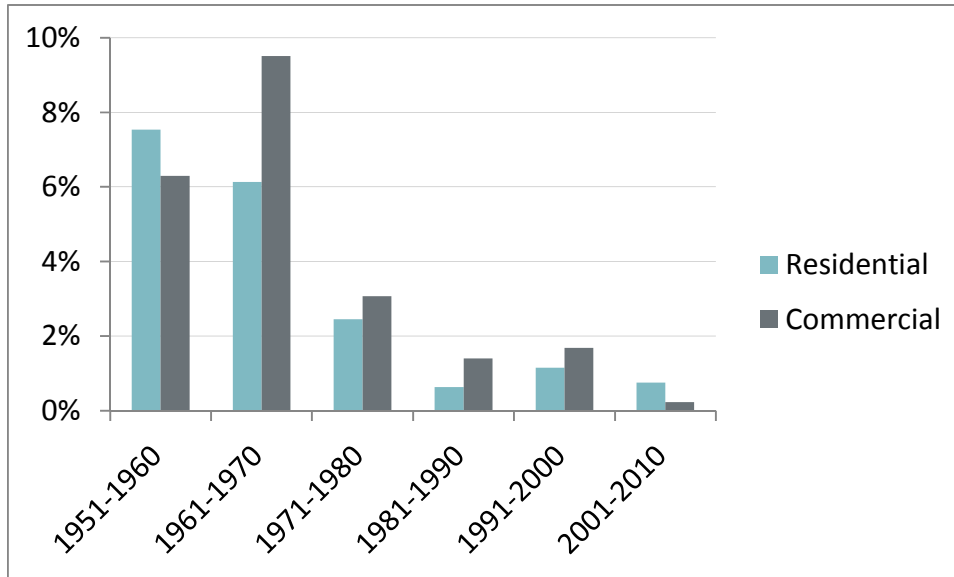


Source: The Brattle Group, *Alternative Regulation and Ratemaking Approaches for Water Companies*, Sep. 30, 2013. All states were in the study sample, except Washington, California, and Rhode Island, shown in green.

Decoupling policies often focus on the residential and commercial classes, where volumetric charges collect a considerable portion of the base revenue requirement that recovers capital investment and fixed operations and maintenance (O&M) costs of distribution. Figure 3 shows the downward trend in residential and commercial electric consumption growth in recent decades, indicating that it is likely to be lower than population or GDP growth in the future. Decoupling can be used to address the situation where fixed and unavoidable costs continue to increase, but where sales volume growth is slow or decreasing for any reasons, including the utility's EE programs, building codes, appliance efficiency standards, and the installation of distributed generation systems on customers' premises.

¹⁷ See Washington Utilities and Transportation Commission, Puget Sound Energy, *Op. Cit.*, footnote 7. Puget Sound Power & Light, predecessor to Puget Sound Energy, had a decoupling mechanism in place from 1991 to 1995, at which time it was discontinued. This is before the Study Period.

Figure 3: Trends in Electric Consumption Growth by Decade: 1951 - 2010



III. COST OF CAPITAL THEORY AND THE IMPACTS OF DECOUPLING

A regulated utility's operating earnings (i.e., earnings before income taxes) are the difference between base revenues (non-fuel) and the sum of all prudent costs, including O&M, administrative and general (A&G), depreciation, and interest. There are several sources of variability in the base revenue stream that can be eliminated by the decoupling mechanism analyzed here. EE programs normally decrease revenues because they decrease sales. Other increases and/or decreases in base revenues are driven by changes in weather, business activity over the business cycle, the number of net new customers, local, state and federal building and appliance codes and standards, and the number of delinquent bills. By design, decoupling ratemaking eliminates or significantly weakens the linkage between revenues and the volume sold, independently from the sources of variability.

Decoupling should stabilize revenues, but net income can still vary. Although depreciation and interest expense are relatively stable, other costs can change materially between rate cases. At times of rapid capital investment, for example, when utilities face significant environmental retrofits and replacements, depreciation and interest may also increase rapidly and put pressure on earnings unless there are more frequent rate cases to adjust base revenues.

