# How Low is the UK Equity Risk Premium?

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# How Low Is the UK Equity Risk Premium?

In this paper, it is argued that previous estimates of the UK arithmetic risk premium show a degree of upward bias. Given the importance of the risk premium in regulatory cost of capital in the UK, this has important policy implications. There are three reasons why previous estimates could be upward biased. The first two arise from the comparison of estimates of the realised returns on Government Bond ("Gilt") to realised returns on equities. These estimates are frequently used to infer a risk premium relative to the current yield on index-linked gilts. This is incorrect on two counts; first, inconsistent estimates of the risk free rate are implied on the right hand side of the CAPM (Jenkinson, 1993); second, they compare realised returns from a bond which carried inflation risk with realised returns from equities which may be expected to have at least some protection from inflation risk. The second source of bias arises from the difference between arithmetic and geometric premia. If markets exhibit "excess volatility" (Shiller 1981), or if part of the historical return arises because of revisions to expected future cash flows, then estimates of variance derived from historical returns or price growth must be used with great care when uplifting geometric averages to arithmetic averages. Adjusting expected returns for the effect of such biases leads to lower *ex ante* premia than those that are typically quoted. At current market values, the arithmetic premium ranges between 2% and 4.3%, although the higher estimates require optimistic assumptions concerning growth; the geometric equivalent ranges between 1.5% and 3.3%.

## Introduction

A focus of some recent work on the equity risk premium has been the resolution of the risk premium puzzle identified by Mehra and Prescott (1985). Campbell (1999), and Dimson, Marsh and Staunton (2002, 2006, 2007) show that the puzzle exists in the international data as well as the US data. The observed historical premia over both Treasury Bills and Government Bonds are too high to be consistent with any plausible degree of relative risk aversion on the part of investors. Attempts to resolve the problem include modifications to the theoretical models that determine the coefficient of relative risk aversion, a useful review of which is in Cochrane (Chapter 21, 2001), and analyses that examine the effect of revisions in cash flow expectations on the historically observed risk premium (Fama and French, 2002; Dimson et al, 2006). Similar to Fama and French (2002), this paper contributes to the latter body of work by estimating the UK risk premium based upon rational historical expectations of the *ex ante* risk premium. As in Dimson et al (2006) a dividend growth ("Gordon's growth") model is used, but the estimates are constructed by incorporating growth terms based both on dividend growth and earnings growth. Thus this study should be viewed as complimentary to that of Dimson et al (2006) in this respect.[1]

A further puzzle that has been observed in past equity prices is the "excess volatility puzzle" (Campbell, 1996; Campbell and Shiller, 1988). Volatility of returns seems too high to be reconciled with the observed volatilities in dividend and consumption growth, and this volatility exacerbates the problem of explaining the observed equity risk premium as it implies a degree of mean reversion in stock prices. Furthermore, as Cochrane (2001, p. 460) points out, these standard deviations are so high that they imply a large amount of uncertainty about the true equity risk premium, a fact that he describes as a "surprisingly underappreciated problem".

Whilst it is widely recognised that revisions in cash flow expectations have implications for the estimation of the *ex ante* risk premium, there seems to be little explicit recognition of the importance of the excess volatility studies for this *ex ante* premium. One line of argument is that if the expected premium is not serially

[1] The incorporation of an earnings growth estimate comes at a cost. Whilst Dimson et al (2006) provide dividend growth estimates back to 1900, from the data used in this study it is only possible to obtain historical series back as far as 1924 for dividends and 1927 for equities.

correlated, then the correct approach to estimating the annual discount rate for equities is to use the arithmetic risk premium. However, there are three caveats here. First, whilst advocating the use of expected simple one period returns in discounting, Fama (1996) highlights the fact that discounting net cash flows by such discount rates implies that the distribution of these cash flows more than one period ahead are right-skewed. Second, Blume (1974) shows that the arithmetic average of an historical series of data gives rise to an upward biased estimate of the *N*-period return, whilst the geometric average is downward biased. He proposes an horizon-weighted average of the arithmetic and geometric average returns to deal with this problem. Third, if there is autocorrelation in past returns, then it does not follow that the arithmetic average will give a reliable measure of simple one period ahead returns, although in a simulation study Indro and Lee (1997) show that Blume's (1974) recommendation of an horizon-weighted average exhibits the least bias compared to alternative estimators.

If expected returns are lognormally distrubuted, from Jensen's inequality the arithmetic average risk premium should be approximately the geometric average risk premium plus half the variance. Dimson et al (2002, p.193) use a 16% estimate of projected market volatility when moving from geometric to arithmetic averages, equivalent to an uplift of 1.3%. Fama and French (2002) argue that as price growth is more volatile than dividend growth, and so any estimate of the *ex ante* risk premium needs to be adjusted to allow for this. In general, if such adjustments are formed on the basis of historically measured variances a problem that arises is that historically observed price growth embeds both the effects of unanticipated cash flow growth and any "excess volatility" resulting from irrational pricing movements. Unless one expects both of these effects to continue into the future, or alternatively rejects the notion of "excess volatility" altogether, any historical estimate of price growth variability will be an over-estimate of the expected variance. As the volatility from the historically estimated long run dividend growth series is considerably lower than either the volatility of past stock prices or contemporaneous market volatility estimates, it can be argued that any estimates of the *ex ante* arithmetic premium derived by adjusting dividend growth model estimates for observed price volatility are over-estimates. This line of argument also depends on the interpretation placed on such forward estimates. Fama and French (2002, p.638) regard the average of such estimates as an estimate of the unconditional expected stock return. By contrast, Claus and Thomas (2001, p.1630) regard their *ex ante* estimates as conditional on the information available in any one year, and specifically note "we do not consider an unconditional equity premium toward which those conditional premia might gravitate in the long run". This difference in interpretation is of critical importance in identifying the correct estimate of the *ex ante* simple annual return, as under the Claus and Thomas (2001) interpretation no adjustment would need to be made to the mean estimated premium, in contrast to the Fama and French (2002) recommendation. Although the main focus is on the arithmetic average return, an added benefit of a more precise (i.e. less volatile) estimate of any equity return or risk premium is that it helps in addressing the "surprisingly underappreciated problem" that Cochrane (2001) highlights.[2]

The equity risk premium in the UK is of central importance to regulators, who make use of it both in setting utility prices and in market investigations, to investors and the investment community, and to corporate finance departments. Precisely because of the UK regulatory regime, an accurate estimate of the risk premium is of particular concern in this country. In a recent report for Ofgem, Wright et al (2006) argued in favour of an uplift of 2% in obtaining the arithmetic risk premium from the the geometric risk premium on the grounds that such an uplift is "conservative". Others might regard such an uplift as being not necessarily in the interests of consumers. In addition, regulators appear to impart two further sources of bias in the estimation of the risk premium. The reason is that regulators and their advisors have typically estimated a real premium relative to either government bonds ("Gilts") or Treasury Bills, and then added this to a contemporaneous estimate of the real risk free rate. There are two problems here. The first goes back to Jenkinson (1993) who argues that there is only one risk free rate in the Capital Asset Pricing Model (CAPM). As such, it is inappropriate to incorporate an equity risk premium derived using one risk free rate, the historical figure, in the CAPM if the first term on the right hand side (RHS) uses a different estimate of the risk free rate, the current rate. This bias

[2] It should be noted that Dimson et al (2006) conducts a world-wide decomposition analysis using geometric returns and is altogether less strong in advocating the use of arithmetic averages, noting that "For those who focus on the arithmetic mean" the world arithmetic average premium is 1.3% higher than its geometric counterpart, although in the concluding paragraph a geometric world risk premium of 3 to 3.5% is used to suggest an arithmetic premium of 4.5% to 5%.

suggests that either historical estimates of the risk free rate should be used throughout, or that the appropriate term to incorporate on the RHS of the CAPM is an estimate of the expected return on equities, from which the current risk free rate is deducted. As the real medium term gilt rate on index-linked gilts is around 1% higher than the typically observed historical real return on gilts, the bias is estimated costs of capital is considerable. Wright et al (2003)[3] argue against the separate estimation of the risk free rate and an equity risk premium on the grounds that estimates of the return on equities exhibits more stability than estimates of the equity risk premium.

