Equity valuation measures: what can they tell us?

By Anne Vila Wetherilt and Olaf Weeken of the Bank's Monetary Instruments and Markets Division.

This article examines the usefulness of summary statistics, such as the price-earnings ratio and the dividend yield, that are commonly used in valuing equity markets. But these measures are very sensitive to assumptions made about the (unobservable) equity risk premium, as well as to the precise definitions of earnings or dividends used in the calculations. This limits their usefulness as summary statistics of equity valuations.

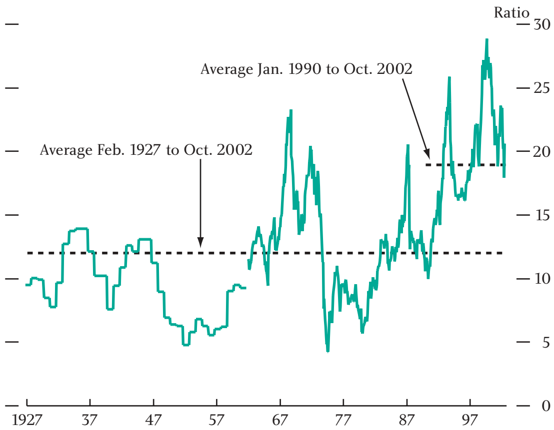
Introduction

Between January 1995 and September 2000, the FTSE All-Share index more than doubled. At that time, many economists and market participants commented on the extraordinary behaviour of market valuation ratios, such as price-earnings ratios, which had risen to all-time highs. Since then equity markets have fallen substantially. For example, at the end of October 2002, the FTSE All-Share index was about 40% below its all-time high of 4 September 2000.

This article discusses the usefulness of some popular ratios for assessing the valuation of equity markets. The price-earnings ratio and the dividend yield are among the best known of these summary statistics. Price-earnings ratios indicate the prices investors are willing to pay in relation to companies' earnings. The dividend yield is a measure of the income return on a stock or an equity index.(1) Another popular valuation measure, commonly referred to as the 'Fed Model', is the relationship between the earnings yield (the inverse of the price-earnings ratio) and nominal bond yields.(2) These three valuation measures are closely related to a well-known accounting model, the dividend discount model, that can itself be used in assessing market valuations.(3)

Charts 1 and 2 show the price-earnings ratio and the dividend yield for the FTSE All-Share index since 1927. They illustrate how over long periods these ratios have tended to move away and then return to their historical averages. In the 1990s, both ratios deviated again substantially from their long-run averages. This prompted some commentators to suggest that equity prices could not depart for much longer from their historical relationships with either dividends or earnings and therefore needed to fall. However, the choice of the historical benchmark is not uncontroversial. Some

Chart 1
FTSE All-Share: price-earnings ratio(a)



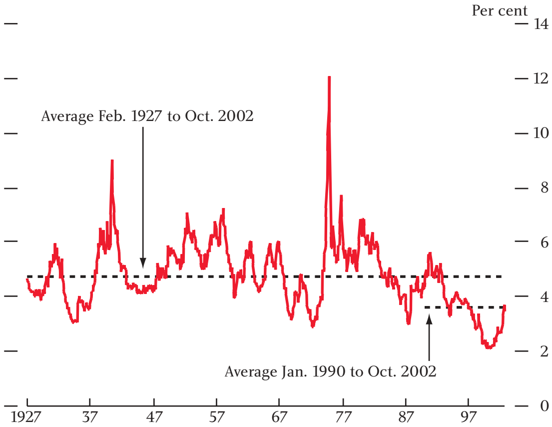
Sources: Global Financial Data, Inc. and Thomson Financial Datastream.

(a) Annual data until 1962, monthly data thereafter.

(1) For an equity index such as the FTSE All-Share index, the price-earnings ratio is the ratio of the total market value of all constituent companies of the index to their net earnings. The dividend yield is the ratio of dividends to the total market capitalisation of the index constituents. Both measures are adjusted for shares that are not actively traded. See FTSE (2002).
(2) This relationship was discussed in Board of Governors of the Federal Reserve System (1997). Lander, Orphanides and Douvogiannis (1997) present a formal model.
(3) Another valuation measure sometimes referred to is 'Q'. It is defined as the value of a firm's capital relative to its replacement cost (Tobin (1969)). In contrast to the other valuation measures described above, Tobin's Q is not derived from the same simple accounting framework and will not be discussed in this article. See Robertson and Wright (2002a and 2002b) for a discussion of Q as a valuation tool for equity markets and Mac Gorain and Thompson (2002) on Q-theory and investment.

commentators have argued that historical relationships may have broken down and that long-term averages—such as the 1927–2002 averages shown in Charts 1 and 2—may therefore no longer be appropriate benchmarks. Compared with an average over a shorter sample period—for example for the 1990s—the price declines of the past two years might lead some to the conclusion that equity prices have 'fallen enough' or 'have fallen too much'. In fact, depending on the historical time horizon chosen, many statements about equity valuations could be supported.

Chart 2
FTSE All-Share: dividend yield



Sources: Global Financial Data, Inc. and Thomson Financial Datastream.

