Measuring the equity risk premium

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Abstract We use surveys of economic forecasts to derive a forward-looking estimate of the US equity risk premium (ERP) relative to government bonds. Our ERP measure helps predict short-term relative returns between stocks and bonds. Over the period we studied, low readings of the ERP tended to adjust back to the mean via a rally in the bond market rather than a fall in stock prices. We do not generalise from this result, however, as our sample period is characterised by strong trends of falling inflation and rising stock prices. Our estimate of the expected ERP — averaging just over 2 per cent — is markedly lower than the premium that historical studies show has been realised. Data from the UK paint a similar picture to the US experience.

Keywords: *equity risk premium; survey data; asset allocation*

Introduction

In this paper, we use surveys of consensus economic forecasts to produce a forward-looking estimate of the equity risk premium (ERP) relative to government bonds for the US market. Using this novel data source, our model provides a more realistic estimate of the *ex ante* ERP than assuming that realised returns accurately indicate what investors expected. Furthermore, the ERP offers the potential to be used as the basis of a tactical asset allocation strategy by active investment managers.

We find that our ERP measure shows a tendency to mean revert and helps predict relative returns between US stocks and bonds; high values of the risk premium are associated with above-average short-term equity–bond return spreads. Also, when the ERP is low, the correction typically takes place via a rally in the bond market rather than a fall in stock prices. We need to be cautious in generalising this result, however, as the period we investigate is characterised by strong trends of falling inflation and rising stock prices.

In the sections that follow, we outline our measure of the ERP and describe the underlying data. We then test the power of the measure in predicting relative returns between stocks and bonds and look in detail at what contributes to this. In particular, we look at the process by which extreme values of the series adjust back towards the mean. We also look briefly at UK data to assess the similarity with the US experience.

The equity risk premium

Finance theory holds that stocks are more 'risky' than government bonds — meaning that equity prices are more volatile than bond prices. Investors require higher expected returns in order to invest in the (volatile) stock market than they do to invest in (more stable) bonds. In simple terms, equity returns must offer a 'risk premium' compared with the returns available on bonds and treasury bills. Welch (1999) notes that this equity risk premium 'is perhaps the single most important number in financial economics', with implications for asset allocation decisions and providing a key input into calculations of the appropriate discount rate for evaluating investments.

It is well documented that US stocks have delivered higher returns, on average, than US Treasury bonds. Returns on the stock market have also been more volatile than those earned from bonds. Figures for the period 1900–1999 are shown in Table 1.

Table 1 US stock and bond returns, 1900–1999 (%)

	Stocks	Government bonds
Arithmetic average annual return	12.2	5.0
Standard deviation	20.0	8.1

Source: Dimson *et al*. (2000).

Welch describes the approach of extrapolating the historically realised equity premium as 'the most popular' method of obtaining an estimate of the required ERP. His survey of the views of 226 financial economists yields an average estimate for the ERP relative to treasury bills of about 7 per cent, not far below the figure derived from historical information. Mehra and Prescott (1985) noted that the realised ERP in the US from 1889 to 1978 (6 per cent) was much larger than could be explained by standard models of risk aversion. Implicitly, they make the assumption that the realised figure they measured is a fair estimate of what investors had required. Their paper sparked a search for a solution to the 'equity premium puzzle'.[1]

The view that the realised ERP is a fair estimate of what investors *required*, or expected, however, needs some quite strong assumptions. We must assume the investors hold 'rational expectations' and that the required risk premium is constant. The growing literature on behavioural finance contains many illustrations of investors making decisions that are inconsistent with the traditional notions of rationality used in finance.[2] Furthermore, Fama and French (1989) present plausible arguments and evidence to suggest risk premiums are not constant, but rather vary through the business cycle. It is also possible to argue that structural factors, such as changing demographics, can cause longer-term shifts in the level of required risk premiums.