The second bias in the current regulatory approach is rather more subtle. The problem here, in the case of the analysis of the historical expected equity premium, is that there is a danger of comparing *expected* returns on equities, which may be to some degree insulated from inflation risk, with *ex post* realised returns on bonds, which are not. The appropriate approach would be to compare the *ex ante* estimate of real equity returns with the *ex ante* estimate of real gilt returns, using common estimates of inflation. This implies using yearly estimates of government bond yields to redemption, rather than realised returns. Such an analysis, in nominal terms, is undertaken by Claus and Thomas (2001), but this contrasts with the approach used in studies of historical investment returns (e.g. Barclays Capital (2007), Dimson et al (2007)) which typically take the risk premium over gilts as the realised real equity return minus the realised real bond return. This approach is not wrong if one is concerned with the historical returns actually earned by investors, but it will give a misleading estimate if combined with an inflation-protected index linked gilt yield to give an estimate of the current risk premium.

The purpose of this paper is to examine the above sources of potential bias in estimates of the UK *ex ante* risk premium, and to calculate bias-free estimates of that premium depending on alternative beliefs concerning price volatility. As these biases are positive and significant, the paper has policy implications for UK regulators, and for others with an interest in the UK equity risk premium. The paper proceeds by describing the research method and data used in the study, and then describes the results of the analysis.

[3] Sometimes referred to as the "Smithers Report".

## Method and Data

The research method is conceptually extremely simple, and relies on the fact that in rational markets, the price of any equity must be the present value of the future dividend stream. Given the interest is in the expected return, $R_m$, on a market-wide portfolio, expressing prices in terms of an expected forward real dividend yield on the market, and assuming constant real growth in perpetuity, implies that expected returns are given by:

$$E_t(R_m) = \frac{E_t(D_{t+1})}{P_t} + E_t(g_t) \quad (1)$$

where $D_{t+1}$ is the real dividend one period hence, and $g_t$ is the long run real growth in prices. Provided the real dividend yield is stationary, long run real price growth will be equivalent to the long run real growth in dividends. The problem is how to estimate expectations. Initially, as in Fama and French (2002, hereafter FF), the assumption is that real dividend growth (*GD*) is simply a function of the most recent period's dividend growth, where dividends are defined by $d_t.(RPI_{t-1}/RPI_t)$, where $RPI_t$ is the level of the retail price index at time t, and $d_t$ is the nominal dividend at time t, and $GD_t = (d_t/d_{t-1}) .(RPI_{t-1}/RPI_t)$. Given this simplifying assumption concerning dividend growth, we can estimate the historical series of expectations as:

$$\overline{R}_{m,t} = \frac{\overline{D}_t}{P_{t-1}} + \overline{G}D_t \quad (2)$$

There are alternative methods of estimating growth. The first, possibly more applicable to the US than the UK, recognises that that if there is a trend towards the use of share buybacks, a better estimate of long run growth in prices may be the earnings growth rather than dividend growth. As in FF[4], this estimate of price growth, $GY_t$, is given by $(y_t/y_{t-1}) .(RPI_{t-1}/RPI_t)$, where $y_t$ is the nominal earnings figure in year *t*. However, there is no particular reason to suppose that investors naively form growth expectations each year on the basis of the last year's dividend or

[4] Fama and French (2002) note that any variable that is cointegrated with stock price can be used to derive (1), so that if firms move away from dividend payout, implying that the dividend-price ratio is non-stationary, forming a growth expectation on the basis of earnings growth will be valid provided that the real earnings yield is stationary.

earnings growth, as assumed by FF. Alternative specifications are possible, so for example one could use a simple rolling ten year average estimate of dividend or earnings growth as a proxy for growth over the trade cycle. Dimson et al (2002) use the full historical run of data in any year to give an estimate of expected growth, although their approach has the different objective of calculating unexpected dividend growth. Although these alternatives could be used, the important point is that such estimates of future return will exhibit lower volatility than estimates formed using annual revisions. As such, the standard conclusions drawn from the estimates made in this paper may be conservative in terms of their implications for arithmetic as opposed to geometric returns. With longer-run estimates of dividend growth, the standard deviation of the $GD_t$ term would be depressed leading to a smaller standard deviation of expected equity returns. Last, it should be noted that there are alternative approaches to estimating long run growth. Claus and Thomas (2001) prefer a residual income approach, which they claim offer advantages over the dividend discount model and "make better use of available information". Whilst the Claus and Thomas results are useful (they report a mean risk premium over 10-year government bond rates of 3.4% for the US and 2.8% for the UK), their argument in favour of the residual income model rather than the dividend discount model is flawed. Properly applied, with consistent assumption, one is bound to get the same answer from the residual income model as from the dividend discount model (Lundholm and O'Keefe, 2001). The differences between the DDM and RI analyses in their paper come about solely as a result of inconsistent assumptions in the growth rates assumed, rather than the model application *per se*.

As the focus of this paper is real returns, real dividend growth and price gains in any year are deflated by realised inflation (as measured by the retail price index) over the year. Monthly data are available for UK prices from 1915 onwards. Besides the equity data, returns on Treasury Bills, and Yield to Redemption data on UK Government Gilts are required. Consistent with the method used to estimate real future dividend, price and earnings growth, estimates of the expected real yield to redemption figures are derived by assuming that the past year's realised inflation is an unbiased estimator of the expected future inflation rate.

To estimate the dividend, earnings and price series requires long run market wide data. Dimson et al (2006) use their own estimates for the largest 100 UK companies for the early years of their sample, in contrast to with the Barclays Capital (2007) study which uses the thirty largest companies. In this study, the data source of earnings, price and dividend information for the early years (pre the formation of the FT All Share Index) is the Global Financial Data (GFD) database.[5] GFD is also used as the source of data for early gilt yields, prior to long run bond yields being available on Datastream. The early gilt yields are based on Consol yields. GFD is also the source of inflation data prior to the UK retail price index being available on either Datastream or from the Office of National Statistics. It is important to emphasise that GFD has been selected as the descriptions of the data indicate that it is more widely based than the Barclays Capital data.[6] Real dividends payable to investors are estimated as the simple 12 month average of the monthly dividend yields multiplied by the monthly equity price index, appropriately deflated by the RPI. In a similar fashion, earnings are calculated as the simple 12 month average of the monthly earnings yield, appropriately deflated. The annual estimates the real dividend and real earnings yields are illustrated in Figure 1.