If decoupling stabilizes the revenue side of the earnings equation, does it stabilize operating earnings as well? This leads directly to the question: does decoupling reduce non-diversifiable risk since this is the risk that determines the cost of capital in financial markets? We shall see that the answer is not a simple "yes."

Not all risks or sources of variance in earnings affect the cost of capital equally, because investors can avoid certain risks. Diversification through portfolio formation can remove diversifiable risks; therefore, diversifiable risks do not affect the cost of capital. For example, extreme weather will cause variance in a single utility's revenues and are a risk factor for that utility's earnings. However, investors can assemble a portfolio of utility stocks from across the climate zones in the United States, thus mitigating the effects of weather on individual stocks. For a portfolio of utility stocks, the effect of weather variations should largely cancel out, removing weather as a source of investment risk, and negating its effect on the cost of capital. Non-diversifiable risks (also known as "business risks") are the risks that remain after diversification. Because investors must bear them, these risks affect a company's cost of capital. The distinction between diversifiable risk and non-diversifiable business risk is important to recognize when evaluating the effect of decoupling, or other regulatory policies, on a company's cost of capital. Simply reducing total risk, i.e., the sum of diversifiable and non-diversifiable risk, does not imply that the cost of capital has been reduced. The risk reduced must be part of a company's business risk, i.e., its non-diversifiable risk, to affect its cost of capital.

Decoupling is often praised by credit rating agencies because it clearly reduces total risk, which is the risk important to bond holders. Adoption of decoupling could reduce the overall cost of capital for a company through a reduction in the cost of debt, but that would not justify a reduction in the allowed ROE. Only reductions in business risk justify a reduction in a regulated company's allowed ROE.

The effect of decoupling on the cost of capital in the current electric environment of low growth and high investment cannot be determined solely on theoretical reasoning. Empirical analysis is needed, looking at the record compiled by utilities across the nation, both before and after adoption of decoupling mechanisms.

IV. CREATING A DECOUPLING SAMPLE OF REGULATED ELECTRIC UTILITIES

We start with a large sample of regulated electric company subsidiaries and their holding companies, then compile data on which have a decoupling policy and when it was officially adopted. We immediately note an important dichotomy. Holding companies, not their subsidiaries, have publicly traded stock that provides the financial information necessary to estimate the cost of capital. On the other hand, individual, state-regulated subsidiaries, not the holding companies themselves, apply for, and are granted, the policy of decoupling. Our methodology addresses this dichotomy. We measure the degree of decoupling of each holding company by examining the decoupling policies of its subsidiaries after differentiating each state

in which a subsidiary operates. We use the subsidiary's share of the holding company's asset to establish the weights of the different subsidiaries.¹⁸

Another feature of the study design is to analyze only a sample of regulated utilities that have experienced a change in decoupling policy within the study period, 2005 to 2012.¹⁹ As mentioned above, adoption of decoupling has been increasing along with the surge in spending on EE programs. There are several recent public surveys of alternative ratemaking policies that include decoupling.²⁰ In the fall of 2013, Brattle, and specifically one of this report's authors, completed a major study comparing the alternative ratemaking schemes of electric utilities on behalf of the National Association of Water Companies.²¹ The report used and supplemented the public survey data on regulated electric utilities that had adopted decoupling as of the summer of 2013. This report supplements the earlier sources with additional information on the Specific Date on which the regulatory policy of decoupling was adopted for each state subsidiary.²²

¹⁸ In this report, we use the term "subsidiary" to refer to the segment of a utility that is regulated at the state level. A particular holding company might own two utilities that are separate corporations. Assume the first is located in a single state, while the second has a service territory extending over three states. In our analysis, this holding company would have four "subsidiaries" for purposes of calculating its degree of decoupling. There are also situations, such as Con Edison in NY, where a holding company owns more than one subsidiary within a single state, and the individual subsidiaries get decoupling at different times. Our weighted average decoupling metric captures this.