Relaxing the rational expectations and constant risk premium assumptions breaks the link between what actually happened — the realised risk premium — and the premium expected by investors when they made their investment. Bernstein (1997), in particular, argues that realised returns on stocks and bonds — and risk premium estimates derived from them — are dominated by unexpected changes in valuations. Siegel (1999) notes the high realised ERP appears to be due more to low returns on bonds than to high returns on stocks. The average real return on fixed income assets this century looks unduly low, and he suggests this may be the result of investors' failure to anticipate higher inflation.[3] If the high realised ERP was not expected by investors, there may not be an 'equity premium puzzle', at least not in the sense used by Mehra and Prescott.

Overall, we think the evidence weighs against the realised ERP being a good measure of the premium investors actually expected. A key motivation of our work is to find a better way of estimating the risk premium expected by investors than the 'extrapolation' approach. As active investors, we also want to assess whether the estimate is a useful predictor of short-term relative returns. The following section outlines the model we use.

Our model

The *ex ante* ERP is simply the difference in expected return between stocks and bonds.

In notation form:

$$ERP = r - y \tag{1}$$

where ERP is the *ex ante* equity risk premium, r is the expected return on the stock market, and y is the expected return on long-term government bonds.

The expected return on the stock market can in turn be expressed in terms of the constant growth dividend discount model developed by Gordon (1962).[4] The model is represented as follows:

$$r = (d/p) + g \tag{2}$$

where d is the expected value of dividends payable in the coming year, p is the price of the stock market index, and g is the expected long-term growth rate of dividends.

Substituting Equation (2) into Equation (1) yields the following expression for the ERP:

$$ERP = (d/p) + g - y \tag{3}$$

The obvious problem with Equation (3) is that only one of the right-hand-side variables, p, the value of the stock market index, is observable. The other variables relate to investors' expectations and are not directly observable. To make our model operational, we need to find proxies for these expectations.

Variable y, the expected return on government bonds, can be dealt with relatively easily. The current redemption yield on a government bond is a reasonable approximation of its longer-term expected return, and this can be observed in the market.[5]

Survey data can be used to provide estimates of d and g. Analysts' forecasts for corporate earnings are readily available through services such as IBES.[6] Each month IBES collate analysts' earnings estimates for each stock and calculate a 'consensus' in the form of the mean forecast. It is then possible to aggregate these forecasts to derive an earnings figure for the market as a whole. By applying a payout ratio to the forecasts of the following year's earnings, we can arrive at an estimate of d, the next period dividends expected by investors. The calculation of the payout ratio is discussed in the next section.

We also need an estimate of expectations of the long-term rate of dividend growth. Over the longer term, we assume that profits, and by implication dividends, will grow at the same pace as nominal gross domestic product. For this assumption to be true, a number of conditions must hold, namely that the stock market index is representative of the economy as a whole, the profit share of GDP is steady, the overseas earnings of US listed companies grow at the same pace as their domestic profits, and the payout ratio is steady. While these conditions may not hold exactly, our analysis will show whether our approach represents a valid proxy for long-term dividend growth expectations.

Long-term 'consensus' forecasts of GDP growth are available from a publication called *Blue Chip Economic Indicators* (various editions). Each month since August 1976, Blue Chip has published a survey of economists' forecasts of key variables for the US economy looking one to two years ahead. The survey takes forecasts from about 50 economists at major financial institutions, industrial corporations and consulting firms. Twice a year since 1979, the survey has been extended to cover the economists' ten-year forecasts. We use the Blue Chip ten-year forecast of nominal GDP growth as our proxy for g — the expected long-term rate of dividend growth.

We are now in a position to estimate the ERP from Equation (3) using observable proxies for the unobservable expectation variables. In the next section, we examine whether our estimate of the ERP is useful as a measure of valuation — specifically, whether it helps predict the short-term return spread between stocks and bonds.

