The Market Equity Risk Premium

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Executive Summary

The *New Zealand Superannuation Act 2001* requires the Treasury to state each year the required capital contribution of the New Zealand Government to the New Zealand Superannuation Fund. This paper examines a key assumption made in that calculation – the level of expected long-term premium of return on equity market investments over return on long-term government bonds.

Over the past seventy-five years, US capital markets have provided an equity risk premium over long-term bonds in the region of 7%. The traditional view has been that these historical results provide an unbiased estimate of the expected future long-term equity risk premium.

This view has given way over the past few years to a consensus that the future expected risk premium is actually somewhat lower. This consensus rests on a range of recent empirical evidence and theoretical analysis. It draws on both the historical records of market returns, dividends and reported earnings, and on forward-looking information through surveys of market experts and from the expectations implicit in analysts' earnings forecasts.

On the basis of this analysis, we believe that the long-term annual (arithmetic) expected equity risk premium sits in the range of 3% to 5%. For the purpose of calculating the required capital contribution to the New Zealand Superannuation Fund, the Treasury is adopting the assumption of a long-term expected future equity risk premium of 4%.

Table of Contents

List of Tables

List of Figures

The Market Equity Risk Premium

1 Introduction

The characteristics of financial asset and liability returns are becoming increasingly salient in fiscal and economic policy work. Long-term fiscal modelling and policies that have long-term financial implications require assessments to be made about what level of annual financial returns we should expect decades out into the future from capital market investments. In particular, the *New Zealand Superannuation Act 2001* (section 42) requires the Treasury to state each year the required rate of capital contribution to the Fund for the following year.[1] Among other things, this is a function of the expected long-term investment performance of the Fund. However, there is a range of popular views about the likely state of financial markets in the long-term.

A key variable of debate is the expected market equity risk premium over the long-term. Compared to bonds, we expect extra return from stocks because: dividends unlike coupon payments are volatile, and bond holders have a priority over stockholders (Harper 2003). This paper reviews the current literature and evidence related to the expected market equity risk premium over the long-term, and takes a view on the level of expected market risk premium over the long-term. The risk premium we consider is a premium for a world portfolio, which is largely dominated by the US market.

A major issue when working through the literature on the equity risk premium is ensuring that the evidence presented by various authors is being compared on a consistent basis, and on a basis that is relevant to the issue at hand. The next section of this paper works through the different ways in which the equity risk premium can be defined so as to provide a basis for interpreting the literature.

The expected risk premium looking out into the future is not directly observable. However, there are reasonably long series available of historical outturns of prices and returns, especially from the US capital markets, that could be informative about expectations of future returns. The third section of this paper examines analyses of the equity risk premium that are based on this historical evidence of prices and returns, and on other historical data, such as dividend yields, earnings yields, and the variability of returns. That section also discusses some of the limitations of using historical analyses. The fourth section of the paper then turns briefly to theoretical analyses of the expected equity risk premium. This literature centres around what is known as the “equity premium puzzle”, in which standard economic models of utility, consumption and risk aversion imply a

[1] McCulloch and Frances (2001) provide the derivation of the calculation of the required capital contribution rate for the New Zealand Superannuation Fund.

significantly smaller expected equity risk premium than has been observed in the historical results.

The fifth section summarises forward-looking estimates of the equity risk premium. It presents estimates of the expected equity risk premium that have been inferred from analysts' earnings forecasts. These estimates are based on the relation that the price of equity equals the present value of expected future dividends. A recent refinement on this approach is the residual income model. This is isomorphic to the dividend model, but uses analysts' earnings forecasts directly. The sixth section presents survey approaches that have been adopted where various populations of experts are asked directly for their expectations about future asset class rates of return, or about the equity risk premium specifically.

The seventh section summarises a range of issues about long-term capital market behaviour that have been identified as possibly influencing the expected equity risk premium in the future. This includes issues surrounding current price levels, capital market developments, macroeconomic developments, and the implications of expected demographic changes. The final section draws all of this together into a quantitative conclusion about the long-term expected market equity risk premium. For the purpose of calculating the required capital contribution to the New Zealand Superannuation Fund, the Treasury is adopting the assumption of a long-term annual (arithmetic) expected future equity risk premium of 4%. In the normal course of events, we would expect this assumption to stay stable over long periods of time.

2 Defining the expected market equity risk premium

The equity risk premium can be defined in a number of ways, and how it is defined can have a significant effect on the quantum that is estimated. It is therefore important to be clear about exactly what is meant by the term. One common reason for apparently contradictory views among commentators is that they can have in mind different definitions of the equity risk premium. For the purpose of this paper, the choice of definition is driven by the requirements for calculating the required contribution rate for the New Zealand Superannuation Fund. In particular, we want to estimate the forward-looking, long-term difference between expected annual aggregate nominal equity market returns and expected annual nominal returns on long-term government bonds. The following parts of this section examine the various choices that this entails. This provides a basis for interpreting the literature where authors have used different definitions.

2.1 Definition of equity returns and bond returns

A risk premium is the difference in expected returns between two classes of financial assets.[2] In calculating the equity risk premium, the choice of those asset classes depends on what the result will be used for.

For equity returns, a widely used measure is the total return (that is, income plus capital appreciation) to large company stocks prepared by Ibbotson Associates (2002). This is

2 While the normal method used to take this difference is by arithmetic subtraction, an alternative method that has been adopted is to take the ratio of total equity returns over total bond returns (Dimson, Marsh and Staunton 2000, Ibbotson Associates 2002).

based on the Standard and Poors' 500 Composite Stock Index, which is a market-value-weighted measure of large company stock performance in the US.[3] The use and relevance of US data is discussed further below. In respect of New Zealand data, the most complete series available is reported by Lally and Marsden (2004b), using data from various sources.

For the base of the premium calculation, the return on government securities is usually used. For an application like the capital asset pricing model, it is being used as a proxy for a financial asset with a risk-free return. Some authors have adopted the return on short-term Treasury bills, while others have adopted the return on long-term government bonds. The difference is substantial, approximately 1.8 percentage points historically (Ibbotson Associates 2002). Another area in which comparability is essential is in respect of using bond returns or yields. Therefore, it is important to be clear about which benchmark is being used. Many authors end up feeling that they have to report returns over bonds and over bills ((for example, see Dimson, Marsh and Staunton 2002)).

For the purpose of the calculation of the required capital contribution rate for the New Zealand Superannuation Fund, the calculation (as it is currently carried out) involves estimating the aggregate return on a portfolio comprising long-term government bonds and equities (McCulloch 2002). Therefore, the relevant measure of the equity risk premium is the difference between the expected return on equities and the expected return (yield) on long-term government bonds. This measure is the focus of this paper. The alternative measures are identified where they are relevant to the discussion.[4]

2.2 Expected returns versus realized returns

Expected returns are not directly measurable. As a result, realized returns are often used as a proxy for expected returns. This is based on an assumption that market informational efficiency will result in "surprises" (deviations between expected returns and realized returns) being zero-mean and unpredictable, in which case realized returns would provide an unbiased estimate of what returns had been expected for that period.

However, this relationship does not hold well. Elton (1999) illustrates this: "In the recent past, the United States has had stock market returns of higher than 30 percent per year while Asian markets have had negative returns. Does anyone honestly believe that this is because this was the riskiest period in history for the United States and the safest for Asia?" He also points to lengthy periods in history when equity returns and long-term bonds returns averaged less than risk-free rates.[5] The correspondence between realized returns and expected returns is particularly weak when expectations are changing. For example, if a change occurred that resulted in investors requiring a smaller risk premium to invest in equities (for example, aggregate risk aversion drops, or transaction costs fall, or risk is shared more widely), the required rate of return on equities would fall. The immediate effect of this would be that individuals would be more prepared to invest in equities, bidding the price up until the expected return fell to meet the required return.

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3 For a discussion of market-value weighted versus price-weighted indices, see Cornell (1999, pp. 6-8). He concludes that market-value weighted indices are appropriate for assessments of total portfolio return over time.

4 Yet another measure of the equity risk premium arises in the context of the tax-adjusted version of the capital asset pricing model, which acknowledges the differential tax treatment of interest, dividends and capital gains (Lally and Marsden 2004b). In the New Zealand tax environment, this measure of the risk premium is larger than that implied by the standard version of the CAPM by 1½ to 2 percentage points.

5 See also Figure 1 below and the discussion on time horizon.

However, in the meantime, the increase in price means that a higher realized return is observed.

Although realized returns for a particular period can deviate substantially from what was expected, it is more reasonable to believe that long-run average realized returns would provide an unbiased estimate of what were expected returns. This is the rationale (rightly or wrongly) behind the historical analyses discussed below.

2.3 Arithmetic and geometric calculation of returns

When assessing historical investment performance it is often of interest to express the observed returns on an average annual basis. The historical average can be calculated either arithmetically:

$$\overline{r_N} = \frac{1}{N}\sum_{t=1}^{N} r_t \qquad (1)$$

or geometrically:

$$\overline{g_N} = \left(\prod_{t=1}^{N}(1+r_t)\right)^{1/N} - 1 \qquad (2)$$

If returns vary over time, the geometric average will always be less than the arithmetic average.[6] The difference will be greater the longer the time period and the greater the observed variability in annual returns.

Like historical averages, expectations about future returns can also be specified in terms of either an expected annual return or an expected geometric return over a specified timeframe.[7] The difference between historical averages of arithmetic and geometric returns can be substantial. For example, Ibbotson (2002) reports that the arithmetic average large company stocks return over the period 1926 to 2001 was 12.7%, while the geometric mean was only 10.7%. Because stocks are more volatile than bonds, most of this difference is also reflected in the risk premium. From the same source, the risk premium of stocks over bonds measured on an arithmetic basis was 7.0%, but the difference between the geometric averages was only 5.4%. Understanding the distinction between expected geometric and arithmetic return is important because both metrics are used by commentators discussing the equity risk premium, and there is scope for confusion about which is relevant in any particular situation.[8] Recognising this, some authors report their analyses on both bases (for example Cornell (1999), Lally and Marsden (2004b)).