## Results

### *Historical returns*

The basic results from what amounts to a replication of the FF US analysis are reported in Table 1. These data are arithmetic averages of the historical *ex ante* expectations and historically observed actual returns. The average real dividend yield of 4.62% is very close to the long run average real dividend yield of 4.7% recorded by FF, although the UK does not see the systematic decline in the average ratio reported in FF. The arithmetic average long run real growth in dividends is 1.27%, less than the FF US figure of 2.08%. The geometric average of this dividend growth is 0.97%, higher than the Dimson et al (2006) UK growth estimate for 1900-2005 of 0.61%. To understand the difference in these estimates, we can use the detailed year-by-year breakdown of dividend income provided by Barclays Capital (2007), whilst recognising that the Barclays Capital data are based on a smaller universe of the thirty

[5] Dimson et al (2006) use this same database as their source for the Canadian market. A full description of the data used by GFD can be found in Appendix 1.
[6] Although it should be noted that gilt, Treasury Bill and inflation data are similar.

largest UK stocks. Their data paints a gloomier picture of UK growth than Dimson et al, with a very small decline in real dividends over the whole period (Figure 88, Barclays Capital 2007). However, this is largely driven by a fall of real dividend income of 86% from 1900 to 1919.[7] The Barclays Capital implied real dividend growth over the period 1925-2006 is approximately 1.2% p.a.. Dimson et al (2005, Ch. 3) have a useful international analysis on the relationship between dividend growth and GDP growth, showing that dividends lag substantially behind GDP growth in all the countries studied. The World figure for real dividend growth was 0.64%, compared to real GDP growth of 3.22%, and real per capita GDP growth of 2.24% (Table 12). Over the period for which earnings data are available (1927 on, so allowing growth estimates to be made for the year 1928 on), arithmetic average UK earnings growth is 1.54%, with a geometric average of only 0.75%. The fact that earnings growth and dividend growth are broadly similar over the long run lends some comfort to the use of the conventional dividend growth model in the UK, as it suggests that share buybacks are not a material problem. Furthermore, since 1951 geometric real dividend growth (1.01%) has been considerably higher than real earnings growth (0.8%). This contrasts sharply with the US picture of FF, where real geometric earnings growth since 1951 has been 1.89%, over double the geometric growth in real dividends of 0.92%. It is only since 1975 that real earnings have grown faster than dividends, and then only by a modest amount ((2.56% earnings growth compared to 2.14% dividend growth). As would be expected, earnings growth is more volatile than dividend growth and the arithmetic average earnings growth figure over the whole period is 1.54%. As for the US estimates of FF, the volatility of earnings growth is lower than the volatility of price growth. Whilst the long run geometric mean of real price growth, at 1.16%, is close to the dividend and earnings growth rates, the long run arithmetic mean of price growth is 3.53% p.a.. The standard deviation of annual price growth, at 19.98%, compares to an earnings growth standard deviation of 12.35% and a dividend growth standard deviation of 7.69%.

[7] I am grateful to Tim Bond at Barclays Capital for the following response to a query on the dividend income index: "On the start point, dividends in our sample indeed fell steeply in the first year or so. That reflects the usual impact of changes in constituents and changes in dividends. Then WW1 intervenes, which has a major impact on div policy amongst British companies. The methodology we used to construct the index is described in the study and it does not change over this period, so it reflects what was going on in the 30 largest capitalised stocks over this period."

Turning to the implied returns on equity, the mean historical expected real return on equities derived from the dividend growth model, $RD_t$, is 5.89%. The estimate is quite stable over the 1925-1950 and 1951-2006 sub-periods analysed (5.96% and 5.86% respectively), but the 1975 to 2006 average is higher at 6.55%, reflecting the more rapid rise in real dividends over that period (arithmetic average 2.31%). Although the overall $RD_t$ estimate is slightly below the 1872-2000 FF US estimate of 6.78%, the 1951-2006 figure of 5.86% exceeds the FF 1951-2000 expected return of 4.74%. However, the findings for the UK are similar to those for the US in one critical respect. FF contrast the observed total real shareholder return on the US market of 8.81% with the expected return of 6.78%, noting that the difference is particularly acute in the 1951-2000 period (9.62% realised versus 4.74% expected). For the UK, the arithmetic average realised real return, $R_t$, for the full period of 8.46% contrasts with a 5.89% $RD_t$ figure[8]. As in the US, the 1951-2006 period is the driver of the difference between realised and expected real returns, with returns of 9.65% and 5.86% respectively.

When price growth is estimated from earnings growth, there is only a small impact on UK expected returns, in contrast to the FF study. The resulting estimates of expected returns resulting from assuming growth is equal to earnings growth gives a mean $RY_t$ of 6.16%, only 0.27% greater than the 5.89% $RD_t$ estimate. In the individual sub-periods differences do arise, but these are primarily due to the volatility of earnings. Whereas the expected return for the dividend growth model varies from a low of 5% (1951-75) to a high of 6.55% (1975-2006), the figures for the earnings growth model range from 4.01% to 7.76% for the same two sub-periods. These contrast with the arithmetic average of the realised real return on the market for these two sub-periods being 9.29% and 9.93% respectively. It is worth remembering that the volatility of the dividend and earnings estimates, modest as they may be compared to the volatility of the realised returns, is in part attributable to investors naively assuming that the last year's realised real growth in dividends or earnings is indicative of future long run growth.

[8] Note that the full period geometric average is 6.39% which contrasts with the Dimson et al (2007) geometric average of 5.5%. This simply reflects the shorter period of this study. For comparison, the Barclays Capital (2007) estimate of total real return over the same period as this study shows a geometric average of 6.3%.

As noted earlier, the Jenkinson (1993) argument for consistency in applying the CAPM is persuasive, suggesting that to obtain a contemporaneous estimate of the forward risk premium it is preferable to combine an estimate of expected equity returns with an observed current risk free rate, either in nominal or in real terms. Nonetheless, it is still valid to ask how these forward estimates would have been formed historically, and so the last three columns in Table 1 present the average *ex ante* premia expected over the real Treasury Bill rate. These are presented for both the dividend growth ($RXD_t$) and earnings growth ($RXY_t$) models, together with the realised returns ($RX_t$). The long run arithmetic average risk premium from the dividend growth model is 4.67%, and varies from a low of 3.57% in the 1975-2006 sub-period to a high of 5.56% for the 1951-75 sub-period. The first period of the 20th century does not produce an estimate wildly different from the later period of the study (1951-2006), with an expected premium over bills of 5.13% compared to a later period premium of 4.46%. The average estimate from the earnings growth model is 5.15%. These figures stand in marked contrast to the arithmetic average risk premium of 7.25% over bills that we observe from realised returns, and can also be compared to the arithmetic premium over bills for the UK quoted in Dimson et al (Table 10, 2007) of 6.2%. The important implication is that the historical *expected* arithmetic risk premium over bills may have been up to 2.6% less than that the estimate obtained by an analysis of historical observed premia.