Our measure is closely related to the practice common among market participants of estimating the ERP by comparing the nominal yields available on stocks and bonds — either in ratio form or as a difference. In difference form, this comparison is equivalent to our model with the long-term growth parameter, g, missing. The risk in excluding this parameter is that we may confuse yield shifts that are an appropriate response to changing profit growth expectations with shifts driven by other factors, possibly including 'irrational' misvaluation. In the following section, we test these alternative specifications of the risk premium model. We also test specifications of our model using actual rather than forecast dividends.

Predicting relative returns

In this section, we test whether our estimate of the ERP is useful for predicting the short-term return spread between stocks and bonds. If investors require a risk premium for investing in (volatile) stocks rather than (more stable) bonds, this implies stocks should outperform bonds on average over the long run. However, the degree of outperformance we observe is volatile and, in some shorter periods, bonds return more than stocks. Our ERP measure may offer a more reliable prediction of the return spread in any single period than simply assuming the historical average will hold.

We make the assumption that the equilibrium level of the ERP is relatively stable over time.[7] Our hypothesis is then that unusually high observations of the ERP should be associated with subsequent periods when stocks outperform bonds by more than average and the risk premium reverts towards its mean level. In contrast, unusually low observations should be associated with low, and possibly negative, return spreads between stocks and bonds as the risk premium reverts to the mean.

It is possible for our risk premium series to mean revert without being a useful predictor of relative returns between stocks and bonds. It may be that the expectation variables in our model change in such a way as to generate mean reversion in the risk premium series independent of moves in relative prices. Our tests deal with this

Table 2 Equity risk premium and relative returns, March 1979–March 1999 (%)

	ERP	Subsequent stock return	Subsequent bond return	Stock–bond return spread
Mean	2.06	8.60	4.37	4.23
Standard deviation	1.33	11.68	7.08	12.81
Minimum	0.11	−18.02	−11.03	−33.54
Maximum	6.25	38.85	23.52	39.03

All returns are expressed as semi-annual rates.

by looking directly at whether the ERP predicts relative returns.

The data we require to estimate Equation (3) are obtained from a number of sources. The forecasts of long-run nominal GDP we use to proxy dividend growth are available from the Blue Chip publication in March and October each year from 1979, with the survey being published on the 10th of the month.[8] We match these data with the corresponding level of the S&P500 index and the ten-year Treasury note yield obtained from Datastream. In the latter case, we use the Datastream Ten Year Benchmark index.

IBES data are used to estimate the forward dividend yield on the S&P500 index. We apply an estimated payout ratio of 0.4 to the IBES consensus forecast of the next 12 months' earnings. We estimate the payout ratio by calculating the relationship between IBES earnings forecasts and subsequent dividends over the period for which we have data. On average, subsequent dividends amount to about 40 per cent of the earnings forecast. Varying the payout ratio between 30 per cent and 50 per cent shows the results of our analysis are largely insensitive to the figure used.

We also use Datastream to source total return data for the S&P500 index and the ten-year benchmark bond index. We match each calculation of the risk premium with the total returns on stocks and bonds in the following period, eg we calculate the risk premium on 10th March and match this with returns from 10th March to 10th October. Since the Blue Chip data are published in March and October, our time series consists of five-month and seven-month periods rather than actual half years. We transform the five-month and seven-month returns into the corresponding semi-annual rates. The return spread series is calculated in ratio form rather than as differences.

Descriptive statistics for the estimated ERP and the relative return series are shown in Table 2. The ERP measure is graphed in Figure 1. While the sample period is short by comparison with those used in many academic studies, it has to be noted that we are constrained by the availability of the survey data. We have used all of the available data.[9]

Figure 1 shows the ERP started the sample period at a high level of over 5 per cent, perhaps reflecting the uncertain economic environment following the second OPEC oil price 'shock'. The premium declined sharply over the following two years and the range 1–3 per cent is much more typical for the rest of the sample period, with the mean level just over 2 per cent. Most deviations outside this range look to have 'corrected' quite quickly. Interestingly, the range is consistent with the theoretical estimates produced by Mehra and Prescott (1985) using standard models of risk aversion. The low of the series occurs in October 1987, just before the 'crash'. It is notable that the