Prospective applications, such as the capital asset pricing model and the assessment of the required capital contribution to the New Zealand Superannuation Fund, are a function of the expected annual return, which is the forward-looking analogue of the average *arithmetic* return. The expected *geometric* return over any period greater than one year will understate the expected annual return. A complication is that the expected values of the distributions of returns are not known with certainty and so must be estimated. Blume

6 In the trivial situation where the time period is only one year, the geometric and arithmetic averages are the same.

7 McCulloch (2003) provides a detailed analysis of the relative merits of these alternative measures of expected return.

8 This confusion exists despite the fact that it is explained routinely in finance textbooks and in other reference sources. For example, see Brealey and Myers (2000 p 157) and Ibbotson (2002 pp 98-99).

(1974) shows that an historical arithmetic average provides an unbiased and consistent estimate of the expected annual return, while an historical geometric average provides a downward biased estimate and it has a larger sample variance than the arithmetic average.

However, it is important to bear in mind that estimates of expected return are usually an input to further calculations, such as final wealth projections, discounted present values and the required capital contribution to the New Zealand Superannuation Fund. These are non-linear calculations and so an unbiased estimate of expected annual return will not necessarily be the best input for obtaining an unbiased final result. For example, Blume shows that using an arithmetic average, even if unbiased as an estimate of expected annual return, produces an upward-biased measure of expected future wealth, while the geometric average is downward-biased.[9] Similarly, in the case of present value calculations, Cooper (1996) shows that both arithmetic and geometric averages provide downward biased estimates of the discount factor, although the bias in the arithmetic average is least and is only slight. This holds even if returns are serially correlated.[10] The form of the calculation of the required contribution rate for the New Zealand Superannuation Fund essentially a present value calculation (McCulloch and Frances (2001)). On the basis of Cooper's analysis, it is reasonable to choose an estimate of expected annual return that is unbiased in itself (that is, a one-year or arithmetic-based measure of return) in order to obtain a satisfactory estimate of the required capital contribution rate. The focus of this paper is therefore the equity risk premium in the context of the expected annual (arithmetic) return.

2.4 Nominal returns and real returns – implications of inflation

The equity risk premium is the difference between the expected nominal equity return and the expected nominal bond return. Although both of these terms contain inflation the inflation does not completely cancel out for risk premium[11]. In the same way, the historical equity premium calculated from nominal equity and bond returns differs slightly from that calculated from the corresponding real returns. Ibbotson (2002) reports an equity premium over 1926 to 2001 of 7.0% when measured from nominal equity and bond returns, but only 6.7% based on the real returns. Similarly, Lally and Marsden (2004b) report a 0.3% difference between the nominal and real measures using New Zealand data. This suggests that estimates of the equity risk premium that are expressed in real terms need to be adjusted upward slightly[12] to obtain the corresponding nominal equity risk premium.

2.5 Time horizon

The time horizon implied for the calculations of required contribution rate to the New Zealand Superannuation Fund is forty years. Therefore, the interest of this analysis is in long-term capital market behaviour, rather than what returns might be expected in the immediate future. These could be quite different. Respondents to surveys typically report different expectations of returns over a one year time frame, compared those over longer

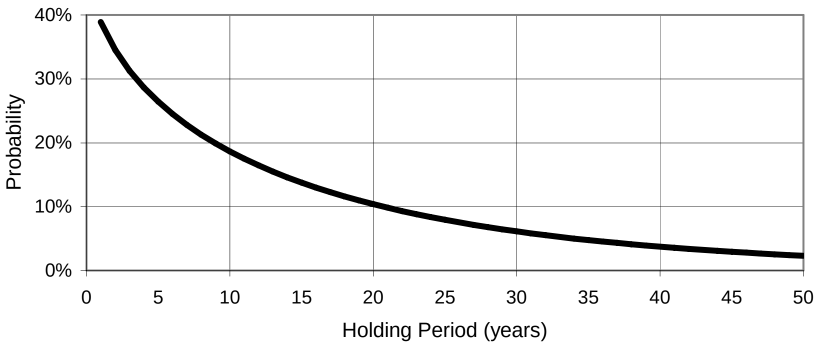
9 Jacquier, Kane and Marcus (2003) provide a more recent discussion of this issue.
10 Indro and Lee (1997) suggest a weighting procedure to use in the case of serial correlation.
11 Furthermore, inflation has been shown to affect different asset classes differently (Fama and Schwert 1977).
12 To obtain nominal returns, real returns need to be multiplied by (1+inflation).

time horizons.[13] Similarly, Arnott and Bernstein (2002) speculate that the current expected risk premium could be negative over a short-term horizon.

Even without the turmoil experienced in capital markets over recent years, the volatility inherent in capital markets means that average returns can deviate substantially from expected returns for long periods of time. In particular, a portfolio of equities can have a greater expected return than a portfolio of bonds, yet could produce quite long runs of lower returns than bonds. Analysing returns over the last century shows that for the majority of countries stocks did not provide a consistently positive real return over interval of 20 years. Italian and Belgian investors, for example, would have needed an investment horizon of more than 70 years, and the world index required 21 years to always produce a positive return[14]. Even in the long run equities are risky. Otherwise why would long term investors receive a reward for short term fluctuations that are irrelevant? (Dimson, Marsh and Staunton 2004).

Making some standard assumptions about the joint distribution of equities and bonds, the probability that equities will underperform bonds in any one year is about 40% and there remains a 19% probability that equities will underperform bonds over a ten-year holding period, even though there is a significant premium in the expected return of equities over that of bonds.[15] This is illustrated in Figure 1.

Figure 1 – Probability that equities will underperform bonds over time



3 Historical analysis

The main approach to assessing the expected equity risk premium has been to examine the historical data of realised returns. The focus in the literature has been on the US. This is because it has the most developed capital market, it represents a large proportion of the international capital markets, and it has long time series of available data. More recently, these results have been supplemented by international analyses, including analysis of the experience in New Zealand markets. In addition to price and returns data, historical series of dividends, earnings and the variability of returns have been analysed.

[13] For example, see Table 3 and Figure 3, and the associated discussion of surveys starting on page 18.

[14] However when it is expressed in German marks, a German global investor would have needed to wait 57 years to always get a positive return

[15] The assumptions for this example are that equity and bond returns are lognormally distributed and serially independent, with means, variances and covariance equal to the summary statistics of historical annual returns reported by Ibbotson (2002).

3.1 Historical prices and returns

3.1.1 US capital markets

Ibbotson's *Stocks, Bonds, Bills and Inflation Yearbook* is a primary source of data on US capital market returns.[16] This annual publication reports monthly returns to various asset classes from 1926 to date. From Ibbotson (2002), the total returns to large company stocks (the S&P 500 Composite Index) averaged 12.7% over the period 1926 to 2001 and long-term government bonds provided a total return of 5.7%, giving a realized equity premium of 7.0%.[17]

Until relatively recently, it seems to have been common practice to assume that this historical result provided an adequate basis for the expected risk premium. For example, in their widely used textbook, Brealey and Myers state: "[We] have no official position on the exact market risk premium, but we believe a range of 6 to 8.5 percent is reasonable for the United States. We are most comfortable with figures toward the upper end of the range." (Brealey and Myers 2000 p. 160) They are referring there to the premium over Treasury Bills, which is about 1½ percentage points greater than the premium over bonds (Ibbotson Associates 2002). This implies that they would look to the upper end of a range of 4.5% to 7% for the equity premium over bonds.[18]

Even though more than seventy-five years since 1926 seems like a long time series, the high volatility of returns means that rather wide confidence intervals need to be placed around estimates of expected annual returns based on these historical returns.[19] These confidence intervals conceivably could be reduced by looking at longer time series. Siegel (1992, 1999) examines indices of stock prices dating back to 1802. His results were:[20]

Table 1 - Arithmetic Average Returns from Siegel (1992, 1999)

	Siegel (1992)			(1999)
Period	Stocks	Bonds	Premium	Premium
1802-1870	6.8%	5.1%	1.7%	3.2%
1871-1925	8.4%	4.5%	3.9%	4.0%
1926-1990	11.9%	4.9%	7.0%	
1926-1998				6.7%
1802-1990	9.0%	4.8%	4.2%	
1802-1998				4.7%

The observed premium for the periods prior to 1926 (between 1.7% and 4%) is markedly lower than in the later years (7% and 6.7%). Siegel (1999) argues that this is because

16 Another frequently used source is the Center for Research in Security Prices (CRSP) at the University of Chicago.

17 This has declined over recent years. For example, the 1999 edition of the yearbook reported 7.5% over the period 1926 to 1998.

18 This quote, from the 6th (2000) edition of their textbook, implicitly admits that the expected risk premium may be something less than that realised historically. Like other textbooks up until just a couple years ago, previous editions of Brealey and Myers' textbook took it for granted that the historical data yielded a "sensible" estimate of the expected risk premium.

19 The likely width of these confidence intervals is discussed further below.

20 It is not clear from his papers why he reported different results in his two papers for the periods prior to 1925.

bond returns were exceptionally low after 1926, while total equity returns were relatively stable over the whole time period. This suggests that the estimate directly from the Ibbotson data could be biased upwards. However, that conclusion needs to be balanced against a question of whether data on capital market behaviour from the 19th century is relevant for estimating returns in the 21st century[21]. This is an aspect of the more general question of the applicability of historical results for assessing expectations about the future. This issue is discussed further below.

A consistent finding is that the equity risk premium has declined over time (Blanchard 1993, Claus and Thomas 2001, Cochrane 1997, Fama and French 2000, Jagannathan, McGrattan and Scherbina 2001, Siegel 1999) and that the real return on US equities is among the highest in the world with the lowest volatility (Dimson *et al* 2004). Pastor and Stambaugh (2001) introduce an approach that allows for structural breaks in the risk premium over time. They estimate that the equity risk premium fluctuated in a range between 4% and 6% over the period from 1834 to 1999. It declines steadily since the 1930s, except for a brief period in the mid-1970s. It declines to 4.8% by the end of the 1990s. McGrattan and Prescott (2001b) present evidence that the observed changes in the equity premium over time reflect changes in taxes over time and changes in regulation of pension plans.