Of course, in any analysis of the historical risk premium, there is always an analysis of the return on equities compared to the realised return on government bonds. Dimson et al (Table 11, 2007) show that for the UK this premium is 5.4%, or 0.8% less than the premium earned over Treasury Bills. However, as argued above, there is a problem of consistency when examining *ex ante* returns. The correct procedure should be to use the same expectations in estimating long bond returns as in estimating long run equity returns, which implies using the contemporaneous inflation rate coupled with the contemporaneous gilt yield. The results of this analysis are shown in Table 2[9], and the effect is to further decrease the historical expected risk premium. The arithmetic average risk premium figures are shown as $RXgD_t$ (the premium from the dividend growth model) and $RXgY_t$ (the premium from the earnings

[9] To facilitate comparison of Gilt and equity returns, the equity data from table 1 are repeated in Table 2.

growth model) are contrasted with the realised equity returns compared to gilt yields ($RXg_t$) in the final three columns of Table 2. The first point of note is that the expected arithmetic average risk premia are over 1% less than that obtained using the Treasury Bill rate, at 3.62% and 4.07% from the dividend and earnings growth models respectively. Second, for the dividend growth model in particular, the expected risk premium shows remarkably little variation through the sub-periods. This is important, as when consistent approaches to expected inflation are taken in gilt and equity ex ante return estimation, the expected premium only varies between a low of 3.37% in the first sub period and 3.90% in the second sub-period. The contrast with the Treasury Bill approach comes about because from the first column of Table 2, it can be seen that investors always expect a positive real return on gilts in every sub-period, and this expected return only varies between a low of 1.1% (second sub-period) and a high of 2.94% (third sub-period). By contrast, column 2 of Table 1 shows that in the second sub-period, investors actually experienced, on average, a negative real return on Treasury Bills. Previous studies of historically realised returns on gilts (e.g. Dimson et al, 2007) have shown a similar gap between the arithmetic average of real Bill and gilt returns, but also show a higher volatility of realised gilt returns. Dimson et al (2007, Tables 8 and 9) show that the geometric average, arithmetic average and standard deviation of Treasury Bill returns, 1900-2006 for the UK are 1%, 1.2% and 6.4% respectively, whereas the equivalent gilt returns data are 1.3%, 2.2% and 13.9%. The average *expected* real return on gilts from Table 2 is, at 2.27%, remarkably close to the realised return from Dimson et al (2007), but the standard deviation of the expected returns is far lower at only 2.18%. This suggests that most of the variation in realised real returns comes from unanticipated inflation shocks, as any variation in the expected real long gilt rate would show up in the standard deviation of expected returns.

***Forecasting dividend and earnings growth***

Whether or not longer run real dividend or earnings growth is predictable has important implications for estimating future expected returns. As is well known, if real dividend growth is essentially unpredictable and serially uncorrelated, then the best unbiased estimate of future dividend growth rate will be the past arithmetic average dividend growth. To appraise the predictability of dividend growth, the FF regressions of dividend growth on various predictor variables available at time *t* are run. Specifically, real dividend growth (earnings growth) is regressed on the lagged dividend payout ratio, the lagged dividend/price ratio, lagged dividend (earnings) growth and lagged market returns. For the last two variables, up to three lags are included in the initial regressions. The regressions are repeated with these variables lagged by two and three years. Lagged price growth was included as an alternative to lagged market returns, but as the regressions were marginally less significant only the former are reported. Given the evidence that stock returns can be predicted by interest rate variables as well as the lagged dividend yield, variables capturing the lagged T-Bill, term structure and the gilt-equity ratio were included in regressions, but as none of these terms proved significant again only the basic regressions are reported[10] in Table 3. The first four columns report the regressions to predict dividend and earnings growth one year ahead, the last four report the regressions to predict dividend and earnings growth two years ahead. Within both sets of growth forecasts, the first column presents dividend growth regressions for the entire data period, the second the dividend growth regressions for the period 1951 on. Again within each set of growth forecasts, the third column shows the earnings growth regressions for the entire period, and the fourth the same predictions for 1951 on. The regressions three years ahead are not reported as the regressions are not statistically significant.

Taking the whole period regressions first, at the one year horizon, real dividend growth exhibits considerable predictability, and is forecast by the payout ratio, the dividend yield (at the 10% level) past lagged growth, and the past two years of realised real market returns.[11] As in the early years of the FF study, the association of dividend growth with both payout ratio and dividend yield are negative, as theory would predict the relationship should be if prices reflect expected dividend growth, as growth is likely to be lower when payout ratios are higher, and the dividend yield should be high when expected future growth is low. The finding that high past growth predicts high future growth one year ahead is not inconsistent with theories that predict firms will try and smooth dividend growth, though conflicts with the FF finding. Last, as with FF, dividend growth is positively related to past returns,

[10] Note that these regressions can only be estimated for 1928 on as the dividend payout ratio requires an earnings estimate to be available.

[11] A very similar result is obtained if real price growth, rather than total return, is used in the regressions.

although here the relationship is driven by the past two years' returns. The adjusted R-squared is almost identical to that of FF, at 38.3%. The real contrast with FF comes about when the 1951-2006 period is examined. For that period, FF find that only the past year's return is a significant explanatory variable, and the adjusted R-squared is a tiny 1%. In the regression reported in the second column, one year ahead dividend growth remains predictable, with an adjusted R-squared of 35.8%. Although the dividend yield loses its predictive power, the payout ratio retains a significant (at the 10% level) negative relationship with growth, as does the last year's dividend growth and the lagged *two* year market real return. However, the one year lagged return loses its explanatory power, and the lagged two year growth in dividends now has a negative sign. At the same one year horizon, earnings growth is considerably less predictable than dividend growth. This contrasts with the FF finding, where earnings growth is the more predictable variable. Taking the whole period, only the lagged earnings yield and the lagged one and two year market return have predictive power, and the adjusted R-squared is only 15.2%. For the period 1951 on, predictive power pretty much collapses, with only the lagged two year market return having any power. The adjusted R-squared is 10.94%, but the F-test is only significant at the 10% level.

Regressions for longer horizons suggest that any predictability in earnings growth is very short run, but dividend growth is rather more puzzling. For dividend growth, only the lagged two year return has any predictive power, and the adjusted R-squared falls to 18.32%. However, as in FF, this predictive ability falls away entirely in the period 1951 on, with the regression F-test failing to be significant at the 10% level. A similar story occurs with earnings growth predictability, but the whole period adjusted R-squared is considerably lower at only 9.32%. At first sight, any attempt to forecast growth with variables that have longer lags quickly runs into the sand. At three year horizons, none of the regressions have any predictive power, and the F-statistics are insignificant. However, a curiosity that emerges from regressions not reported in the Table is that dividend growth has some predictability at the four year horizon. For the whole period, growth is positively related to the four year lagged yield, and negatively related to the four year lagged return (with a significant F-statistic and an adjusted R-squared of 7.4%. Furthermore, these relationships are preserved in the post 1950 period, with an adjusted R-squared of 12.6%. However, at the 5 year horizon the whole period data shows no relationship, whereas the post 1950 relationship shows that whilst lagged yield and return have no predictive power, the 5-year lagged payout now has a negative relationship with dividend growth. The adjusted R-squared is 9.7%. Whilst these relationships, particularly the four year lagged coefficients which seem inconsistent with theory, appear somewhat troubling, none of the longer lags on returns or dividend growth have any explanatory power when included in the models for forecasting growth one period ahead. This may be because any power that longer lagged returns have to predict dividend growth largely come about because of the weak autocorrelation in stock returns.