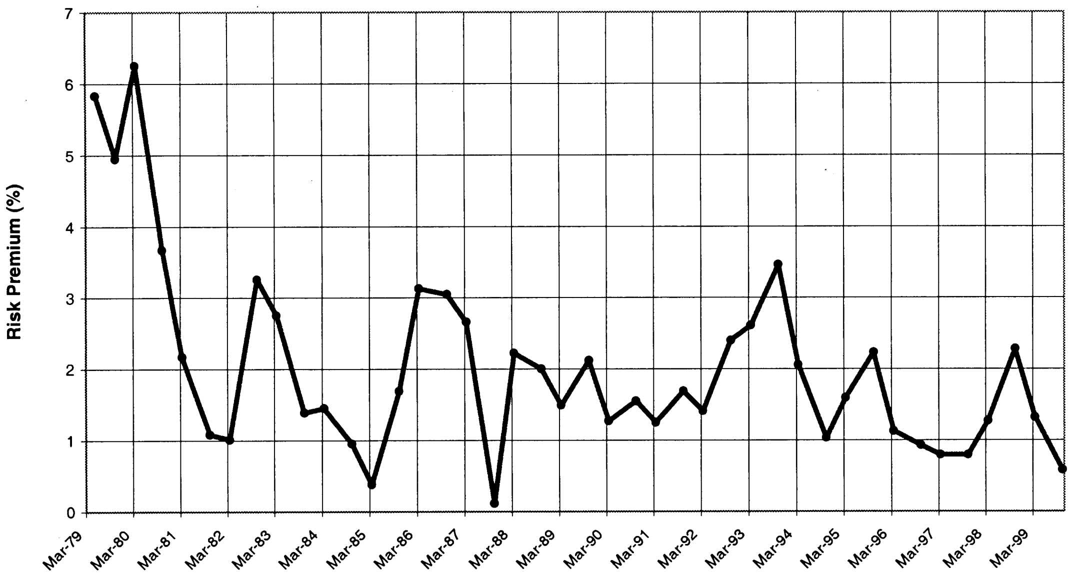

Figure 1 US equity risk premium

last data point from October 1999 is the third-lowest reading in the series, lending support to some commentators' concerns about high valuation levels in the US equity market.

To test whether our ERP measure is a useful predictor of the return spread between stocks and bonds, we estimate an ordinary least squares regression, where the level of the ERP at the end of one period is used to explain the return spread in the following period.

In notation terms:

$$SVB_t = a + b\ ERP_{t-1} + e_t \qquad (4)$$

where SVB_t is the log total return on stocks in period t relative to the total return on bonds [=(1 + total return on S&P500 index)/(1 + total return on Datastream 10-Year Treasury Index)], ERP_{t-1} is the estimated ERP at the end of period $t-1$, and e_t is the error term. The results of the regression are shown in Table 3.

The regression equation reveals a positive relationship between our ERP measure and the subsequent return spread between stocks and bonds. The t-statistic of 3.3 indicates the relationship is statistically significant at a 99 per cent confidence level. Our ERP measure explains almost 20 per cent of the variation in relative returns between stocks and bonds over the sample period. Diagnostic tests show no significant econometric problems, although the sample size is relatively small.

Putting our results into more obvious economic terms, on average, stocks outperformed bonds by 4.2 per cent in each semi-annual period in our sample. The average ERP measure over the sample period was 2.1 per cent. For every percentage point increase (decrease) in the ERP, the subsequent semi-annual relative return was increased (decreased) by 4.5 percentage points. Figure 2 shows a scatter diagram of the ERP

Table 3 Regression results, March 1979–March 1999

	$SVB_t = -5.00 + 4.47\ ERP_{t-1}$	
t-statistics	(−1.50) (3.27)	
Adjusted	$R^2 = 19.5\%$	$n = 41$