3.1.2 International capital markets

Blanchard (1993) examines the evolution of stock and bonds rates over the period 1978 to 1992 for the United States, Japan, Germany, France, Italy and the United Kingdom. He analyses ‘world’ rates of return, constructed using relative GDP weights for the countries. He documents how the realised risk premium has declined over the decade but his analysis does not allow any conclusions to be drawn about long-term expectations.

Jorion and Goetzmann (1999) explicitly examine survivorship bias among world markets by examining 39 markets, for which data is available for some period over the last 80 years, including markets with breaks. Their conclusion is: “We find striking evidence in support of the survival explanation for the (high US) equity risk premium. Over our sample period, the US has the highest uninterrupted real rate of appreciation, at 4.3 percent annually. For other countries, the median real appreciation is around 0.8 percent. This strongly suggests that estimates of equity premia obtained solely from the US market are biased upward by survivorship.” However, while US returns exceed the median of other markets’ returns, the nominal (US$) arithmetic average return to their US index (8.04%) is only slightly above that of their value-weighted global index of all markets (7.76%).[22] This suggests that a focus on US capital market behaviour might overstate world capital market returns, but the bias is not likely to be great. Jorion and Goetzmann do not examine world bond returns so they do not make explicit estimates of the world equity risk premium.

Dimson, Marsh and Staunton (2003) report on returns over the period 1900 to 2002 for sixteen countries, representing 94% of today’s world market capitalisation. They report an average arithmetic risk premium over Treasury bonds over all countries of 4.9%, with the US at 6.4% and Australia at 7.6%. Using standard deviations they deduce that “a

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[21] Hunt and Hoisington (2003) suggest that the low inflationary experience in recent years is more closely related to the period from 1871 through 1945. Hence estimate the equity premium of 4.3% for 1871 trough 2001.

[22] Because they do not have dividend information, their data are capital appreciation indices. According to the Ibbotson (2002) data from 1926 to 2001, total returns of 12.7% comprise capital appreciation of 8.0% and income returns of 4.4%, with the balance (0.3%) being reinvestment of income.

plausible, forward-looking risk premium for the world's major markets would probably be around 5%" on arithmetic basis. In their previous work Dimson, Marsh and Staunton (2002) show that the premium was generally higher for the second half century than for the first. For example, the World had 4.7% in the first half, compared to 6.2% in the second half. The series used by Dimson, Marsh and Staunton were compiled to avoid the survivorship bias that can arise from backfilling.[23] However, their choice of international markets was limited by their requirement to have data for the whole century. This meant that markets that had permanent breaks were omitted, as well as markets for which complete data just was not obtainable. This introduces a market survivorship bias so that their world return results are possibly overstated.

3.1.3 New Zealand

Durham (1998) implemented a version of Merton (1980) methodology using New Zealand data, and generated time-varying estimates of the standard and tax adjusted market risk premiums. His standard estimate using simple average is 5.0% and using superior risk-based estimate is 6.1% in New Zealand over the period 1967-1998.

Lally and Marsden (2004b) document historical market risk premia in New Zealand over the period 1931 to 2000. They report an equity risk premium over bond yields of 5.5%.[24] This is an update of previous work by Chay, Marsden and Stubbs (1995), who estimated the equity risk premium for the period 1931 to 1992 at 6.5%.

Lally and Marsden (2004a) also report the New Zealand equity risk premium following an approach similar to the one proposed by Siegel (1992, 1999). Siegel's proposal is that historical real bond returns are understated and so it is more appropriate to estimate the equity risk premium on the basis of a long-term real bond yield in the region of 3% to 4%. This reduces the estimate of the equity premium on New Zealand data by 1.5% to 2.5% to a range of 3% to 4%. However, they note that Siegel's arguments should be treated with caution because it is unknown what the effect on equity returns would have been if the factors that gave rise to the low bond returns had not arisen.

3.2 Using additional historical information

3.2.1 Variability of returns

As discussed further below, the high volatility of equity returns means that relatively wide confidence intervals need to be placed around estimates of expected returns. This is even with the relatively long series that are available. Merton (1980) shows that volatility can be measured relatively more reliably than expected return. Drawing on the relationship between the price of risk and volatility, he examines how data on the volatility of returns could be used to estimate the market risk premium. French, Schwert and Stambaugh (1987) show that expected market risk premium is positively related to the predictable volatility of stock returns and that unexpected stock market returns are

[23] Backfilling is where an existing series is extended back in time by adding earlier observations for entities that existed at the start date of the series. This omits data on entities that existed during the earlier period but failed to survive to the start date of the original series. These entities are likely to have performed poorly prior to their failure. As a result, the backfilled series will overstate the aggregate market returns over that period.

[24] Lally and Marsden (2004b) also report estimates of the market risk premium based on the tax-adjusted version of the capital asset pricing model, which is commonly used in New Zealand to reflect the differential taxation of interest, dividends and capital gains. These estimates are higher at around 7%.

negatively related to the unexpected change in the volatility of stock returns. Lally (2000) uses Merton's approach to estimate market risk premia for the US, Australia and New Zealand to be 4.3%, 6.2% and 7.6%, respectively[25].

3.2.2 Dividends and earnings

Fama and French (2002) note that average returns comprise the average dividend yield plus the average capital gain:

$$A[R_t] = A\left[\frac{D_t}{P_{t-1}}\right] + A\left[\frac{P_t - P_{t-1}}{P_{t-1}}\right] \tag{4}$$

With the assumption that the dividend-price ratio is stationary, the average capital gain is equivalent to the average dividend growth. This provides an alternative estimate of returns based on dividend growth:

$$A[R_t] = A\left[\frac{D_t}{P_{t-1}}\right] + A\left[\frac{D_t - D_{t-1}}{D_{t-1}}\right] \tag{5}$$

This is similar in appearance to the dividend growth model, except that it uses the realized growth rate instead of a forecast growth rate.[26] With the same logic, they present a further model based on average earnings growth:

$$A[R_t] = A\left[\frac{D_t}{P_{t-1}}\right] + A\left[\frac{Y_t - Y_{t-1}}{Y_{t-1}}\right] \tag{6}$$

They compare the average real risk premium calculated from these two models with the actual realized returns on an S&P 500 index from 1872 to 2000, including two sub-periods pre- and post-1950. These are shown in Table 2. Because these are real returns and the premium is calculated with respect to six-month commercial paper the actual magnitudes of the results are not directly comparable with the nominal equity risk premia over long-term bonds reported elsewhere in this paper. Nonetheless, the relative magnitudes of the results from their models compared to the average realized returns are of interest.

Table 2 - Fama and French Realized Return Models

	Average Realized Return	Dividend Growth Model	Earnings Growth Model[27]
1872-2000	5.57%	3.54%	
1872-1950	4.4%	4.17%	
1951-2000	7.43%	2.55%	4.32%

25 Note that this approach assumes that the markets are fully segmented.

26 The dividend growth model specifies expected return as a linear function of current dividend yield and dividend growth in perpetuity. It is derived from the relation that price equals the expected present value of future dividends, along with an assumption that the dividend growth rate is constant. This model is examined in more detail when forward-looking applications based on the dividend growth model are discussed below (page 15 onward).

27 Average earnings is not available for the pre-1950 period.

While the average return predicted from the dividend growth model is similar to the realized return over the period prior to 1950, the predictions from both the earnings growth and dividend growth models for the 1950-2000 period are much less than the realized returns. This is because prices grew at a faster rate than both dividends and earnings over that period. Fama and French argue that the growth models (and the dividend growth model, in particular) provide better measure of the true unconditional expected value of the equity risk premium because they are more precise, they produce more consistent Sharpe ratios, and the results are more consistent with the behaviour of other fundamental variables, such as the book-to-market ratio. They therefore conclude that the average realized return for the last fifty years was a lot higher than expected and that the true expected equity premium is a lot lower than that measured from the historical realized returns. Ibbotson and Chen (2001) adopt a similar approach with two models that use the historical growth in earnings and growth in GDP per capita as proxies for dividend growth. They obtain estimates of the expected equity risk premium of 5.9% and 6.2%, respectively.

Jagannathan, McGrattan and Scherbina (2001) also adopt an average dividend growth model and apply it to three portfolios: the S&P Composite Index (1926-99), the value-weighted portfolio of publicly traded stocks from CRSP (1926-99) and an aggregate portfolio of stocks held by US residents based on data from the Federal Reserve Board (1946-99). They use both the historical dividend growth and historical growth in US GNP for the dividend growth rate. They obtain estimates for the equity risk premium for the sample periods of between 3.4% and 5.9%.

Arnott (2004) claims that just over 2.5% is a reasonable estimate for the future real returns on stock. The estimate is obtained by adding 1.5% dividend yield and just over 1% for the historic growth rate in real earnings and dividend growth. His estimate of US government inflation-indexed bonds is 2.3% giving an equity premium of only 0.3%.

Contrary to Arnott (2004), Siegel (2004) believes that the real earning growth is likely to increase in the future to 4.73%. Combining this estimate with the 1.6% dividend yield gives a 6.3% real return on equities in the future. He assumes that only a portion of dividend yield goes towards earnings growth, hence the final estimate of earning growth is about 4.85%. Siegel then uses indexed-linked bond's average of 1.9% to conclude that a reasonable equity premium going forward is about 3%.

3.2.3 Other historical information

Ibbotson and Chen (2003) analysed historical equity returns by decomposing them into major financial and macroeconomic factors – inflation, earnings, dividends, price to earnings, the dividend-payout ratio, book value, return on equity, and GDP per capita. They found the equity premium to be around 5.90% on arithmetic basis.