¹⁹ The choice of the study period was deliberate. The study started with the first quarter of 2005 when no holding companies in our sample had an electric subsidiary under decoupling. That continued for seven quarters until first quarter of 2007, when Idaho Power was decoupled. Thus, the study period has eight quarters of data for observing cost of capital without decoupling. There followed steady growth in decoupling across the sample states for the next six years, as shown in Figure 4. Our project and the data collection were initiated in the middle of 2013, so the last quarter of 2012 was used as an end point.

²⁰ Sources of information on decoupling and other alternative regulatory policies are cited in footnotes 3 and 4. Where there are disagreements, Brattle investigated and decided which policies to include for a state.

²¹ The Brattle Group, *Alternative Regulation and Ratemaking Approaches for Water Companies*, *Op. Cit.* Footnote 3. See Appendix A, "Tabulation of the Alternative Regulatory and Rate Approaches in the Three Infrastructure Industries."

²² We assume that for a particular state subsidiary, this Specific Date of approval is the likely date when any uncertainty in capital markets about adoption of decoupling is fully resolved, resulting in the possible change in cost of capital from a reassessment of the future risk for the holding company that owned the state regulated electric utility at issue. Capital markets are forward looking, and investors are aware of regulatory proceedings that potentially affect future risk. We report in the final section some results that test whether the capital markets anticipate the adoption of decoupling by one, two or three quarters prior to the Specific Date.

Each Specific Date was initially defined as the month and year of adoption. This was then converted to a quarter and year, so as to match the financial data. Decoupling for a state-regulated electric subsidiary is a binary variable, 0 or 1. On its Specific Date, each state subsidiary goes from 0, not decoupled, to 1, decoupled, or in the reverse direction. In general, a holding company may have several subsidiaries, and the Decoupling Index for the holding company is a weighted average of its subsidiaries. The decoupling index changes on each Specific Date, with the weights being the relative book value of assets in the subsidiaries with decoupling compared to the total book value of total assets of the holding company. Thus, for each sample holding company, we calculate a percentage of total assets that are decoupled as of each quarter in the study period. For example, a company with two subsidiaries, one decoupled representing 40 percent of the total assets and the other not decoupled, would have a decoupling index of 0.40 in the quarter.

The calculation of the decoupling index is sometimes complicated by the fact that some regulated subsidiaries cover more than one state and could have decoupling in one state and not the other. In that circumstance, we estimate the percentage of assets that are decoupled for that subsidiary by reference to the percentage of MWh of electricity consumed in the separate jurisdictions compared to the total MWh for the entire subsidiary. This is necessary because the distribution of assets of a multistate subsidiary is not generally reported.

The decoupling sample development started with the Brattle *Alternative Rates* Report of September 2013, supplemented by additional information. The initial list included 98 state regulated electric companies in 42 states. The final sample contains a subset of the following size:

- 14 electric holding companies;
- 21 state-regulated electric subsidiaries of the holding companies. The subsidiaries operate in 11 states and during some quarters in the study period had decoupling;
- 32 quarters from 2005 through 2012, when growth in the policy of decoupling was rapid; and
- 291 observations, each pertaining to a holding company and consisting of the cost of capital in that quarter, the decoupling index value in that quarter, and a set of explanatory or dummy variables, as discussed below in Section V. Holding company data financial data are screened for potential bias, using a set of standard financial and other criteria that Brattle uses continuously when estimating the cost of capital. The criteria are discussed in Section V.

Figure 4 shows the increase in the total state subsidiaries in our sample with decoupling over the study period.