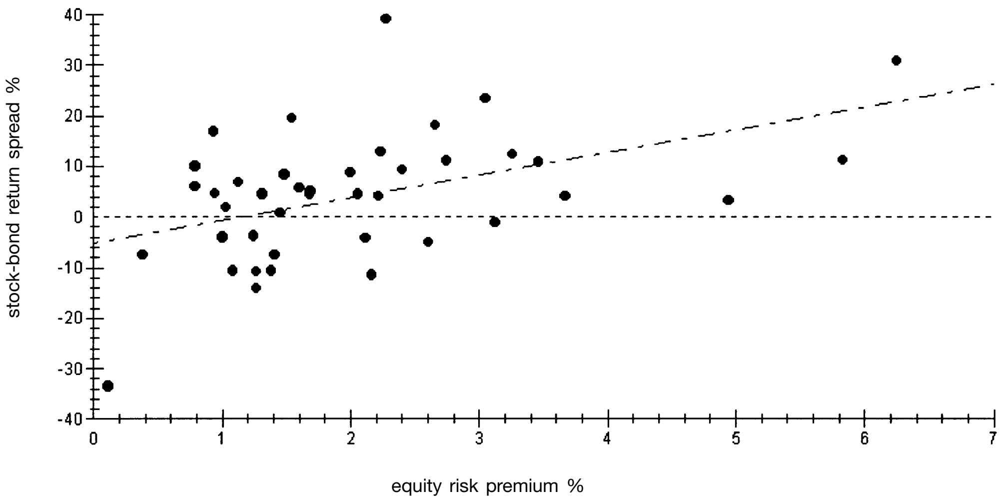

Figure 2 Stocks and bonds return spread against equity risk premium

observations against the subsequent equity–bond return spread. The positive relationship can be seen in the data.

In order to test the robustness of our results, we also tested a number of alternative specifications of the ERP. Using actual dividends rather than the IBES forecasts produces results that are similar, but slightly weaker, than our initial specification. Using the difference between the nominal earnings yield on stocks and the bond yield, ie omitting the long-term growth term, also produces similar results for predicting relative returns. This measure does not show significant mean reversion, however, raising questions about its reliability. Using the ratio between the forecast earnings yield on the stock market and the bond yield produces results similar to but slightly stronger than our chosen specification. Our main concern about this specification is that it is unlikely to be robust to significant changes in long-term dividend growth expectations. Using the Blue Chip forecasts for growth in the national income definition of profits rather than nominal GDP produces similar, but slightly weaker results.

In short, the alternative specifications produce similar, though generally slightly weaker, results. We would argue that the more complete specification of our measure makes it more robust to changes in the environment, especially revised long-term growth expectations.

What really happened

We have established that our risk premium measure is a reliable predictor of the return spread between stocks and bonds. An unusually high risk premium implies stocks will outperform bonds by a wider-than-average margin in the following period. Similarly, a low-risk premium implies the short-term return margin between stocks and bonds will be narrow or even negative.

To investigate what is driving these results, we rank the 41 observations according to the level of the ERP. We then split the data into quartiles — missing out the median observation[10] — and examine the return characteristics of each quartile. The results are shown in Table 4. Note all returns shown are expressed on a semi-annual basis.

Table 4 reveals that in quartiles one

Table 4 Equity risk premium and returns by quartile (%)

	Average ERP	Average relative return	Average stock return	Average bond return
Quartile One	3.90	12.38	11.29	−1.09
Quartile Two	2.18	6.29	8.17	1.88
Quartile Three	1.40	−0.81	4.75	5.56
Quartile Four	0.82	−0.97	8.24	9.21

All returns are expressed as semi-annual rates.

and two, bond returns are below average, while stock returns are higher than average. It is apparent that the above-average relative returns observed in these quartiles are driven both by below-average bond returns and by above-average stock returns. In quartiles three and four, bonds perform better than stocks on average, which is unsurprising given the econometric results in the previous section. The mechanism for this result is interesting, however. The 'overvaluation' of stocks is usually corrected by a rally in the bond market rather than by stocks falling in price — stock returns are below average, but not generally negative. The most notable exception is the October 1987 data point. The forecast ERP registered just 0.1 per cent on 10th October 1987. Over the following five months, bonds delivered a 15.5 per cent semi-annual return, helping to restore a more normal ERP. Stocks dropped sharply, however, registering a return of −18.0 per cent for the period. As we know, the 22.0 per cent 'crash' on Black Monday, 19th October, caused most of the damage to investors' portfolios.