Goval and Welch (2004) identified the main variables that were used in the literature to try and predict the equity premium. They were the dividend-price ratio (and the dividend yield), the earnings price ratio (and the dividend-earnings payout ratio), the interest and inflation rates, the book-to-market ratio, the consumption wealth and income ratio, and the aggregate net issuing activity. Using the data from 1871 to 2003 they estimated simple linear regressions to predict the equity premium. They find that they could "not identify a single variable that would have been of solid and robust use to a real-world investor (who did not have access to ex-post information)". They concluded that "the rumours of the predictability of the equity premium are greatly exaggerated".

Bostock (2004) developed a framework for constructing an equity risk premium as a combination of required premiums for duration of equities, issuer risk, discretionary income, trading costs, and tax risk. According to his estimates total premium over government bonds should be 1.7%±0.6%.

3.3 Limitations of historical analyses

3.3.1 Relevance

Estimates of the expected long-term future equity risk premium based on historical analysis presume that the historical record provides an adequate guide for future expected long-term behaviour. However, the true market risk premium shifts over time and therefore the use of historical data (particularly of the Ibbotson type) would yield a biased estimate of the current value for the market risk premium). Following Siegel (1992), Booth (1999) identified risk-free rate bias, inflation rate bias and term premium bias present in estimating market risk premium. His suggestion to minimise biases is to base forecast of the equity premium on the real equity return combined with the current inflation expectation. Examples of other work in the area include Merton (1980), who addresses time variation in volatility, and Lally (2002), who addresses time variation in market leverage.

The seventh section of this paper catalogues a series of developments in capital markets, the macroeconomy and demographics that are expected to take place over coming years. Some of these may well result in markets behaving differently than they have in the past. This suggests caution should be exercised when relying on assessments based on historical data.

3.3.2 Other Biases

Survivorship bias[28] has been identified as one of the main reasons why the results based on historical analyses can be too optimistic (for example see Brown, Goetzmann and Ross (1995) who formalised how the observed return, *conditioned on survival*, can overstate the unconditional expected return). However the importance of survivorship bias can be overstated (Dimson *et al* 2003, Li and Xu 2002) what is more crucial is the period over which the risk premium is estimated. Following (Mehra 2003), it is implicit in Brown et al (1995) analysis that catastrophes in equity markets are not matched in government bonds. If both markets are subject to similar risks of implosion, then both average stock and bond returns in surviving markets will exceed their expectations, but the difference between the two, being equity risk premium, need not be biased.

Illmanen (2003) summarises the peso problem, where the market equity premium is influenced by the events that did not happen, and he states “with hindsight we know that the US… survived two World Wars, the Cold War, and the Great Depression, and did not suffer the hyperinflation, invasion, or other calamities of many other countries. This was not a forgone conclusion at the time”. Dimson *et al* (2003) highlight the survivorship bias relative to the market, “even if we have been successful in avoiding survivor bias within each index, we still focus on *markets* that survived”.

[28] Survivorship bias applies not only to the stocks within the market, but also for the markets themselves (ie highlighting relative important of US and UK markets (Dimson *et al* 2003), “US market’s remarkable success over the last century is typical neither of other countries nor of the future for US stocks” (Dimson *et al* 2004)).

3.3.3 Predictability

Even though series as long as 75 years might seem like plenty of data for assessing expected values, the high volatility of returns means that standard statistical inference requires wide confidence intervals to be placed around the results. For example, the expected equity risk premium estimated from the 77 years of data from Ibbotson (2002) is 7.0%, with a standard deviation of 20.2% for annual returns. Assuming the process is stationary (which is questionable), a standard *t*-test will reject the hypothesis that the true expected risk premium is zero (*t*=3.04). However, a 95% confidence interval is ±5%, giving a likely range for the true expected value of 2% to 12%. Even with 200 years of data, the interval is still ±3%.

Dimson et al (2003) give an example of how sensitive the stock returns are to the sampling period, for a hundred year period: 1900-1999 return is 7.1%, for 1901-2000 its 6.7%, for 1902-2001 its 6.4%, and for 1903-2002 its 6.1%. Changing only three observations in a one hundred year data series is sufficient to shift the estimate by a whole percentage point.

4 Theoretical analysis – the equity premium puzzle

The equity premium has also been examined from a theoretical perspective. The starting point for this is a standard utility function, in which utility is defined as the expected present value of the utility from consumption in future periods. Investment is essentially deferred consumption. If the investor's utility function is concave (as is generally assumed), the investor will prefer to smooth consumption over time and hence will value more highly a stream of returns that provides higher payoffs when consumption is growing faster. Cochrane (1997) summarises the key result in the following relation:

$$\frac{E(r)-r_f}{\sigma(r)}=\gamma\sigma_{\Delta C}corr(\Delta C,r) \qquad (7)$$

The left hand side of this equation is the Sharpe ratio: the market risk premium divided by the standard deviation of returns. The right hand side expresses this Sharpe ratio as the product of investor risk aversion (γ), the riskiness of changes in consumption ($\sigma_{\Delta C}$) and the correlation between changes in consumption and returns ($corr(\Delta C,r)$). The problem, originally identified by Mehra and Prescott (1985) and termed the "equity premium puzzle" is that plausible values for the variables on the right side of the equation produce estimates of the equity risk premium of less than one percent. This is an order of magnitude smaller than the observed equity risk premium, as documented throughout this paper.

Mehra and Prescott's article has led to a range of literature attempting to reconcile their theoretical result with the historical results.[29] It has involved both relaxing the

[29] For reviews, see Abel (1991) Cochrane (1997), Siegel and Thaler (1997), Kocherlakota (1996), Cornell (1999, chapter 4), Campbell (2000). Note that this issue is only relevant if the consumption CAPM (Breeden 1979) is valid.

assumptions underlying the standard theoretical models, and more carefully interpreting the historical data. Cochrane (1997) summarised the then current state of the literature as follows:

> Standard models predict nothing like the historical equity premium. After a decade of effort, a range of drastic modifications to the standard model can account for the historical equity premium. It remains to be seen whether the drastic modifications and a high equity premium, or the standard model and a low equity premium, will triumph in the end. Therefore, economic theory gives one reason to fear that average excess returns will not return to 8% after the period of low returns signalled by today's high prices.
>
> Cochrane (1997)

Reviewing the accumulated evidence just two years later, Cornell (1999) was prepared to be somewhat more positive:

> Taken alone, none of the theories reviewed in this section convincingly explains the observed equity risk premium on its own. The problem is that the observed premium is so large that the models have to be stretched to breaking point to explain the data. An easy way to solve the problem is to cook up a stew of explanations. … If all these factors interact, none of the models has to be stretched unreasonably to explain the observed premium.
>
> Of course, the fact that a stew *can* explain the equity risk premium does not mean that it is the right explanation. Since the work of Mehra and Prescott (1985), dozens of the best economic minds in the world have been working on the problem of explaining the equity risk premium. It is not surprising that they have come up with some *possible* solutions."
>
> Cornell (1999)

Since 1999, the empirical and theoretical literature around the equity premium puzzle has continued to grow (for example, Brennan and Xia 2000, Constantinides 2002, Constantinides, Donaldson and Mehra 2002, McGrattan and Prescott 2001b, Philips 2002, and other recent literature cited throughout this paper). Hibbard (2000) illustrated that the puzzle also holds for New Zealand data[30]. The emerging consensus seems to be that the 'puzzle' provides a useful straw man for drawing out complex elements of the real-world environment that are not reflected in the standard economic models. However, the theoretical results are not now seen (as they possibly were a decade ago) as having strong normative implications for the expected equity risk premium. They have nonetheless bolstered the credibility of the empirical analyses that now consistently predict an expected long-term equity risk premium that is somewhat lower than the realised outcomes over the past few decades. In 2003 Mehra reviewed the literature since his original article and came to the conclusion that

> Before the equity premium is dismissed, not only do researchers need to understand the observed phenomena, but they also need a plausible explanation as to why the

[30] He calculated the arithmetic historic average over the period of 1965 to 1997 to be 5.55% while the theoretical analysis suggested that the value should not exceed 1%. Although due to high standard deviation for that period in New Zealand data the difference between theoretical and empirical equity premium was not significant.

future is likely to be any different from the past. In the absence of this explanation, and on the basis of what is currently known, I make the following claim: Over the long term, the equity premium is likely to be similar to what is has been in the past and returns to investment in equity will continue to substantially dominate returns to investment in T-bills for investors with a long planning horizon

Mehra (2003)

5 Forward-looking estimates

The empirical literature examined above focuses on historical evidence of past capital market behaviour. Two underlying assumptions are that the past behaviour of capital markets provides a reliable guide as to their future behaviour, and that average past realisations provide an unbiased estimate of expectations about the future. Another source of information about expectations is the future-oriented information that can be elicited from analysts and other market participants. This section reviews forward-looking estimates based on analysts' earnings forecasts.

Analysts routinely forecast future levels and growth rates of firms' earnings. These forecasts impound assumptions about the expected equity risk premium. Several authors have therefore used these forecasts to attempt to gauge the expected risk premium implied in the forecasts. The first attempts at this estimated the risk premium by solving the dividend growth model (in which price is the expected present value of future dividends) to obtain the implied return as the discount factor. More recently, authors have adopted the residual income model, which directly uses analysts' earnings forecasts.

5.1 Dividend growth model

A fundamental valuation theory is that the price of a stock equals the present value of expected future dividends. This provides the dividend discount model:

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t} \tag{8}$$

With the assumption of a constant growth rate of dividends, this can be restated so that the expected return equals the current dividend yield plus the dividend growth rate:

$$r = \frac{D_1}{P_0} + g \tag{9}$$

Harris and Marston (1999) use analysts' forecasts of the earnings growth rate as a proxy for the dividend growth rate and estimate the expected return using this relationship for each company on the S&P 500 for 1982 to 1998.[31] A value-weighted sum of the returns for each company in a year gives an estimate of the expected market return for the year. Subtracting this from the prevailing bond yield gives an estimate of the equity risk premium. They find an average equity risk premium over the 17 years of 7.1%, with a range in any year of 5.2% to 9.2%. This is relatively close to the historical realisation of 7.0% (Ibbotson Associates 2002). One difficulty with this approach is that the aggregated

[31] This is essentially an update of an earlier study (Harris and Marston 1992) that used data up to 1991.

earnings growth forecasts are in the region of 12% per year. With nominal GDP growth less than 8%, a dividend growth rate of 12% is clearly not sustainable in perpetuity. Since this represents about three-quarters of the estimated return on equities, it calls into question the reliability of the calculated risk premia. It is consistent with the findings of Chan, Karceski and Lakonishok (2001), who report evidence that analysts' forecasts are optimistic and have low predictive power for long-term growth.