**Figure 4: Count of State Regulated Subsidiaries
In Sample with Decoupling over the Study Period 2005 – 2012**

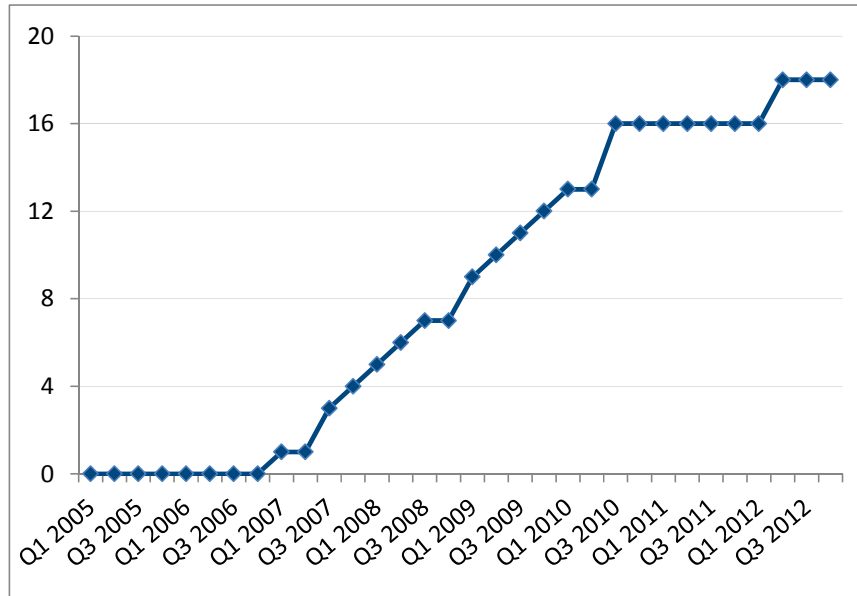
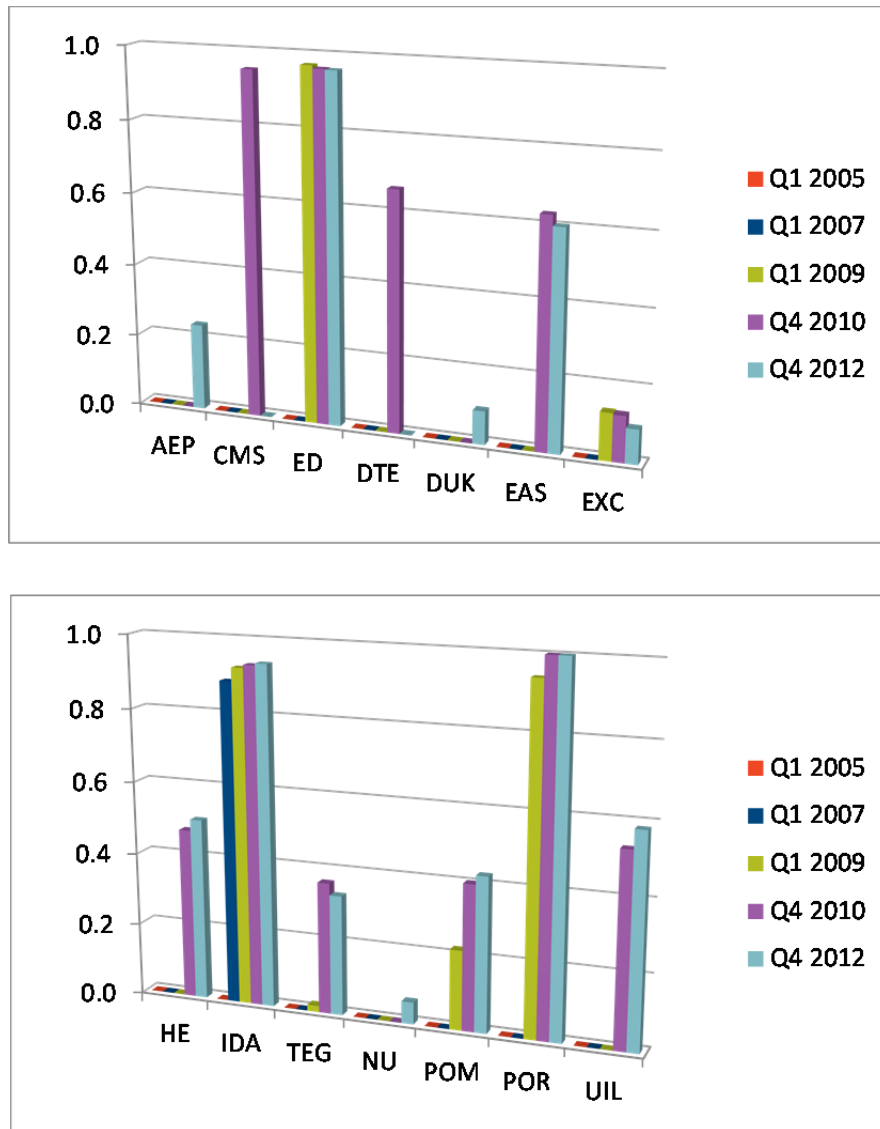