The conclusion from the analysis of the dividend and earnings growth regressions is that although one year growth has some predictability, which might argue the case for using a regression model to forecast short run growth, longer terms growth is far harder to predict. It would not be valid to reach the same conclusion for the UK as FF do for the US, namely that any forecasting ability disappears at horizons greater than two years, but the patterns that emerge from the regression models here suggests a weak ability to predict growth far ahead. If long run growth is entirely unpredictable, then the best forecast of future dividend growth would be the long run arithmetic average growth rate. However, if there is any negative serial correlation in growth rates, and there is evidence of this (whilst the one year autocorrelation is 0.44, the two, three, four and five year lags are -0.02, -.24, -.23 and -.06 respectively), using a long run arithmetic growth rate will tend to overestimate growth.

***Implications for the equity risk premium going forward***

Given the consistency argument outlined above, the preferred treatment is to use the analysis to estimate a future expected real return on equities, and compare that to a current index linked gilt yield to derive an expected risk premium. Despite recent market volatility, the dividend yield on the FT All Share Index has been around 3% on average over the last three years. The critical choices when forecasting the expected return forward are: the expected dividend growth going forward; the adjustment needed (if any) to arrive at a simple annual rate for discounting purposes, and; whether when makes a conditional forecast (i.e. one based on the current dividend yield) or an unconditional one (based on the assumption of mean reversion to the long run dividend yield). The latter unconditional estimate implies a short run fall in market prices so that the dividend yield reverts to its long run mean value. The long run average nominal dividend/opening price ratio is 4.85%, which implies a sharp drop (around the order of one-third) from current market values, as the dividend/opening price ratio in December 2006 was 3.2%. Of course, such a transition could take place gradually or quickly. Alternatively, growth in dividends could be higher than the long run historical average, which would justify a higher dividend price ratio. However, even taking the post 1976 period as indicative of a period of strong future growth, from Table 1 the mean real dividend growth rate in this period was 2.31%, and the real dividend/opening price ratio averaged 4.23%. As the December 2006 real D/Pt-1 figure was 3.05% even a reversion to the mean long run dividend yield of 1976-2006 implies a fall in valuations of around 28%. If the Table 1 estimates are viewed as unconditional, then as Fama and French show, the estimation of an annual simple return (assuming this is equivalent to the arithmetic average return) requires that the estimates formed from mean dividend/earnings growth model expected returns are uplifted by half the difference between the variance of the price growth series and the variance of the dividend growth model returns. As these are historical estimates, the appropriate risk free rate is the historical real yield on gilts. The resulting calculations are shown in the first four rows of Table 4. Depending on whether future growth, gilt yields and variances are based upon the full sample period or the period 1976-2006, the expected risk premium varies between a low of 4.41% and a high of 5.32%. However, it must be emphasised that *all* of these calculations imply a short-run fall in equity prices as the dividend yield reverts to its unconditional mean. The geometric equivalents can be calculated from the mean dividend price ratio and the geometric mean growth rate. These figures are reported in Table 5 and reveal an expected geometric premium of 3.19% to 3.75%, which again imply a short-run fall in equity prices.

The alternative to assuming short run falls in equity prices, which imply an uncomfortable rejection of market efficiency, is to assume prices are rational expected present values and that the dividend yield can be used to give a conditional estimate of the ERP going forward. An estimate based upon an expected geometric growth rate in dividends would lead directly to an estimate of the expected long run compound rate of return. An estimate based upon an estimate of the long run arithmetic growth in dividends is less clear cut in its interpretation. The question that now arises is how to adjust such returns to an estimate of the *ex ante* annual simple rate of return. At one extreme, if the estimates of past expected stock market returns are viewed as conditional estimates, as in Claus and Thomas (2001), then one approach is to add half the variance from the historical $RD_t$ estimate in Table 1 to any "pure" estimate of the expected geometric rate of return. Alternatively, one can form the returns expectation directly from the arithmetic mean growth rate, giving an implied return of 3(1.027) + 1.27 = 4.3%, as shown in row 9 of Table 4. It so happens that an identical result is obtained from the geometric calculation with uplift. Alternatively, one can view the historical growth rates as *unconditional* estimates, ignore the problem of excess volatility and price adjustment entirely, and calculate the bias adjustment based on the historical difference in variances between dividend growth and price growth. Such an approach will over-state the uplift required if excess volatility or past price adjustments have been experienced which are not expected to be repeated. Particularly extreme estimates of price volatility are obtained if one uses the entire data period. In Row 5 of Table 4, the row 9 estimate of 4.3% on equity becomes 6.01% by virtue of the 1.7% uplift. A far smaller uplift (0.8%) arises if the 1976-06 period is used as the basis of variance estimation. The current medium-term yield[12] on index-linked gilts is around 2.3%, suggesting a forward *arithmetic* risk premium of only 2% if the equity return is not uplifted, to a maximum of 3.71% if it is uplifted by the full period variance. Rows 7 and 11 of Table 4 provide estimates if both growth and volatility are derived from the 1976-06 period. The arithmetic mean dividend growth in that period is 2.3%, so the resulting risk premium is 3.88% (with full uplift) and 3.08% (with no uplift). The geometric premium requires no uplift to be made, and the premium is estimated by using the geometric mean dividend growth rate. The equivalent geometric means in Table 5 range from 1.7% to 2.9%.

Of course, dividend growth could be assumed to be equal to earnings growth or GDP growth. Using historical earnings growth as the estimate for future growth (Table 4, rows 6, 8, 10 & 12) gives a base estimate for equity returns of between 4.58% and 6.63%. With an uplift for the difference in variance between earnings growth and

[12] The use of a medium term Index-Linked Gilt rate in this calculation is not uncontentious, aa one can argue that a more appropriate rate for calculating the long run risk premium may be the long term Index-Linked Gilt rate. However, there is an argument that these long-dated yields are depressed by pension fund purchases, and international real yield curves do not appear to exhibit the same patterns at the long end as is found in the UK data.

price growth, the implied equity return is 5.82% if the 1928-2006 period is used, and 6.65% if the period 1976-06 is used, resulting in risk premia of 3.52% and 4.35% respectively. These contrast with estimates of 2.28% and 4.33% with no uplift. However, there must be some doubt as to whether the 1976-06 arithmetic mean earnings growth rate of 3.5% is a sustainable growth rate for dividends in the longer term. The expected geometric return equivalents to these earnings growth estimates imply an expected geometric premium of between 1.47% and 3.34%. Two final estimates are made, with slightly differing growth assumptions. These are reported in the last two rows of Table 4. Both estimate long run growth as long run GDP per capita growth (1.81%). The first of the two bottom rows assumes short run growth also occurs at this rate, which gives an estimated equity returns of 4.88% and a risk premium of 2.58%. The second uses the 1951-2006 regression coefficients from Table 3 to forecast short run dividend growth and combines this with an assumption of long run growth equal to the GDP per capita growth figure. Such an approach shades the estimated return figures up by 0.1%. The final question concerns an appropriate uplift (if any). No estimates of the variance of long run GDP per capita growth are available, but the standard deviation of GDP Consumption growth since 1976 is approximately 1.8%. If the usual half difference between the consumption and price growth variances are added as an uplift, the 4.98% figure would give a simple average estimate of 5.94% for equity returns and 3.64% for the equity risk premium.