Cornell (1999, chapter 4) outlines a similar approach using analysts' forecast dividend growth rates for the first five years, then reverting the growth rate over a transition period to a forecast of the nominal growth rate of the economy. Cornell notes that this approach could be implemented either by estimating this model for each firm then aggregating the results to get a market equity risk premium, or by aggregating the individual firm forecasts and undertaking the estimation once for the market as a whole. Using the first approach and firm-level data for 1996, he finds an equity risk premium over bonds of 4.53%. He also reports that Goldman Sachs used the second approach to give an equity premium over bonds of 4.27% in 1996.[32] Lally (2001) adopts the second approach of undertaking the estimation once for the market as a whole. He estimates a market risk premium of 3.8% to 5.9% for New Zealand, depending on the growth assumption and the length of the transition period.

5.2 Residual income model

The procedures discussed above assume that the earnings growth rate is a sufficient proxy for the dividend growth rate. Another way to manipulate the dividend pricing model is to substitute the 'clean surplus' relation (that dividend equals earnings minus change in book value) into the dividend discount model, so that price is expressed as a function of current book value (B_0), future "abnormal earnings" (ae_t) and the discount rate of return:[33]

$$P_0 = B_0 + \sum_{t=1}^{\infty} \frac{ae_t}{(1+r)^t} \tag{10}$$

where $ae_t = earnings_t - rB_{t-1}$. This model is mathematically equivalent to the dividend discount model described above. The advantage is that the earnings forecasts can enter directly instead of just as a proxy for dividend growth.

Claus and Thomas (2001) express this model in finite form as follows:

$$P_0 = B_0 + \frac{ae_1}{(1+r)} + \frac{ae_2}{(1+r)^2} + \frac{ae_3}{(1+r)^3} + \frac{ae_4}{(1+r)^4} + \frac{ae_5}{(1+r)^5} + \left[\frac{ae_5(1+g_{ae})}{(r-g_{ae})(1+r)^5}\right] \tag{11}$$

where g_{ae} is the long-term growth in abnormal earnings. Claus and Thomas assume that this follows the expected inflation rate. They then aggregate firm-level data on analysts' earnings forecasts, book values and capitalization into market measures so that they can solve this equation for the discount rate of return for each year from 1985 to 1998. Subtracting these from the long-term bond rate for each year gives their estimate of the

32 Goldman Sachs reported a similar approach in 2002, with an estimate of 2.4% (O'Neill, Wilson and Masih 2002). This was calculated as current dividend yield (2.3%) plus real GDP growth (2.5%) minus real bond yield (2.4%). They note that this result is significantly lower than most investors seem to expect.

33 This is known as the "residual income model" and the "abnormal earnings model". It has generated an active field of research in recent years. Lee (1999) provides a survey of this literature.

expected equity risk premium for that year. The mean equity risk premium over the 14 years is 3.4%, with a range of 2.5% to 4.0%.

The main difficulty with forward-looking approaches is obtaining good estimates of the long-term growth rate. Claus and Thomas argue that their approach has several advantages. First, the inclusion of current book values and near-term analysts' forecasts in the estimation means that the calculation is not especially sensitive to the choice of growth rate. Second, they argue that the assumption that the growth rate is equal to the expected inflation rate is defensible macroeconomically[34]. Third, if analysts' earnings forecasts are biased upwards then the true expected equity premium would be even lower than their estimates.

Gebhardt, Lee and Swaminathan (2001) also adopt the residual income model. They estimate the risk premium for each firm and then aggregate (equally-weighted) across firms to obtain a market equity risk premium. For the period 1979 to 1995, they obtain an average of 2.7%, which they claim confirms Claus and Thomas' conclusion that the implied risk premium is significantly lower than that obtained from realized returns.[35]

Claus and Thomas (2001) also estimate the equity risk premium in Canada, France, Germany, Japan and the United Kingdom. They find that the equity premium values generally lie between two and three percent, except for Japan, where the estimates are considerably lower. Gendreau and Heckman (2002) carry out a similar analysis to Claus and Thomas for the same six countries over the period 1990 to 2002. They use a shorter (one year) forecast horizon and they use forecast GDP growth rates to proxy the growth rate of abnormal earnings. They obtain average risk premia in the range of 2.3% to 3.6% (except Japan at 1.6%).

A potential limitation with the approaches adopted by Claus and Thomas and by Gebhardt, Lee and Swaminathan is that they both require assumptions to be made about the growth in perpetuity of abnormal earnings, even though as Claus and Thomas point out they rely less on the growth rate than do approaches using the dividend discount model. Easton, Taylor, Shroff and Sougiannis (2002) also base their analysis on the abnormal earnings model. However, they adopt an approach that allows them to estimate the rate of return and the growth rate simultaneously.[36] Using the same IBES source of analysts' forecasts as Claus and Thomas and Gebhardt, Lee and Swaminathan, they obtain an average equity premium of 5.3% (with a range of 2.2% to 8.3% for any one year) over the period 1981 to 1998, compared to the 3.4% and 2.7% averages of the other authors.[37] Their higher result arises mainly because their *estimated* growth in abnormal earnings is higher than the growth rates *assumed* in the other papers. Whether these higher estimated growth rates are plausible is an open question. Claus and Thomas (2001) noted that their assumed growth rate was already higher than any rate assumed in the prior abnormal earnings literature.

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[34] They assume that the expected inflation rate is the upper bound to the assumed long-run expected growth, this is not necessarily right. They acknowledge that growth in abnormal earnings reflects the expected growth rate in economic rents and the degree of accounting conservatism. There are no obvious bounds for these. However for dividend growth model the upper bound on the long-run expected growth rate in dividends is the long-run expected growth in GDP.

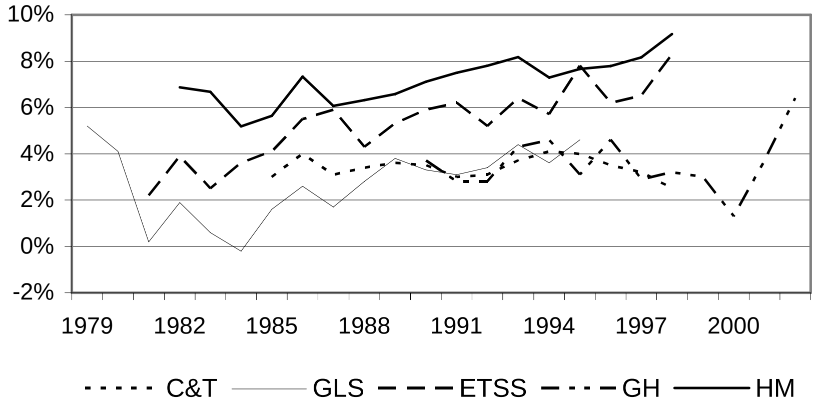
[35] The time periods of these two studies overlap for the years 1985 to 1995. For these years, the average premium estimated by Claus and Thomas was 3.4%, compared with 3.2% by Gebhardt, Lee and Swaminathan.

[36] The additional restriction they impose in order to make this estimation is that the four-year sum of residual income has a linear relationship with price (all weighted by book value). This can be derived from a one-period version of the residual income model. They estimate this as a random coefficients linear regression across the firms in their sample. The two regression coefficients are functions of the discount rate and the growth in residual income. Inverting these functions and solving them simultaneously for the discount rate and growth gives the required estimates.

[37] For the common 1985 to 1995 period noted in footnote 35, Easton *et al.*'s average is 5.7%

Figure 2 summarises the results from the various studies which provide a time series of estimates of the market equity risk premium based on analysts' forecasts. The Harris and Marston (1999) results (the top line on the chart), based on the dividend growth model and using analyst long-term growth forecasts, is clearly above the series based on the residual income model. The three residual income approaches that use growth assumptions (Claus and Thomas 2001, Gebhardt *et al* 2001, Gendreau and Heckman 2002) are fairly closely aligned at about 4% over their years of overlap. The more volatile recent results from Gendreau and Heckman are understandable, given the market events of the last few years. The results from the residual income model with an implied growth rate (Easton *et al* 2002) fall above those of the other residual income approaches for all years, but below the dividend growth model results.[38]

Figure 2 – Market Equity Risk Premium from Analysts' Forecasts[39]



6 Survey approaches

This section reviews direct survey approaches, in which individuals are asked to provide forecasts of either the equity premium, or of returns to the various asset classes from which an equity premium forecast can be calculated directly. Interpretation of the results of surveys is not straightforward. Survey approaches appear attractive in concept in that they are attempting to directly elicit the variables of interest – people's expectations about future returns. They are reviewed here for that reason. However, there are some reasons to put less weight on these results than on the results from other approaches. First, as detailed earlier in this paper, there is a range of definitions and measures of returns and the risk premium. Even with a carefully specified question (such as in the Welch surveys discussed below), it is impossible to know whether the question is being interpreted as intended. Second, survey responses can be biased, like the documented bias in analysts' forecasts (Chan *et al* 2001). In particular, subjective assessments about long-term market behaviour may well overweight recent events and immediate prospects. Third, there is anecdotal evidence from respondents to surveys that sometimes not a great deal of care goes into making responses. So long as the responses are unbiased, this could be dismissed as random error. However, simple judgement heuristics (such as anchoring and adjustment from the last period's response) may well result in systematically biased

[38] It also has the appearance of being upward-sloping over time and the null hypothesis of a zero OLS slope is strongly rejected. However, with the small sample this could well be driven by a couple of random low points at the start and high points at the end. Or it could be an artefact of the procedure used to simultaneously estimate the growth rate of abnormal earnings.