Figure 5 displays the decoupling index values for the 14 individual holding companies at selected times over the study period. These holding companies had no decoupling at the beginning in 2005 – 2006, but this changed substantially over the next six years.

Figure 5: The Level of Electric Decoupling Index for 14 Holding Companies in 5 Selected Quarters in Study Period



The holding companies are American Electric Power Co. Inc. (AEP), CMS Energy Corp. (CMS), Consolidated Edison, Inc. (ED), DTE Energy Co. (DTE), Duke Energy Corp. (DUK), Energy East (EAS), Exelon Corp. (EXC), Hawaiian Electric Industries Inc. (HE), IDACORP Inc. (IDA), Integrys Energy Group Inc. (TEG), Northeast Utilities (NU), Pepco Holdings Inc. (POM), Portland General Electric Co. (POR), UIL Holdings Corp. (UIL).

V. ESTIMATION OF THE COST OF CAPITAL FOR THE ELECTRIC INDUSTRY

This section explains the estimation of the cost of capital for the sample holding companies. First, the universe of holding companies is screened to remove companies whose estimated cost of capital could be biased by other factors. To be in the sample, the holding companies must meet all of the following conditions:

- no recent, substantial merger and acquisition (M&A) activity;
- investment grade credit rating, i.e., BBB- or better;
- has not cut its dividend in the last two quarters; and
- is a U.S. company.

Substantial M&A activity is defined to be a merger or acquisition/divestiture comprising 25 percent or more of the pre-merger book value of assets of the company. The stock prices of companies involved in mergers or acquisitions react more to the latest news on the progress of the M&A than to developments in the capital markets, but this is contrary to the assumptions underlying the cost of capital estimation models. A holding company with substantial M&A activity is dropped from the sample for the period one quarter before the quarter of the merger announcement through two quarters after the quarter in which the merger was consummated or abandoned.

Companies with non-investment grade credit ratings are generally considered to be in financial distress so that their cost of capital estimates could be affected by the market's perception of their likely survival in their current form. Similarly, companies resist cutting dividends unless absolutely necessary to conserve cash. Cutting the dividend is viewed by the market as a signal of some level of financial distress, so we require that there be no dividend cuts in the previous two quarters. Finally, only U.S. companies are considered because the cost of capital may differ for companies whose home capital market is in another country. In all these situations, the cost-of-capital estimates are likely to be biased.

Estimating the Overall After-Tax Weighted-Average Cost of Capital

We estimate the cost of capital quarterly for the period quarter 1, 2005 to quarter 4, 2012. The following describes the steps we used to calculate the overall cost of capital for each of the 14 holding companies listed in Figure 5 above. First, we calculate the cost of equity, COE, using the constant growth version of the discounted cash flow model (DCF).

$$\begin{aligned} r &= \frac{D_1}{P} + g \\ &= \frac{D_0 \times (1 + g)}{P} + g \end{aligned} \tag{1}$$

where “D1” is the dividend expected at the end of the first period, “g” is the perpetual growth rate, and “P” and “r” are the market price and the cost of equity, respectively.