Our measure appears to have some predictive power over both stocks and bonds individually as well as over relative returns. To confirm these results in econometric terms, Table 5 shows regression equations where we use the ERP measure to predict the return on stocks S_t and the return on bonds B_t.

As expected given the quartile analysis above, there is a negative relationship between the ERP measure and the return on bonds, ie bonds tend to perform poorly in the period following a high ERP. Stocks tend to perform strongly following a high ERP, as shown by the positive regression coefficient. The main caveat is that the regression coefficient for stocks is not statistically significant at conventional confidence levels.

Our results show that over the period for which we have data, overvaluation of the stock market relative to bonds has tended to be corrected by a rally in the bond market, ie a fall in yields. In only seven of the 41 periods was the return on the stock market negative. It would be wrong to generalise from this result, however. Over the period we studied, the average level of inflation dropped sharply, providing a beneficial environment for financial assets. Consumer price inflation averaged 7.9 per cent in the five years leading up to

Table 5 Regression results, March 1979–March 1999

Stocks		
	$S_t = 5.32 + 1.59\ ERP_{t-1}$	
t-statistics	(1.57) (1.15)	
Adjusted	$R^2 = 0.8\%$	$n = 41$
Bonds		
	$B_t = 10.33 - 2.89\ ERP_{t-1}$	
t-statistics	(5.89) (−4.03)	
Adjusted	$R^2 = 27.5\%$	$n = 41$

Table 6 UK equity risk premium and relative returns, April 1982–April 1999 (%)

	ERP	Subsequent stock return	Subsequent bond return	Stock–bond return spread
Mean	2.07	8.40	5.88	2.52
Standard deviation	1.22	12.01	6.20	11.96
Minimum	0.35	−26.75	−6.66	−38.26
Maximum	5.34	30.00	24.53	24.41

All returns are expressed as semi-annual rates.

our first data point in March 1979. For the five years to October 1999, the comparable figure is 2.4 per cent. The ten-year bond yield has fallen in tandem with the drop in inflation, moving from 9.1 per cent in March 1979 to 6.0 per cent in October 1999. Without this beneficial environment of falling inflation, and rising stock prices, investors buying stocks when the risk premium was low may have faced a harsher experience than they have had.

While many investors and media commentators have been talking about the overvaluation of the US stock market for several years, there has been significant variation in the level of the ERP measure over the recent period. During the third quarter of 1998, stocks fell sharply as investors undertook a 'flight to safety' in the aftermath of the Russian government's decision to introduce a moratorium on debt repayments. Treasury bond yields fell as investors sought secure and liquid instruments in which to hold their capital. The result was to drive the ERP to an above-average level of 2.3 per cent in October 1998. In contrast, the March 1998 reading was only 1.3 per cent. The October 1998 data point stands out as the 'best' buying signal for equities in our series, with the S&P500 index outperforming bonds by 39.0 per cent on a semi-annual basis over the following five months, as fears of deflation and recession abated.

The international evidence

We have focused on the US market due to the ready availability of the survey data we use to proxy expectations. Some data, however, are also available for international markets. In particular, we have been able to assemble a series of ERP estimates for the UK market from April 1982 to April 1999 using IBES earnings forecasts and long-run nominal GDP from Consensus Economics Inc.'s *Consensus Forecasts* (various editions), an international equivalent to *Blue Chip Economic Indicators*.[11] We use the FTSE 100 as our equity index and the Datastream ten-year benchmark gilt index for our bond series. With the exception of the sources of the forecasts, the methodology and data sources are the same as outlined for the US in the section on 'Our model'. Table 6 gives descriptive statistics for our UK ERP measure and the corresponding returns. Figure 3 plots the ERP series.