[39] C&T=(Claus and Thomas 2001); GLS=(Gebhardt *et al* 2001); ETSS=(Easton *et al* 2002); GH=(Gendreau and Heckman 2002); HM=(Harris and Marston 1999).

responses. The surveys tend to be more optimistic than theoretical analysis (Ibbotson and Chen 2003). They tell us more about "hoped-for returns" than about required returns (Ilmanen 2003).

6.1 United States

Welch (2000, 2001) surveyed financial economist professors on their views about the short-term and long-term equity risk premium in 1998 and again in 2001.[40] The results are summarized in Table 3. The period intervening the two surveys saw equity prices climb rapidly, and then decline to about their original level. In addition, several of the influential articles reviewed in this paper were published over the period[41]. The results show that respondents have become more pessimistic, both about short-term prospects and about the long-term. The focus of this paper is on the long-term, so the 30-year forecasts are most relevant. The mean long-term expected risk premium of respondents in the 2001 survey was 5.5% and the median was 5%, down from 7.1% and 7%.

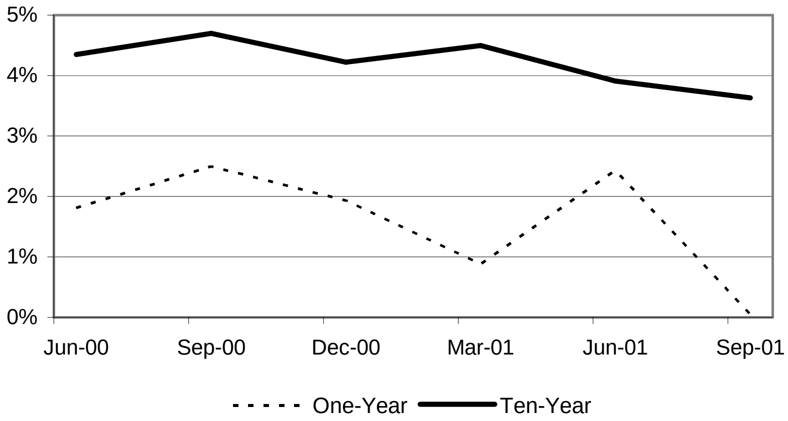
Table 3 – Forecasts of Arithmetic Equity Risk Premia (Welch 2000, 2001)

Time Horizon	1-Year		30-Year	
Year	1998	2001	1998	2001
Mean	5.8%	3.4%	7.1%	5.5%
Median	6%	3%	7%	5%
Interquartile Range	4%-8.5%	2%-5%	6%-8.4%	4%-7%

Graham and Harvey (2001) report on a rolling quarterly survey of chief financial officers from June 2000 to September 2001.[42] Their forecasts of the equity risk premium for one-year and ten-year horizons are illustrated in Figure 3. The ten-year forecasts are most relevant for this analysis. They are generally lower than the thirty-year forecasts from Welch (2001). Graham and Harvey speculate that this is because chief financial officers have a better understanding than financial economists. However, there are two reasons to believe that Graham and Harvey's results might be biased downward. First, the time horizon is only ten years. The immediate prospects for the short term would be expected to have a greater impact on a ten-year time horizon than they would on a thirty-year time horizon. As Figure 3 shows, their short-term forecasts were low, suggesting that the ten-year forecast could be biased downwards as a long-term estimate. Second, the survey question was not specific about whether an arithmetic or a geometric return was sought. It is reasonable to assume that some proportion of the respondents gave their estimate in geometric terms. This implies that the reported result would be biased downwards as an estimate of expected arithmetic annual premium.

[40] The 1998 Survey had 226 respondents and the 2001 survey had 510.
[41] For example in 1998 the most recent Ibbotson Yearbook published an equity risk premium of 8.9% over 1926-1997.
[42] There were between 125 and 250 respondents each quarter.

Figure 3 – CFO Quarterly Forecasts of Equity Risk Premium



Source: (Graham and Harvey 2001)

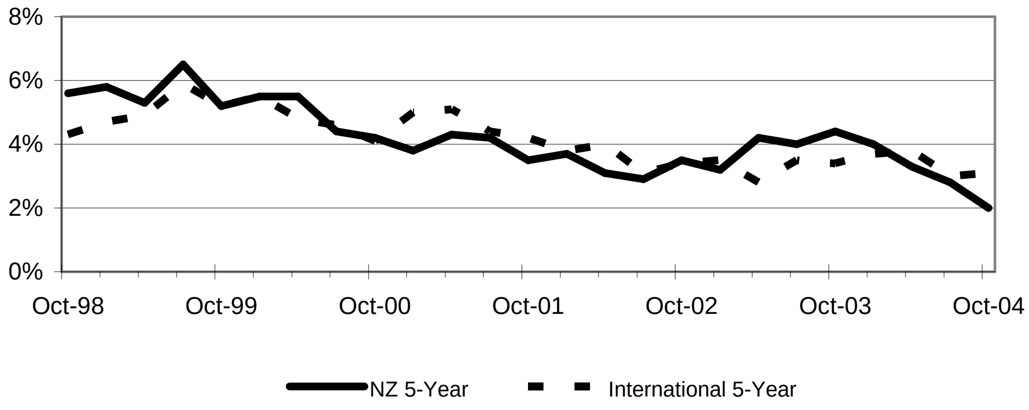
A survey of global bond investors by Schroder Salomon Smith Barney (Ilmanen, Byrne, Gunasekera and Minikin 2002) elicited an average equity risk premium in the range of 2% to 2.5%. They note that the results vary across countries according to recent experience in those countries, and they suggest that the cautious response may be specific to bond investors. A survey of Goldman Sachs' global clients in July 2002 elicited an average response on the long-run equity risk premium of 3.9%, with most responses clustered in the 3.5% to 4.5% range (O'Neill *et al* 2002).

6.2 New Zealand

Aon Consulting prepare a quarterly survey of investment managers' expectations for investment returns (Aon Consulting 2002). Figure 4 shows the difference between "Equities" and "Fixed Interest" in the New Zealand and international markets for the time period "Over the next five years" in successive surveys taken over the last six years. Like the Graham and Harvey (2001) survey, the survey question was not specific about whether an arithmetic or a geometric return was sought. It is reasonable to assume that some proportion of the respondents gave their estimate in geometric terms. This implies that the reported result would be biased downwards as an estimate of expected arithmetic annual premium.

It is interesting to note that the one-year forecasts made by the Aon respondents (not graphed) are typically higher than the five-year forecasts, especially in the last two years. This is contrary to the results reported by both Welch (2001) and Graham and Harvey (2001).

Figure 4 – Risk Premium from Aon Investment Forecasts



Source: Aon Consulting (2002)

Recently Lally, Roush and van Zijl (2004) surveyed members of the Institute of Finance Professionals of New Zealand Inc ("practitioners") and selected academics in finance, economics, and accounting ("academics") to get a consensus estimate of the market risk premium in New Zealand. The median for the whole group was 7%, dominated by practitioners[43]. The results for subgroups were 7.0% for practitioners and 5.5% for academics. The difference was statistically significant and might be at least partially explained by the influence of the early results of Ibbotson and Sinquefield on practitioners. Academics demonstrated larger confidence interval for equity premium indicating awareness possibly due to consideration of wider range of methodologies.

7 Issues in long-term capital market behaviour[44]

The environment surrounding long-term capital market behaviour may well be changing in ways that limit the external validity of analyses based on historical data and may not even be fully internalised in analysts' forecasts and other observable forward-looking information. This section first examines the implications of current price levels for future capital market behaviour. Emerging trends in capital markets, the macro-economy and demographics are then reviewed.

7.1 Current price levels

By any measure, world stock prices have been at all-time highs over recent years. Whether the unit of analysis is price indices, dividend yields, price-earnings ratios, market capitalization to national income, the graphs all show the past few years as impressive outliers (see Figure 5).[45]

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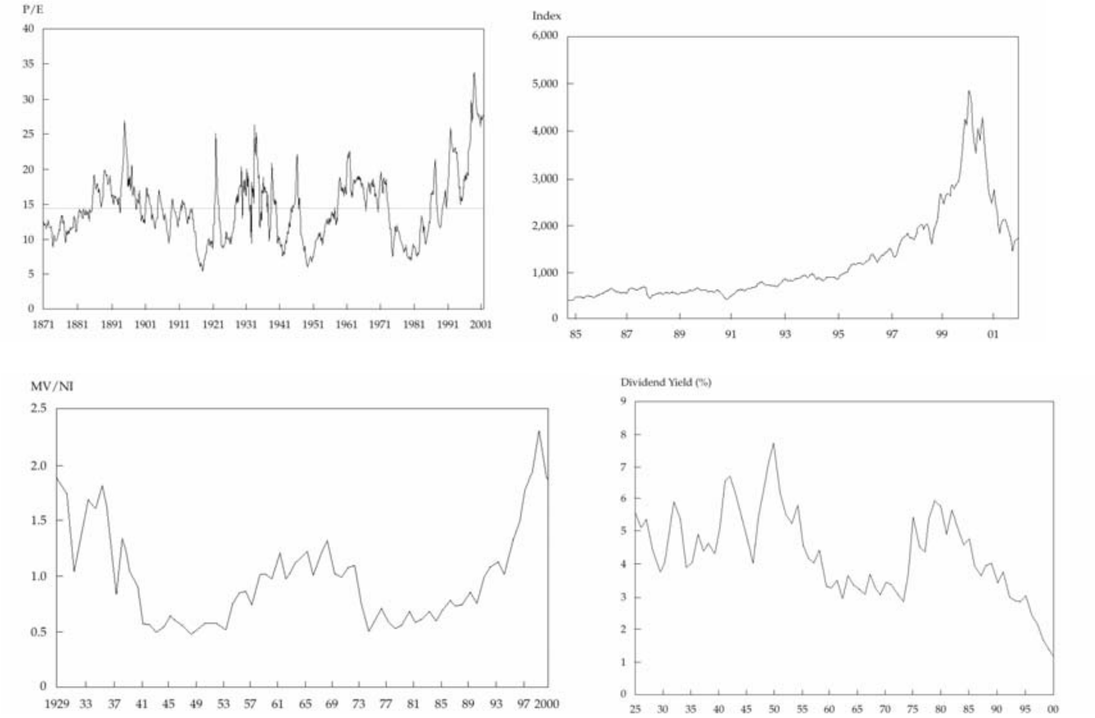
43 Sample size was 76 people, represented by the responses from 47 out of 520 practitioners and 29 out of 80 academics.