The COE is the information of interest to regulators when they set the allowed ROE for a utility, so our focus is ultimately on whether there is a measurable reduction in the COE from the policy of decoupling.²³ In general, the COE increases not only with increased business risk but also with increased financial risk.²⁴ Therefore, in testing for an impact on the cost of capital from decoupling, we systematically account for differences in the COE in different holding companies in the samples that arise from different levels of financial risk, which has nothing to do with decoupling.

This analysis relies on the DCF model instead of the Capital Asset Pricing Model (CAPM) because the DCF model is the more forward looking model. The beta parameter in the CAPM is normally estimated using three to five years of historical data, but historical data would not capture the effect of a change in risk from the adoption of decoupling. In contrast, the DCF model relies upon the current stock price and a forecast of the future growth of earnings and dividends. We use an average over 15 trading days for the current stock price and security analyst earnings five-year forecasts from Thomson-Reuters.

Second, we calculate the company's after-tax weighted-average cost of capital (ATWACC) which measures the overall cost of capital for the firm. To control for the effect of differences in capital structure (i.e., differences in financial risk) among the sample companies, we converted estimates of the COE into corresponding estimates of the overall ATWACC.²⁵ The ATWACC measures the cost of capital for the business itself, while the COE estimate represents the cost of equity capital taking into account the equity-holders' additional financial risk from the company's level of debt financing. In other words, the ATWACC measures business risk, while the COE is also affected by financial risk. We use the ATWACC in our statistical analysis below to control for differences in financial risk. Of course, the effect of decoupling on the cost of capital would primarily be reflected in the COE, but it could also affect the cost of debt, albeit with a lag.

The ATWACC is a better measure of the relevant cost of capital for our investigation because it takes differences in capital structure among the sample firms into consideration. Firms with

²³ In general, the regulator sets the allowed return on equity equal to the estimated cost of equity in order to provide the regulated company a fair opportunity to earn its cost of capital. In some circumstances the regulator may set the allowed ROE above or below the COE to compensate for differences in risk between the regulated company and the sample companies.

²⁴ Financial risk, as distinct from business risk, is related to the degree to which the company's assets are debt financed. The greater the share of debt in the capital structure, the greater the interest that must be paid out of operating revenues before any shareholder earnings are available.

²⁵ To be specific, the ATWACC is the measure we use; it is a weighted average of both the cost of equity and cost of debt after taking into account the tax deductibility of interest payments. The weights used in the calculation are the market values of debt and equity in the capital structure. See Chapter 20 of Brealey, Myers and Allen, Op Cit.

similar assets will have different cost of equity if they have different capital structures even though their overall cost of capital may be identical. The ATWACC is calculated as follows:

$$ATWACC = r_D \times (1 - T_C) \times \% D + r_E \times \% E \quad (2)$$

where r_D = market cost of debt,
 r_E = market cost of equity,
 T_C = corporate income tax rate,
 $\% D$ = percent debt in the capital structure, and
 $\% E$ = percent equity in the capital structure.

- The cost of debt, r_D , is based upon the yield on utility debt from Bloomberg's utility bond index for companies of comparable S&P credit ratings.
- For T_C , we use a 40 percent combined federal and state corporate tax rate for all companies.²⁶
- For those companies with preferred equity in their capital structures, we estimate the return on preferred equity as equal to the before tax return on the company's debt and weigh it by its share in the capital structure.²⁷
- The market value of equity, E , is calculated as the product of P , the price of the stock, and the number of shares outstanding at the time.
- The market value of debt, D , is approximated by the book value of debt because the market value of debt and the book value were not substantially different.
- The market value of preferred, P_f , is also approximated by the book value of preferred equity if there is any in the capital structure.
- The total market value of the firm is the sum of the E , D and P_f .

The result of this process is an estimate of the ATWACC for each sample company for each quarter of the sample period.

²⁶ Although state tax rates vary, a combined 40 percent rate is used for all to avoid any distortions in the results from attempting to model different tax rates.

²⁷ This is an approximation because we do not know of an index for the cost of preferred equity. The approximation is not likely to have a large effect because the percentage of preferred equity in the companies' capital structures is relatively small.