The conclusion from all these *ex ante* estimates of the simple annual premium is that the unadjusted risk premium ranges between 2% and 4.33%, whereas the "bias adjusted" figures range between 3.52% and 4.35%, although the highest estimates may be viewed as employing an implausibly large dividend growth assumption. It should also be noted that these higher estimates ignore the Dimson et al (Ch. 3, 2005) results (which update those of Bernstein and Arnott, 2003) which show that dividend growth is less than GDP growth, and indeed less than GDP per capita growth in most countries. The rationale for this, put forward in Bernstein and Armnott (2003) is that a substantial part of economic growth comes from entrepreneurial activity and new firms not included in the main market indices. Given this, the Dimson et al (2005) long run (1900-2004) estimate of GDP per capita growth of 1.83% for the UK seems difficult to reconcile with the higher assumed rates of dividend growth. In short, with any reasonably plausible growth assumption, and even disregarding the problems of over-estimation of price growth variance, it seems difficult to get an upper estimate for the simple annual equity risk premium greater than 4%. At the lower end, employing reasonable assumptions concerning variance and growth it is possible to produce an estimate of the arithmetic risk premium of as low as 2%.

Last, a real question for regulatory purposes is whether a simple expected rate of return is actually appropriate. Fama (1996) highlights the implied right skew in cash flow estimates that is a corollary of discounting at expected simple rates of return. It is by no means obvious that such cash flow forecasts are compatible with regulatory budgeted cash flows, which one could argue are more likely to be based upon median cash flows or an assumption of normally distributed cash flows. In addition, there are the estimation bias issues highlighted by Blume (1973) and Indro and Lee (1997) which point to the use of a weighted average of arithmetic and geometric mean returns in estimating required rates of return. In short, it is far from obvious that the simple rates of return derived above can be unambiguously recommended as providing the optimal estimate of equity cost of capital for regulatory purposes.

**Conclusion**

The analysis of the historical expected returns to equity, and the historical expected risk premia, have not given rise to *geometric* averages that are radically different from those seen elsewhere. However, the focus of the paper has been on *arithmetic* averages, or estimates of the simple annual rate of return, which feature heavily in applications such as discount rate estimation and regulatory cost of capital. In this regard, figures are different. The historical estimates of the mean of the long run expected return on equities are around 5.9% resulting in an arithmetic risk premium over Treasury Bills of around 4.7%, and an arithmetic risk premium over gilts of 3.6%, although marginally higher estimates are obtained from an earnings growth (rather than dividend growth) version of the model. This estimate of the risk premium over gilts treats expected inflation in equity and gilt returns consistently, something which past studies miss by focussing on realised returns on gilts.

Estimates of the expected arithmetic average return on equities going forward depend upon the growth rates assumed for future dividends and on the procedure used to estimate return volatility. Given there is no particular problem with share buybacks in the UK (in contrast to the position in the US), it seems appropriate to focus on dividend growth rather than earnings growth. At the lower end, taking past long run dividend growth as indicative of future growth, expected real returns would only be 4.3%. Higher estimates of dividend growth result when the 1976-2006 period is used to estimate future dividend growth, when an estimate of 6.18% can be obtained. Higher estimates are only plausible if a significant short term correction to share prices is assumed. Following Jenkinson (1993), this paper has argued throughout for the consistent treatment of the risk free rate in any applications featuring the CAPM. Assuming a current index-linked gilt rate of 2.3%, the *ex ante* returns on equity described above suggest that the appropriate arithmetic average equity risk premium going forward is between 2% and 3.88%. The geometric risk premium going forward is between 1.7% and 2.9%. A somewhat wider range results if earnings growth is used as the estimate of dividend growth. These risk premia, whilst low relative to some other estimates, are not inconsistent with theory given that equity investments are subject to higher transactions costs (for example, stamp duty and dividend reinvestment costs) than investment in gilts.

Finally, for regulatory purposes it is not obvious that the use a simple annual expected return forms the basis of an acceptable equity cost of capital unless the regulatory cash flows are right-skewed (Fama, 1996). Even if they are, following Blume (1974) and Indro and Lee (1997) there is a case for using some weighted average of arithmetic and geometric rates of return in setting the regulatory cost of capital. It seems hard to reconcile some recent regulatory estimates for the equity risk premium with the estimates that are implied by current market valuations.

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**Appendix 1: Equity Market data descriptors from Global Financial Data**
From http://www.globalfinancialdata.com/index.php3?action=detailedinfo&id=2546

Stock market data:
Country: United Kingdom
Begins: December 1923 and January 1939
Sources: *Journal of the Institute of Actuaries*, (LXII), part 2, no. 304, pp. 321-331, *New York Stock Exchange Bulletin* (1929-1938), Central Statistical Office *Annual Abstract of Statistics*, London: CSO (1939-1988), Eurostat (1989-) for the Financial Times-Actuaries yields and *The Economist* (1939-1965), Central Statistical Office, *Monthly Digest of Statistics*, London: CSO (1966-) for the FTI-30 yields; London and Cambridge Economic Service, *Key Statistics of the British Economy*, London: L&CES, 1966 for earnings yield from 1927 through 1962.
Notes: Dividend yields were calculated by the Actuaries beginning in 1923. Monthly yields for the Financial Times 30 industrials are also provided. All yield data are monthly. The Financial Times calculated earnings yield data (E/P) rather than price/earnings ratios, so earnings yield data have been inverted to give the price earnings ratio. Price/earnings ratios are provided for the FTI-30 index beginning in 1955 with data annual through 1966 and monthly thereafter. The price/earnings ratio is also provided for the Financial Times-Actuaries Index with annual data from 1927 through 1962 and monthly data beginning in April 1962. This series is based upon data calculated for the Actuaries General index through 1962, the FT Non-Financials from April 1962 through January 1993, and the FT All-Share from February 1993, which begins daily data on June 14, 1993 on.

**Table 1 Inflation, real Treasury Bill, dividend and earnings growth, market returns and expected real returns, 1925-2006.**

| | $Inf_t$ | $TB_t$ | $D_t/P_{t-1}$ | $GD_t$ | $GY_t$ | $GP_t$ | $RD_t$ | $RY_t$ | $R_t$ | $RXD_t$ | $RXY_t$ | $RX_t$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Means of annual values*** | | | | | | | | | | | | |
| 1925/8-1950 | 1.10% | 0.83% | 4.62% | 1.34% | 1.73% | 1.11% | 5.96% | 6.33% | 5.92% | 5.13% | 6.29% | 5.09% |
| 1951-1975 | 6.14% | -0.55% | 5.12% | -0.12% | -1.10% | 3.80% | 5.00% | 4.01% | 9.29% | 5.56% | 4.57% | 9.84% |
| 1976-2006 | 5.72% | 2.97% | 4.23% | 2.31% | 3.52% | 5.33% | 6.55% | 7.76% | 9.93% | 3.57% | 4.78% | 6.96% |
| 1951-2006 | 5.91% | 1.40% | 4.63% | 1.23% | 1.46% | 4.64% | 5.86% | 6.08% | 9.65% | 4.46% | 4.69% | 8.25% |
| 1925/8-2006 | 4.39% | 1.22% | 4.62% | 1.27% | 1.54% | 3.53% | 5.89% | 6.16% | 8.46% | 4.67% | 5.15% | 7.25% |
| ***Standard Deviation of Annual Values*** | | | | | | | | | | | | |
| 1925/8-1950 | 4.39% | 5.16% | 0.63% | 9.58% | 11.55% | 13.70% | 9.31% | 11.31% | 13.98% | 10.10% | 13.27% | 13.83% |
| 1951-1975 | 5.48% | 3.80% | 1.46% | 7.03% | 10.34% | 29.12% | 7.28% | 10.06% | 30.81% | 7.69% | 11.73% | 31.46% |
| 1976-2006 | 4.30% | 2.91% | 1.16% | 5.91% | 13.76% | 13.93% | 6.31% | 13.72% | 14.63% | 6.35% | 14.36% | 14.15% |
| 1951-2006 | 4.87% | 3.77% | 1.38% | 6.54% | 12.56% | 22.06% | 6.80% | 12.36% | 23.29% | 7.05% | 13.25% | 23.55% |
| 1925/8-2006 | 5.26% | 4.29% | 1.20% | 7.69% | 12.35% | 19.98% | 7.73% | 12.14% | 20.99% | 8.20% | 13.36% | 21.14% |
| ***Geometric Average*** | | | | | | | | | | | | |
| 1925/8-1950 | 1.01% | 0.70% | | 0.88% | 1.01% | -0.01% | | | 4.97% | | | |
| 1951-1975 | 6.01% | -0.63% | | -0.36% | -1.68% | -0.47% | | | 4.82% | | | |
| 1976-2006 | 5.64% | 2.93% | | 2.14% | 2.56% | 4.33% | | | 8.88% | | | |
| 1951-2006 | 5.80% | 1.33% | | 1.01% | 0.80% | 2.16% | | | 7.05% | | | |
| 1925/8-2006 | 4.26% | 1.13% | | 0.97% | 0.75% | 1.16% | | | 6.39% | | | |