44 This section is largely drawn from the material in the appendix of McCulloch & Frances (2001).

45 However, McGrattan and Prescott (2001a) show that the market value of equity was close to the market value of productive assets in 2000. On this evidence, they questioned whether the stock market was overvalued.

Figure 5 – Time-Series of Capital Market Behaviour[46]



This fact has resulted in wide-ranging discussion about the possible implications of the high prices. These implications can be categorised as follows:

- The market is overvalued and a significant fall is imminent (a ‘crash’ or ‘burst bubble’).
- The market is overvalued and there will be a long and depressing slide of negative returns as it corrects over time.
- The market is correctly valued and rose because investor required rates of return have declined over recent years (the expected risk premium has fallen).
- The economy will continue to grow rapidly and earnings growth will continue (the ‘new era’).

The experience of the last couple of years is that prices have dropped back, consistent with the ‘bubble’ explanation. However, they are still historically high and views still differ as to whether we should expect a slide of small to negative premia as the market further corrects (Arnott and Bernstein 2002, Arnott and Ryan 2001, Arnott 2004), or we should expect a significantly positive long-term equity risk premium, although somewhat less than the historical average outturns of the last few decades (Philips 2002).[47] Campbell (2001) took the view:

> “It is too soon to tell which of these views is correct, and I believe it is sensible to put some weight on each of them. That is, I expect valuation ratios to return part way but not fully to traditional levels. A rough guess for the long-term, after the adjustment

[46] “P/E” = S&P 500 Index divided by the last 12 months earnings; “Index” = Real Nasdaq Composite Index; “MV/NI” = US Stock Market Value divided by US National Income; “Dividend Yield” = S&P 500 dividends divided by price. Source: AIMR (2001), Shiller (2000).

[47] The ‘new era’ explanation has fallen away.

process is complete might be … a long-run average equity premium of 1.5% to 2.5% in geometric terms or about 3% to 4% in arithmetic terms."

Campbell (2001)

7.2 Capital market developments

Capital markets are not static. They are continually evolving. This section examines some trends that have been mooted as possibly affecting future required rates of return.

7.2.1 New investments[48]

A major development in investment has been the establishment of mutual funds, in which investors pool their resources to acquire a more diversified portfolio at lower cost by taking advantage of economies of scale. Because this reduces the price to individual investors of investing in risky assets (otherwise they presumably would not do it), it has been suggested that this should lead to a lower equity risk premium in the future. On one hand, although mutual funds have grown significantly in recent years, they still own a relatively small proportion of the market (less than 20% of the US market in 1999) and the cost savings do not apply to large investors who have always enjoyed lower charges (Diamond 1999). On the other hand investors at the end of the 20th century were exposed to much wider pool of investments than the investors at the beginning of that century. Hence now investors are exposed to less diversifiable risk and are faced with lower equity premium (Siegel 2004).

7.2.2 Declining transaction costs

Another trend in capital markets is a decline in transaction costs as trading technology, especially over the internet, has developed and deregulation has taken place.[49] This applies to both stocks and bonds, but possibly more to stocks, suggesting that both the total expected return and the equity risk premium might decline. Again, however, large institutional investors, who make up the bulk of the market, already enjoy low charges so this trend would not be likely to have a significant effect on future returns.

7.2.3 Widening pool of investors

Heaton and Lucas (1999) document the increasing participation rates in the US stock market over the last decade. This increase is partly attributed to "baby boomers" entering their peak saving years, and also to developments in tax law, pension provision and globalisation of capital markets. Like the other capital market developments discussed above, the risk spreading resulting from this greater participation suggests that both the total expected return and the equity risk premium might be reduced but, again, the increase is primarily for small investors who do not own a large proportion of the market. Nonetheless, Siegel (1999) suggests that declining transaction costs and increased

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48 The composition of future market investments also matter for the returns, for example Lally (2002) also showed that variability of market risk premium depends on the market leverage, providing that the market portfolio is proxied by a portfolio of only equities rather than equities and corporate debt.

49 For example, prior to 1975, brokerage commission on trading individual stocks was set by the New York Stock Exchange, and were substantially higher than they are today (Siegel 1999).

diversification could have had an effect as great as one to two percentage points on expected net returns.

7.2.4 Market Volatility

Mayfield (2004) presents the model where he illustrates that variability of the market has positive correlation with the risk premium. He shows that the second half of the century in the US is associated with lower volatility hence leading to lower estimates of equity risk premium after 1940. Arguably if the trend continues we might see further reductions in the equity premium in the future.

7.2.5 Fall in Risk Aversion

Ilmanen (2003) reports that consumer surveys indicate that investors experienced a fall in perceived risk aversion. Investors experienced high positive long-run returns and that enhanced their risk tolerance and decreased equity risk premium. “Lower trading costs, better market access, greater global diversification opportunities, and negative stock-bond correlations enabled investors to reduce the systematic risk in their portfolios, which in turn raised investors’ willingness to take risks” (Ilmanen 2003).

7.3 Macroeconomic developments

7.3.1 Low inflation environment

After an analysis of 34 years data for 20 countries, Lindh and Malmberg (2000) find a pattern of inflation effects consistent with the hypothesis that increases in the population of net savers dampen inflation, whereas especially the younger retirees fan inflation as they start consuming out of accumulated pension claims. If this result has any predictive power, it suggests that inflation would be higher over the next few decades. This would be reflected in expected nominal rates of return. However, others believe that we are entering a permanent low-inflation environment that is different from historical experience, and with significant implications for pensions and other products that are priced on the basis of expected long-term returns (Meredith and others 2000). However, both bond prices and equity prices would presumably be affected, and possibly in different ways (Fama and Schwert 1977), so it is not clear what are the implications, if any, for the long-term expected equity risk premium. It is possible, for example, that an environment with both a low level and a low volatility of inflation affects the relative riskiness of stocks and bonds, and hence the risk premium.

Bostock (2004) suggests that there is a high correlation over history between the equity risk premium and unanticipated inflation. Campbell and Vuolteenaho (2004) find that the level of inflation explains almost 80% of the time-series variation in stock market mispricing. Ilmanen (2003) summarises that inflation may have an impact on real earning growth, on prospective real returns through money illusion, and on required real returns through rational risk premium.

Blanchard (1993) observed that the decrease in the risk premium in the US over the 1980s occurred while the inflation rate was declining and, as inflation stabilised in the late 1980s and early 1990s, the equity premium partly recovered. Hunt and Hoisington (2003) show that equity risk premium over bonds is positively correlated with inflation, due to the way that bonds are priced. They suggest that the “combination of tight fiscal policy, conservative monetary policy, and an abundance of goods worldwide [indicating] price stability – a historic setup for bonds to outperform stocks" (Hunt and Hoisington 2003). However, the relationship does not necessarily have predictive power.

7.3.2 Macroeconomic Volatility

Dimson et al (2003) suggest that the reason for high stock market prices is a fall in the required rate of return due to diminishing business and investment risks. "Business risk declined as the economic and political lessons of the 20th century were absorbed, international trade flows increased and the Cold War ended" (Dimson *et al* 2003). Lettau, Ludvigson and Wachter (2004) show that there is a strong and statistically robust correlation between low macroeconomic volatility and high asset prices. They conclude that "the estimated posterior probability of being in a low volatility state explains 30 to 60 percent of the post-war variation in the log price-dividend ratio". They go further to conclude from the international evidence that "in the model economy, a boom in stock prices occurs because the decline in macroeconomic risk leads to a fall in expected future stock returns, or the equity risk-premium".

7.3.3 Future GDP growth

Labour force growth is expected to slow over the next few decades as the population ages. With a constant or declining labour productivity, this implies that economic growth will be lower in future than now. This lower economic growth may or may not flow through to a lower marginal product of capital and lower returns. Diamond (1999) uses a standard (Solow) model of economic growth to show that slower long-run economic growth with a constant savings rate will yield a lower marginal product of capital. However, he also notes that savings and growth are related, with slower economic growth resulting in lower savings, which could preserve stability in the rate of return since in his Solow model, low savings increase the marginal product of capital[50]. However general consensus is that the future GDP growth has more substantial impact on bond returns than on the equity-premium.

7.3.4 Globalisation

As globalisation of markets, particularly capital markets, gathers pace, country-specific effects will be increasingly dominated by worldwide trends. As a result, the specific conditions in a particular country, for example its demographic structure, will come to have less of an effect on investment returns in, and to, that country than will the global demographic trend. In this vein, Bowman (2001) proposes an approach to estimating the market risk premium in Australia by reference to evidence from United States capital markets, with explicit adjustments for taxation, market differences, country risk, and time horizon. Lally (2000) compares the real cost of capital in New Zealand, Australia, and the United States, identifying sources of difference in both the risk-free rate and the market risk premium. Lally shows that, if markets are integrated, the risk premium for a particular market will be driven by the sensitivity of that market's return to world market return and the world market risk premium, with the latter driven by the variance in the world market return. By contrast, if markets are completely segmented, the risk premium for a particular market will be driven by the variance in that market's return. For small markets,

[50] If markets are efficient then declining labour productivity and its implication for future risk premium is already reflected in today's prices.

the effect of markets integrating could substantially lower the risk premium. Dimson et al (2003) suggest that

> Much of the cross-country variation in historical equity premiums is attributable to country-specific historical events that are unlikely to recur. When making future projections, there is a strong case, particularly given the increasing integrated nature on international capital markets, for taking a global rather than a country-by-country approach to determining the prospective equity risk premium
>
> Dimson et al (2003)

7.3.5 Demographics

The inevitable shift in the population age structure over the next few decades reflects the effects of increasing longevity and declining fertility, and it is accentuated slightly by the passage through life of the "baby boom" generation. It has generated a broad-ranging debate on the implications of a changing age structure for capital market behaviour that has not been especially conclusive. The following paragraphs summarise the main threads.