VI. AN EMPIRICAL TEST OF THE EFFECT OF DECOUPLING ON THE COST OF CAPITAL

Finally, we test the effect of decoupling on the overall cost of capital by regression analysis on the time series of our estimated ATWACCs for the sample of holding companies. The dependent variable is the overall cost of capital, i.e., the ATWACC, and the prime explanatory variable is the decoupling index. We use dummy variables to capture the fixed effects for the different holding companies and for different time periods. These are discussed in more detail below in the section on the Regression Model.

Regression Model

We estimate the following regression model:

$$ATWACC_{i,t} = \beta_0 + \beta_1 * Decoupling\ Index_{i,t} + \beta_2 * QTR_t + \beta_3 * Company_i + \varepsilon_{it} \quad (3)$$

For the ROE estimate in the ATWACC, we use the single-stage version of the DCF model based upon security analysts' 5-year forecasts of company-specific earnings growth. QTR_t is a dummy variable for the quarter (period t) of the estimate, and $Company_i$ is a dummy variable for the specific company (company i).

In assembling the data set, we recognize that detecting the effect on decoupling will be affected by a number of factors. The *Company* dummy variable captures the difference in the average ATWACC by company, which can be due to such factors as the average amount of unregulated assets compared to regulated assets in the holding company or due to differences in regulation in the various states. There are 14 companies in the sample, so there are 13 Company variables. Unlike our previous study of gas LDCs, the 14 company electric sample is not nearly as close to a "pure-play" sample. That is, the electric utility holding companies are larger and more diverse than the gas LDC sample. There may be changes in the risk of unregulated assets that we are not fully capturing.

The *QTR* dummy variable captures the variation in average ATWACC across companies in a quarter due to differences in interest rates or other economic conditions. Our period covers eight years or 32 quarters so there are 31 *QTR* variables. The *QTR* dummy variables are intended to control for macro-economic effects on the average cost of capital for the sample, which is important given that our study covers a very unusual period for the U.S. economy. The U.S. suffered the worst recession since the Great Depression. Interest rates generally declined.

Decoupling could be signaling the company is entering a period of higher risk. Decoupling reduces both the upside and the downside for a regulated company. If a company believes that policies or economic conditions impose additional risk, the company may request decoupling to mitigate rising risk. On the other hand, state policy makers and commissions may seek to impose decoupling to ensure success of EE programs. Perhaps decoupling reduces risk but not enough to offset the increase in risk due to other associated policies or circumstances.

Finally, we know that financial markets are forward looking. Information is available to the market when a company files for decoupling and the ongoing status of the hearings, and when decisions are expected. To test whether these expectations led the markets to adjust the cost of capital before the decision was released, we consider three alternative periods for when financial markets react to the possibility that decoupling may be implemented. The periods are one, two or three quarters *before* the quarter that the decision was announced, i.e., the Specific Date.²⁸ We use these alternative anticipation dates in separate models to serve as robustness checks for our primary, contemporaneous specification.

The coefficient of interest for testing our hypothesis is β_1 , the coefficient on the Decoupling Index. We consider a null hypothesis that decoupling does not lower the cost of capital, i.e., the ATWACC. This framework allows us to determine whether there is statistically significant evidence in favor of the contention that decoupling does lower the ATWACC.

Statistical Results

The results of our test for each of the four models with varying financial market anticipation are all in general agreement and fail to reject the claim that decoupling does not lower the cost of capital. Although the coefficient on the decoupling index is negative, the null hypothesis that the coefficient is zero or positive (i.e., not negative) cannot be rejected at the 5% level. Hence, there is no statistical support for the claim that decoupling leads to a decrease in the cost of capital. The primary point estimate from the contemporaneous model is -41 bps, with point estimates ranging from -46 to -49 bps for the models with anticipation by the capital markets. The estimated impacts and associated one-sided *p*-values are shown in Table 1 for all four models. The *p*-values are all above the conventional 0.05 level and are generally above the 0.10 level as well, therefore justifying our conclusion that decoupling does not lead to a statistically significant decrease in the cost of capital.²⁹

²⁸ We also recalculate the holding company Decoupling Index for each of the earlier periods in which the effect of decoupling could be reflected in the capital markets.