The columns show respectively the arithmetic averages, standard deviations and geometric averages for inflation ($Inf_t$), real Treasury Bill returns ($TBt$) real dividends over opening prices ($D_t/P_{t-1}$), real growth in dividends ($GD_t$), real growth in earnings ($GY_t$), real growth in equity market prices ($GP_t$), the estimated forward return from the dividend growth model ($RD_t = D_t/P_{t-1} + GD_t$), the estimated forward return from the earnings growth model ($RY_t = D_t/P_{t-1} + GY_t$), the realised real return on the market index ($R_t$), and the estimated risk premia over Treasury Bills resulting from the dividend growth ($RXD_t = RD_t – TB_t$), earnings growth ($RYDt = RY_t – TB_t$) and market return ($RX_t$) models, respectively.

**Table 2 Real Gilt yields, dividend and earnings growth, market returns and expected real returns, 1925-2006.**

| | $GILT_t$ | $D_t/P_{t-1}$ | $GD_t$ | $GY_t$ | $GP_t$ | $RD_t$ | $RY_t$ | $R_t$ | $RX_gD_t$ | $RX_gY_t$ | $RX_{gt}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Means of annual values*** | | | | | | | | | | | |
| 1925/8-1950 | 2.59% | 4.62% | 1.34% | 1.73% | 1.11% | 5.96% | 6.33% | 5.92% | 3.37% | 4.31% | 3.32% |
| 1951-1975 | 1.10% | 5.12% | -0.12% | -1.10% | 3.80% | 5.00% | 4.01% | 9.29% | 3.90% | 2.92% | 8.19% |
| 1976-2006 | 2.94% | 4.23% | 2.31% | 3.52% | 5.33% | 6.55% | 7.76% | 9.93% | 3.61% | 4.82% | 7.00% |
| 1951-2006 | 2.12% | 4.63% | 1.23% | 1.46% | 4.64% | 5.86% | 6.08% | 9.65% | 3.74% | 3.97% | 7.53% |
| 1925/8-2006 | 2.27% | 4.62% | 1.27% | 1.54% | 3.53% | 5.89% | 6.16% | 8.46% | 3.62% | 4.07% | 6.20% |
| ***Standard Deviation of Annual Values*** | | | | | | | | | | | |
| 1925/8-1950 | 4.66% | 0.63% | 9.58% | 11.55% | 13.70% | 9.31% | 11.31% | 13.98% | 9.91% | 13.02% | 13.76% |
| 1951-1975 | 3.05% | 1.46% | 7.03% | 10.34% | 29.12% | 7.28% | 10.06% | 30.81% | 7.82% | 11.33% | 31.54% |
| 1976-2006 | 2.29% | 1.16% | 5.91% | 13.76% | 13.93% | 6.31% | 13.72% | 14.63% | 6.43% | 14.26% | 14.31% |
| 1951-2006 | 2.81% | 1.38% | 6.54% | 12.56% | 22.06% | 6.80% | 12.36% | 23.29% | 7.08% | 13.07% | 23.62% |
| 1925/8-2006 | 3.53% | 1.20% | 7.69% | 12.35% | 19.98% | 7.73% | 12.14% | 20.99% | 8.14% | 13.14% | 21.22% |
| ***Geometric Average*** | | | | | | | | | | | |
| 1925/8-1950 | 2.51% | | 0.88% | 1.01% | -0.01% | | | 4.97% | | | |
| 1951-1975 | 0.78% | | -0.36% | -1.68% | -0.47% | | | 4.82% | | | |
| 1976-2006 | 3.04% | | 2.14% | 2.56% | 4.33% | | | 8.88% | | | |
| 1951-2006 | 2.03% | | 1.01% | 0.80% | 2.16% | | | 7.05% | | | |
| 1925/8-2006 | 2.18% | | 0.97% | 0.75% | 1.16% | | | 6.39% | | | |

The columns show respectively the arithmetic averages, standard deviations and geometric averages for real expected Gilt yields (*GILTt*) real dividends over opening prices ($D_t/P_{t-1}$), real growth in dividends ($GD_t$), real growth in earnings ($GY_t$), real growth in equity market prices ($GP_t$), the estimated forward return from the dividend growth model ($RD_t = D_t/P_{t-1} + GD_t$), the estimated forward return from the earnings growth model ($RY_t = D_t/P_{t-1} + GY_t$), the realised real return on the market index ($R_t$), and the estimated risk premia over Gilt yields resulting from the dividend growth ($RX_gD_t = RD_t – GILT_t$), earnings growth ($RY_gDt = RY_t – GILT_t$) and market return ($R_gX_t$) models, respectively.