Accounts from the US of the effect of the "baby boom" generation on house prices in the late 1970s and early 1980s as they moved through their "home-buying years" (Mankiw and Weil 1990), and more recently on stock market values as they move through their "peak saving years" (IMF 2004), have led to wide speculation that asset values will decline over the next few decades as the baby boomers start to dis-save to finance their retirement years. Poterba (1998) investigates the empirical association between population age structure and the returns on stocks and bonds using historical data from the US over the past seventy years. He does not find any robust relationship between demographic structure and asset returns. However, the effects of age structure may well be too small to be detected amongst other shocks to asset markets. Strong serial dependence in age structures also limits the power of statistical tests.

Changes in government social policy, particularly retirement income provision and health insurance, could affect saving rates across age cohorts. For example, Poterba (1998) suggests: "If government provision of retirement income declines, this may stimulate saving among younger workers, thereby changing the current age-wealth accumulation profile."

Another possibility is that the development of financial markets in currently "emerging markets" might dilute the effect of changing age structures. Siegel (1999) states: "The developing world emerges as the answer to the age mismatch of the industrialized economies. If their progress continues, they will sell goods to the baby boomers and thereby acquire the buying power to purchase their assets." This assertion is consistent with the results reported by Brooks (2000a) from an overlapping generations model of eight world regions to simulate the effects of historical and projected demographic trends on international capital flows. However, a World Bank study (Holzmann 2000) concluded that investments in emerging markets might help at the margin but are unlikely to be a major factor.

If the market is made by investors who act on rational expectations, any predictable effect of a changing age structure should already be incorporated in the prices of financial instruments, at least to some extent. This puzzle has been partially resolved through intergenerational analysis. For example Geanakoplos, Magill and Quinzii (2004) show that there is a link between age distribution and stock returns even if investors have rational expectations. Only the current generation trades in the financial market, so the difference in the supply and demand caused by generations can not be arbitraged away ahead of time. The analysis showed that demography and business cycles account for almost all variation in stock market over the post-war period.

Individuals tend to shift from investments in equities to investments in less risky financial assets, such as government bonds, as they age.[51] This might lead to depressed returns for the baby boom generation as they sell their equities all at once to a smaller follow-on generation. Brooks (2000b) demonstrates this effect in theory using a neo-classical growth model with three overlapping generations (children, working parents and retired). However, this effect is mollified in the existence of publicly funded pay-as-you-go income provision. The real-world effect would also be expected to be weaker because there are more than three overlapping generations trading with each other and wealth is not evenly distributed within cohorts.

Constantinides, Donaldson and Mehra (2002) also adopt an overlapping generations model with the constraint that the young cannot borrow. Calibrating to historical US dividend and consumption patterns yields interest rate and stock price processes that conform closely to the historical performance of the US capital market. The borrowing constraint on the young has the effect of lowering the risk-free rate and hence raising the risk premium. The authors suggest that this might provide a partial explanation to the 'equity premium puzzle'. However, this is a 'representative consumer' model (in which each cohort comprises one representative person, so it is not informative about the effect of changes in the age.

IMF (2004) suggests a correlation between high stock prices and the baby boomers moving into their prime saving years. However this trend may change after 2010 as the baby boomers start to retire, "selling off their stocks to a much smaller generation of buyers, causing stock prices to decline" (Davis and Li 2003, Geanakoplos *et al* 2004, IMF 2004). Although this is only one of the arguments and empirical link is not strong (Ang and Maddaloni 2003, IMF 2004).

8 Conclusion

Assessing a point estimate of the long-term expected future equity risk premium is not an easy task. This variable is not directly observable, even in hindsight, and a range of evidence has been presented over time, with views differing on their relative strength. Nonetheless, it is clear that the consensus has shifted over time from a strict reliance on the realized historical results to now somewhat lower estimates. Interpretation of the evidence is made more difficult by people having different concepts in mind when using the term, equity risk premium. Which concept is correct depends on the purpose for which it is used. For the purpose of a forward-looking pricing model, such as the calculation of the required capital contribution for the New Zealand Superannuation Fund, an estimate of the expected future long-term annual premium of nominal equity returns over nominal long-term bond returns is required. That is the objective of this paper.

[51] The usual explanation for this, that people become more risk averse as they age, is not very satisfactory and has led to a long debate about the merits of time-diversification. See Thorley (1995) for a review. Also, Bodie (1995) provides an analysis using options theory. A more satisfactory explanation is that individuals run down their implicit holding of a non-traded asset, human capital, over their life cycle, so the move toward bonds is a rebalancing of their overall portfolio (Viceira 1999).

The traditional view has been that realized US market returns over the past seventy-five years (giving an average equity risk premium over long-term bonds in the region of 7%) provide an unbiased estimate of the expected future long-term equity risk premium. This view has given way over the past few years to a consensus that the future expected risk premium is actually somewhat lower.

This view of a declining expected long-term equity risk premium reflects a range of recent empirical evidence and theoretical analysis. Richer evidence on historical returns has been presented by analysing longer time series of US capital markets data and by looking over multiple international capital markets. Additional historical information on dividends, earnings and the variability of returns has also been harnessed. Various methodologies have been adopted to analyse this historical record. The results from these studies now consistently suggest that the expected long-term equity risk premium sits in the range of 0% to 7%. The theoretical result that the traditional view was not consistent with that implied by standard economic models of consumption, utility and risk aversion (the “equity premium puzzle”) has helped bolster the emerging view of a lower expected equity risk premium. However, the very low (less than 1%) expected equity premium implied by the theoretical results is not now seen as having strong normative implications.

Two potential limitations need to be taken into account in interpreting the historical analyses. First, although seventy-five or more years of data across several capital markets may seem like an abundance of data, it is not actually enough to allow very statistically precise estimates to be made. This is because of the high volatility of capital markets. Second, the external validity of the historical record for predicting future expected long-term capital market behaviour is of question. Recent all-time high equity prices have generated broad-ranging speculation about future capital market behaviour. In addition, trends in capital markets over time (including new institutions, declining transaction costs, and a widening pool of investors) along with macroeconomic developments (including changing inflation and GDP growth expectations, and globalisation) and impending demographic changes provide the possibility that future capital market behaviour may well deviate substantially from past experience, resulting in a general decrease.

Although the long-term expected future equity risk premium is not directly observable (and hence the past emphasis on the historical information that is available), there is other forward-looking information that is informative about future expected capital market behaviour. These include survey approaches, in which expectations are elicited directly from market experts, and approaches that infer the expected equity risk premium implied by analysts forecasts of dividends and earnings. The most recent survey results are providing median estimates of the long-term equity risk premium in the 2% to 5% range. This represents quite a decline over the past few years. A year or so ago, a median in the 5% to 7% range was indicated. However, by their nature, survey results are not necessarily very diagnostic and should be treated with caution.

Market analysts routinely put considerable effort into making forecasts of firms’ expected future earnings performance. Estimates of the market equity risk premium implied by these forecasts are therefore a potentially strong source of information about market expectations. Research using analysts’ earnings forecasts has gone through an evolution starting with straightforward applications of the dividend growth model. These initially gave an expected equity risk premium similar to the 7% historical result. However, the assumed long-term earnings growth rate has a crucial impact on the result in this model and there was some doubt about the realism of analysts’ growth forecasts when seen in the context of expected growth in the economy as a whole. Later applications using analysts' near-term forecasts but lining long-term growth up with expected growth in the economy obtained estimates that were more in the 3% to 5% range. A more recent innovative development has been the application of the residual income model in place of the dividend growth model. Although isomorphic to the dividend growth model, the residual income model has the advantage of being based on the underlying earnings that analysts forecast, rather than using those forecasts as a proxy for dividends. A few approaches have been adopted applying the abnormal earnings methodology, with the results generally coming out lower than the earlier historical-based approaches, with range for the expected equity risk premium of 2.7% to 5.3%.

At the conclusion of a forum on the equity risk premium sponsored by the Association for Investment Management and Research (AIMR 2001), comprising twenty leading researchers and practitioners, Campbell Harvey stated:

> We have talked today about the current state-of-the-art models. There is a burgeoning literature on different measures of risk, and we are learning a lot from the new behavioral theories. So, we are moving forward in our understanding of the risk premium. Indeed, some of the foremost contributors to this effort are in this room. And I think more progress will be made in the future. It is somewhat frustrating that we are not there yet. I cannot go into the classroom or into the corporate world and say with some confidence, "This is the risk premium."
>
> Campbell Harvey

With that difficulty in mind, the final task of this paper is to conclude on a point estimate assumption for the expected long-term equity risk premium. In summary, the traditional view based on historical returns of an expected equity risk premium of 7% has given way over the past few years to a consensus that the long-term future expected equity risk premium is somewhat lower. We believe that the long-term annual (arithmetic) expected future equity risk premium now sits in the range of 3% to 5%. In forming this view, we found the research based on analysts' earnings forecasts with a residual income model to be the most persuasive, and those results are broadly consistent with the latest research using historical data. While the survey results also happen to be broadly consistent with this as well, we put less weight on them. The risk premium we have considered is a premium for a world portfolio, which is largely dominated by the US market.

For the purpose of calculating the required capital contribution to the New Zealand Superannuation Fund, the Treasury is adopting the assumption of a long-term annual (arithmetic) expected future equity risk premium of 4%.[52] In the normal course of events, we would expect this assumption to stay stable over long periods of time.

[52] We noted at the outset of this paper that various definitions are used for the term, equity risk premium. A 4% nominal arithmetic expected equity risk premium is equivalent to a real premium that is a few tenths of a percent lower, and to an expected geometric premium of between 2% and 3%, depending on the length of time for which the geometric calculation is being made, and depending of what assumption is made about the volatility of returns.

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