It is notable that the UK series shares many similarities with our US data. The mean level of the ERP, at 2.1 per cent, is almost identical to the US average. The highs and lows are also broadly similar, and both series typically occupy a range from about 1 per cent to 3 per cent. Unlike the US, October 1987 did not represent the low for the UK, which in fact occurred in April 1991. The last data point in the sample, 1.7 per cent in October 1999, is much closer to the mean than the comparable US observation.

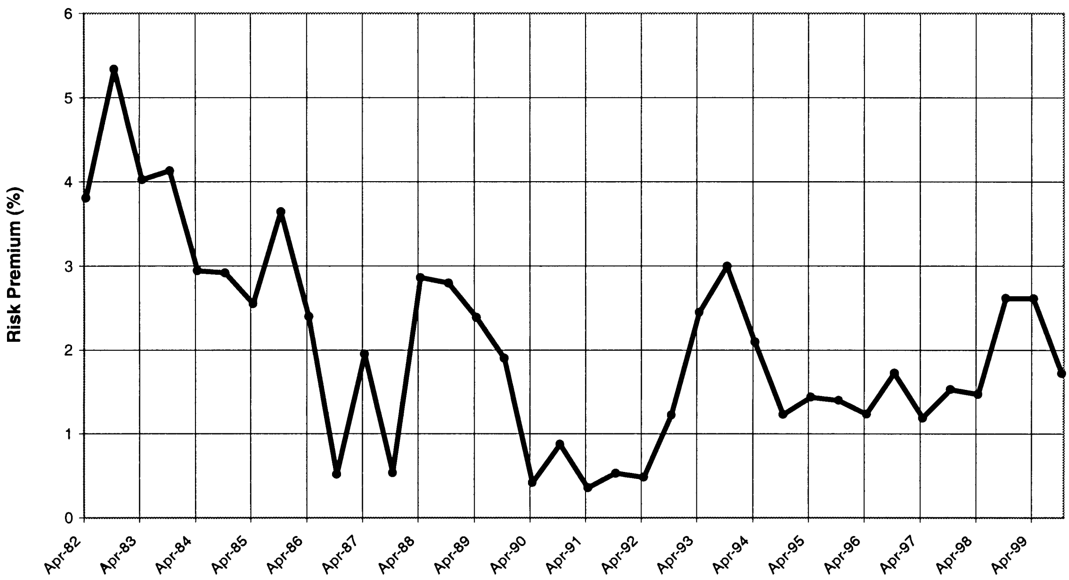

Figure 3 UK equity risk premium

Following the US analysis, we also test whether the UK ERP series helps predict the short-term stock–bond return spread. The regression yields a slope coefficient of 3.72 with a *t*-statistic of 2.35 — similar to the US equation. The adjusted *R*-square statistic at 12 per cent is lower than in the US model. Overall, the results are qualitatively similar.

Regression of the ERP series on stock and bond returns separately produces a contrast to the US results. In our results (not shown), we find the ERP series is more predictive of stock returns than bond returns. The slope coefficient of the bond equation is statistically insignificant, though it has the expected negative sign.

In general, the UK results and their similarity to the US experience give us confidence in the validity of our approach. The techniques are also applicable for other international markets, but data availability is a problem. For many European and Asian markets, comprehensive surveys of economic forecasts have only become available in the past decade. This will, however, provide a useful 'out-of-sample' test of our analysis once the data histories are longer.

Table 7 Regression results, April 1982–April 1999

Stocks
$SVB_t = -5.19 + 3.72\ ERP_{t-1}$
t-statistics (−1.37) (2.35)
Adjusted $R^2 = 11.7\%$ $n = 35$

Conclusions

Our work represents an attempt to produce a well-specified *ex ante* measure of the ERP expected by investors. We use surveys of economic forecasts as a novel way to solve the problem that many of the variables in the risk premium calculation are unobservable. We focus on the US experience, but also present results for the UK which are similar.