²⁹ In testing for statistical significance, the *p*-value is the probability of obtaining a test statistic at least as extreme as the one observed, assuming the neutral or null hypothesis is true, which in this case is that decoupling does not reduce the cost of capital. “In most scientific work, the level of statistical significance required to reject the null hypothesis (i.e., to obtain a statistically significant result) is set conventionally at .05, or 5%. The significance level [or *p*-value] measures the probability that the null hypothesis will be rejected incorrectly, assuming that the null hypothesis is true.” See Rubinfeld, Daniel, “Reference Guide on Multiple Regression” in National Research Council, *Reference Manual on Scientific Evidence*, 3rd ed. Washington, DC: The National Academies Press. 2011.

In our models, we account for differences in the estimated cost of capital due to economy-wide impacts by quarter and due to company-specific variation through the use of time period-specific and company-specific indicator variables respectively. We also use clustered standard errors to account for correlation in each company’s performance across time.

Table 1: Impact of Electric Decoupling in Basis Points and Test Results: Primary Model and Three Alternative Models of Financial Market Anticipation

	Primary model	1 Qtr. anticipation	2 Qtr. anticipation	3 Qtr. anticipation
Estimate	-40.88	-46.5	-48.7	-45.9
p-value	0.14	0.12	0.08	0.11

VII. CONCLUSION

Our statistical tests do not support the claim that the cost of capital is reduced by the adoption of decoupling. The results of our models of the effect of decoupling on the cost of capital are consistent and collectively demonstrate that there is no statistically significant evidence of a decrease in the cost of capital following adoption of decoupling. If decoupling policy decreases the cost of capital, these tests strongly suggest that the effect must be relatively small because we are not able to detect it statistically.

As decoupling continues to grow in importance, cases will frequently come up where interveners and commission staff may explore the extent to which decoupling reduces business risk and the utility’s cost of capital. To date, in a small minority of cases in which decoupling was approved, the utility explicitly had their allowed ROE reduced. Our research leads us to conclude that these reductions were implemented without reliable empirical analysis to support the ROE reduction. The results of our analysis show that if such empirical analysis had been done, it is unlikely that it would have supported even the moderate reductions in allowed ROE that were imposed on the utilities.

Although the point estimate of the coefficient on decoupling is negative, this result is not statistically significant (for this sample over this period). Further, there is another reason for the regulator not to simply deduct some amount from the allowed rate of return: the cost of capital comparison samples used in regulatory proceedings are not generally restricted to holding companies without any subsidiaries with decoupling. Whatever effect adoption of decoupling may have on the cost of capital, it will be reflected in the sample results. Reducing the allowed ROE relative to the sample average cost of capital estimate would risk “double counting” the effect of decoupling, because that effect is already captured by the sample estimates.

Even if decoupling does not reduce a company's cost of capital, it is still a beneficial policy if it is effective in removing the utility's disincentive to pursue conservation programs. Where decoupling is associated with implementing enhanced EE programs (as is frequently the case), adopting a reduction in allowed ROE in essence punishes a utility for pursuing EE programs. If a utility's management fears an unjustified reduction in the allowed ROE as a result of decoupling, the original disincentive to pursue EE programs is recreated in a new form, and the purpose of decoupling to align the interests of customers, shareholders, and society as a whole may be frustrated.

Appendix A Regression Statistics

Variable	Actual	1Q Forward	2Q Forward	3Q Forward
DecoupledIndex	-0.00408 (0.00362)	-0.00465 (0.00376)	-0.00487 (0.00330)	-0.00459 (0.00353)
Constant	0.0504*** (0.00518)	0.0503*** (0.00509)	0.0502*** (0.00489)	0.0502*** (0.00478)
Observations	291	291	291	291
R-squared	0.678	0.679	0.680	0.679

Clustered standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1