**Table 3: Real dividend and earnings growth regressions**

| Dependent/independent variables | $GD_t$, 1928-2006 | $GD_t$ 1951-2006 | $GY_t$, 1928-2006 | $GY_t$, 1951-2006 | $GD_t$, 1928-2006 | $GD_t$ 1951-2006 | $GY_t$, 1928-2006 | $GY_t$, 1951-2006 |
|---|---|---|---|---|---|---|---|---|
| **Payout ratio, t-1** | -0.16681 | -0.11991 | -0.20966 | -0.32711 | | | | |
| | *-2.43* | *-1.68* | *-0.88* | *-1.05* | | | | |
| **Payout ratio, t-2** | | | | | -0.1237 | -0.09247 | 0.16333 | 0.167631 |
| | | | | | *-1.55* | *-1.08* | *0.66* | *0.52* |
| **$D_{t-1}/P_{t-1}$ or $E_{t-1}/P_{t-1}$** | -1.47684 | -0.56981 | -1.16488 | -1.2611 | | | | |
| | *-1.86* | *-0.73* | *-1.72* | *-1.51* | | | | |
| **$D_{t-2}/P_{t-2}$ or $E_{t-2}/P_{t-2}$** | | | | | -0.66377 | 0.342033 | -0.03123 | 0.12276 |
| | | | | | *-0.72* | *0.35* | *-0.04* | *0.14* |
| **$GD_{t-1}$ or $GY_{t-1}$** | 0.339848 | 0.583466 | 0.175534 | 0.153002 | | | | |
| | *2.86* | *3.62* | *1.35* | *0.92* | | | | |
| **$GD_{t-2}$ or $GY_{t-2}$** | -0.12272 | -0.37903 | -0.06558 | -0.17229 | -0.04935 | -0.09379 | -0.03695 | -0.09455 |
| | *-1.06* | *-2.26* | *-0.56* | *-1.21* | *-0.4* | *-0.56* | *-0.29* | *-0.61* |
| **$GD_{t-3}$ or $GY_{t-3}$** | -0.07672 | 0.126259 | 0.002578 | -0.04382 | -0.1679 | -0.05848 | -0.04936 | -0.07587 |
| | *-0.74* | *0.88* | *0.02* | *-0.3* | *-1.42* | *-0.36* | *-0.4* | *-0.52* |
| **$R_{t-1}$** | 0.128497 | 0.045385 | 0.154471 | 0.124702 | | | | |
| | *3.19* | *1.06* | *2.09* | *1.42* | | | | |
| **$R_{t-2}$** | 0.108149 | 0.079963 | 0.160103 | 0.145601 | 0.165607 | 0.090998 | 0.198647 | 0.166786 |
| | *2.89* | *2.31* | *2.38* | *1.95* | *3.54* | *1.81* | *2.58* | *1.83* |
| **$R_{t-3}$** | 0.017708 | -0.01172 | -0.00324 | -0.0112 | 0.056887 | 0.04473 | 0.028582 | 0.023552 |
| | *0.47* | *-0.33* | *-0.05* | *-0.15* | *1.38* | *1.13* | *0.42* | *0.32* |
| **Constant** | 0.143931 | 0.088957 | 0.208064 | 0.28733 | 0.08982 | 0.03488 | -0.08662 | -0.10275 |
| | *2.34* | *1.37* | *1.14* | *1.19* | *1.25* | *0.44* | *-0.46* | *-0.41* |
| Adjusted R-squared | 0.383 | 0.3583 | 0.1518 | 0.1094* | 0.1832 | 0.0626** | 0.0932 | 0.0632** |

The columns show the results of regressing the real growth in dividends ($GD_t$) or the real growth in earnings ($GY_t$), on the following variables: lagged dividend payout ratios (t-1, t-2), lagged real dividend or real earnings yield ratios ($D_{t-1}/P_{t-1}$ $D_{t-2}/P_{t-2}$), ($E_{t-1}/P_{t-1}$ $E_{t-2}/P_{t-2}$), lagged real dividend growth ($GD_{t-1}$, $GD_{t-2}$, $GD_{t-3}$ ) or real growth in earnings ($GY_{t-1}$, $GY_{t-2}$, $GY_{t-3}$ )and lagged real realised return on the market index ($R_{t-1}$), ($R_{t-2}$), ($R\text{-}3_t$).

**Table 4: *Ex ante* simple annual returns as of August 2007.**

| Basis of estimate | Type of bias adjustment | Base estimate | Bias adjustment | Annual simple return | Fall in equity prices implied? | gilt basis | Arithmetic ERP over gilts |
|---|---|---|---|---|---|---|---|
| LR historical DGM | 1/2 diff | 5.89% | 1.70% | 7.59% | Y | H | 5.32% |
| LR historical YGM | 1/2 diff | 6.16% | 1.23% | 7.39% | Y | H | 5.12% |
| 1975-06 DGM | 1/2 diff | 6.55% | 0.80% | 7.34% | Y | H | 4.41% |
| 1975-06 YGM | 1/2 diff | 7.76% | 0.02% | 7.78% | Y | H | 4.84% |
| Current DY, LRDG | 1/2 diff | 4.30% | 1.70% | 6.01% | N | 2.30% | 3.71% |
| Current DY, LRYG | 1/2 diff | 4.58% | 1.23% | 5.82% | N | 2.30% | 3.52% |
| Current DY, 75-06DG | 1/2 diff | 5.38% | 0.80% | 6.18% | N | 2.30% | 3.88% |
| Current DY, 75-06YG | 1/2 diff | 6.63% | 0.02% | 6.65% | N | 2.30% | 4.35% |
| Current DY, LRDG | none | 4.30% | 0.00% | 4.30% | N | 2.30% | 2.00% |
| Current DY, LRYG | none | 4.58% | 0.00% | 4.58% | N | 2.30% | 2.28% |
| Current DY, 75-06DG | none | 5.38% | 0.00% | 5.38% | N | 2.30% | 3.08% |
| Current DY, 75-06YG | none | 6.63% | 0.00% | 6.63% | N | 2.30% | 4.33% |
| Current DY, LR GDP | none | 4.88% | 0.00% | 4.88% | N | 2.30% | 2.58% |
| Current DY+SRG, LR GDP | none | 4.98% | 0.00% | 4.98% | N | 2.30% | 2.68% |

Columns show: the basis of the estimate (LR = long run, DGM = dividend growth, YGM = earnings growth, DY = dividend yield, GDP = GDP per capita growth, DY+SRG = short run growth estimated from Table 3 regression model), where either the historical mean estimates are used, or a current dividend yield (assumed to be 3%) plus the appropriate mean growth rate is used; the type of bias adjustment employed (if any), where "1/2 diff" refers to an uplift of half the difference between the historical price growth variance and the historical dividend or earnings growth variance; the base estimate ($D_1/P_0$ + Growth); the amount of the bias adjustment; the resulting *ex ante* annual simple return estimate; whether the estimate implies a fall in market prices from current levels (see text); the consistent estimate of gilt return (either mean historical real gilt yield or a contemporaneous estimate of 2.3%); and the resultant estimate of the equity risk premium over the gilt rate.

**Table 5: *Ex ante* geometric returns as of August 2007.**

| Basis of estimate | Geometric rate of return on equities | Fall in equity prices implied? | gilt basis | Geometric ERP over gilts |
|---|---|---|---|---|
| LR historical DGM | 5.60% | Y | H | 3.42% |
| LR historical YGM | 5.37% | Y | H | 3.19% |
| 1975-06 DGM | 6.37% | Y | H | 3.33% |
| 1975-06 YGM | 6.79% | Y | H | 3.75% |
| Current DY, LRDG | 4.00% | N | 2.30% | 1.70% |
| Current DY, LRYG | 3.77% | N | 2.30% | 1.47% |
| Current DY, 75-06DG | 5.20% | N | 2.30% | 2.90% |
| Current DY, 75-06YG | 5.64% | N | 2.30% | 3.34% |

Columns show: the basis of the estimate (LR = long run, DGM = dividend growth, YGM = earnings growth, DY = dividend yield, GDP = GDP per capita growth), where either the historical geometric mean estimates are used, or a current dividend yield (assumed to be 3%) plus the appropriate geometric mean growth rate is used; the base estimate ($D_1/P_0$ + Growth); the amount of the bias adjustment; the resulting *ex ante* geometric return estimate; whether the estimate implies a fall in market prices from current levels (see text); the consistent estimate of gilt return (either mean historical real gilt yield or a contemporaneous estimate of 2.3%); and the resultant estimate of the equity risk premium over the gilt rate.

**Figure 1: Real dividend and earnings yields for the UK**