The results show that the ERP measure helps predict the short-term relative return between stocks and bonds. When the premium is higher than average, the stock–bond return spread in the coming period also tends to be above average. When the risk premium measure is below average, the subsequent return spread tends to be low or even negative. The measure therefore offers scope to be the basis of a tactical asset allocation strategy.[12]

It is not clear why our measure, which uses widely available data, should offer potential for generating excess returns. It may be the model captures inefficiency in the relative pricing of stocks and bonds, but other, more 'rational', explanations are possible. Fama and French (1989) find that US stock and bond returns between 1926 and 1987 were predictable using the market dividend yield; the 'default' spread between the average corporate bond yield and the yield on AAA-rated bonds; and the term premium of AAA-rated corporate bonds over Treasury bills. They argue the explanatory variables are related to the business cycle and that predictable variation in expected returns reflects a rational response to economic conditions. For example, when business conditions are poor, income is low and expected returns from bonds and stocks must be high to induce substitution from consumption to investment. In the case of our analysis, it may be that the business cycle leads to short-term fluctuations in the compensation investors require for equity risk. Similarly, the actual or perceived level of risk in stocks and bonds may vary through the business cycle, leading to variations in expected returns that have rational foundations. Our tests do not offer any way to decide between these different explanations.

Our analysis also suggests, in recent years at least, the risk premium expected by equity investors has been significantly less than the levels (7 per cent or so) that historical studies show have been realised. The most recent US data we have show stocks priced to deliver only about 1 per cent more than bonds over the longer term, if our model specification is correct. Our concluding message has to be to caution against using a measure of the realised ERP as an indication of what can be expected in future.

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Notes

1 A review of some of the initial solutions proposed can be found in Kocherlakota (1996).
2 See Shefrin (1999) for a comprehensive review of this field.
3 Best *et al*. (1998) show that investors in the US bond market in recent years appear to have made large and persistent errors in forecasting inflation. As a result the realised real returns earned by these investors seem to have been very different from what they expected at the outset. It is not apparent in the data that these forecast errors average out to zero over time.
4 The Gordon model is a simple valuation model, which necessarily rests on a number of strong assumptions. The firm is assumed to be debt free and to finance its investments through retaining a constant portion of its earnings. The investments have infinite lives and earn a constant return on capital. A full critique of the model and the assumptions is outwith the scope of our paper.
5 This approximation involves a number of assumptions, such as a flat and unchanging yield curve and the ability to reinvest coupon payments at the same rate as the yield. The effect of these assumptions is likely to be small.
6 IBES is a data vendor specialising in the systematic collection of earnings estimates from 'sell-side' investment analysts.
7 It is possible to argue the risk premium will shift over time, eg as a result of changing demographics. Such changes by their nature, however, are likely to be very gradual. Tests on the ERP series indicate it is stationary over the sample period. The augmented Dickey–Fuller statistic for the series is −5.99, which is significant at a 95% confidence level.
8 Prior to 1983, some of the data points relate to May and November. After 1983, the series becomes more regular.
9 To avoid the need for survey data, some analysts assume investors have had perfect (or at least unbiased) foresight. They argue that what happened, for example in terms of dividend growth, was what

investors had expected and thus historical out-turn data can proxy for prior expectations. While this can yield longer data histories, to us the assumption is too strong.

10 The median observation is from October 1985 and is characterised by: $ERP = 1.69$ per cent; stock return = 28.01 per cent; bond return = 23.52 per cent; relative return = 4.49 per cent.

11 UK data from IBES and Consensus Economics is only available from 1987 and 1989 respectively. We create our own comparable series for the early periods by combining the relevant forecasts of leading economic forecasting institutions.

12 Best and Byrne (1997) present the results of a simulated tactical asset allocation strategy based on this measure.

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