This article will not comment on current equity valuations. Instead it aims to clarify some of the issues surrounding popular equity valuation measures. It first sets out the accounting framework that forms the cornerstone for the main valuation measures. It goes on to examine the historical relationship between the dividend yield and equity prices. The article then considers under which conditions equity valuation measures can be expected to revert to historical averages and whether such historical benchmarks may have shifted. The penultimate section examines the 'Fed Model' and the dividend discount model. Throughout this analysis, it is assumed that all variables are correctly measured. Measurement issues and their implications for valuation ratios are discussed in the final section of this article.

A framework for interpreting valuation measures

The dividend yield, the price-earnings ratio and the 'Fed Model' all go back to a simple present value formula: stock prices P equal the present discounted value of expected cash flows D.

$$P_t = \frac{D_{t+1}}{1+r_{t+1}} + \frac{D_{t+2}}{(1+r_{t+1})(1+r_{t+2})} + \dots \qquad (1)$$

where the discount rate (r) is equal to the expected or required real return on equity. In this framework, stock prices are high when investors expect future cash flows to be high and/or future returns to be low.(1) The expected return (r) in turn can be written as the sum of the expected real return from a risk-free asset such as a government liability (r^f) and the extra return that investors require as compensation for the uncertainty about future cash flows associated with equity investments. This excess return is called the equity risk premium (k).

Although conceptually very simple, the present value model presents some practical difficulties that arise because the discount factor may vary over time. To simplify matters, a linear approximation of the present value model, first suggested by Campbell and Shiller (1988), can be used, which is explained in the appendix. Alternatively, simplifying assumptions can include a constant discount factor, as in the well-known constant-growth dividend discount model.

In its simplest form, this model assumes that both the risk-free rate and the equity risk premium are constant, that earnings (Y) grow at a constant rate (g) and that in each period a constant fraction (θ) of earnings is paid as dividends. Under these assumptions, equation (1) collapses to the 'Gordon growth model':

$$P_t = \frac{D_t(1+g)}{r-g} = \frac{D_t(1+g)}{r^f+k-g} \qquad (2)$$

Rearranging equation (2), simple expressions for the dividend yield and the price-earnings ratio can be derived:

$$\frac{D_t}{P_t} = \frac{r^f+k-g}{(1+g)} \qquad (3)$$

Equation (3) tells us that when the dividend yield is low, equity investors expect some combination of high future dividend growth (g) and low future returns ($r^f + k$). And equation (4) below shows that price-earnings ratios are

(1) A third possibility is that investors expect future stock prices to be even higher. This possibility is ruled out in the accounting framework used to derive equation (2). See Shiller (2000) for a detailed treatment of so-called asset price bubbles.

high when investors expect future earnings growth (g) to be high, dividend pay-out ratios (θ) to be high and/or future expected returns to be low.

$$\frac{P_t}{Y_t} = \frac{(1+g)\theta}{r^f + k - g} \qquad (4)$$

The 'Fed Model' can be derived by imposing the additional simplifying assumptions of a 100% pay-out rate (θ = 1). As will be shown later, this also implies zero earnings growth (g = 0). Now equation **(4)** can be rewritten as:

$$\frac{Y_t}{P_t} - r^f = k \qquad (5)$$

Splitting the real risk-free rate (r^f) into the nominal risk-free rate (R^f) and expected inflation (π^e), the left-hand side of equation **(6)** represents the 'Fed Model':

$$\frac{Y_t}{P_t} - R^f = k - \pi^e \qquad (6)$$

The main valuation ratios are thus affected by the same variables: the risk-free rate, the equity risk premium and—with the exception of the 'Fed Model'—the growth rate of earnings or dividends.

The historical relationship between the dividend yield and equity prices

Having set out the accounting framework for these equity valuation measures this section focuses on the historical relationship between equity valuation ratios and equity prices. As shown in Charts 1 and 2, valuation ratios have in the past tended to fluctuate within a fairly narrow and stable range. Whenever these valuation ratios have moved towards the bounds of this range, some form of adjustment has followed that restored the ratio towards its historical average. This adjustment process is referred to as mean reversion. In the case of the dividend yield it could in principle be brought about by either a change in equity prices or in dividends. In the case of the price-earnings ratio either equity prices or earnings might adjust.

In an influential article, Campbell and Shiller (1998) argued that valuation measures for the US equity market were at extreme levels in 1997 and that the adjustment would be brought about through a correction in equity prices. They illustrated their argument with a series of scatter plots that showed the historical relationship between valuation ratios and subsequent equity price changes for the S&P 500 index since 1872. This section repeats their analysis using a long sample of historical data for the FTSE All-Share index. For illustrative purposes, the focus is on the dividend yield, but the analysis of this section applies equally well to the price-earnings ratio.

To see whether in the United Kingdom dividend yields have in the past been systematically related to subsequent actual dividend growth or equity price changes, some simple scatter plots are shown in Charts 3 and 4. On the horizontal axis, they show the current dividend yield. On the vertical axis, they show real dividend growth rates (Chart 3) and real equity price changes (Chart 4) measured over a fixed ten-year future horizon.(1)

Chart 3
Dividend yield and ten-year real dividend growth

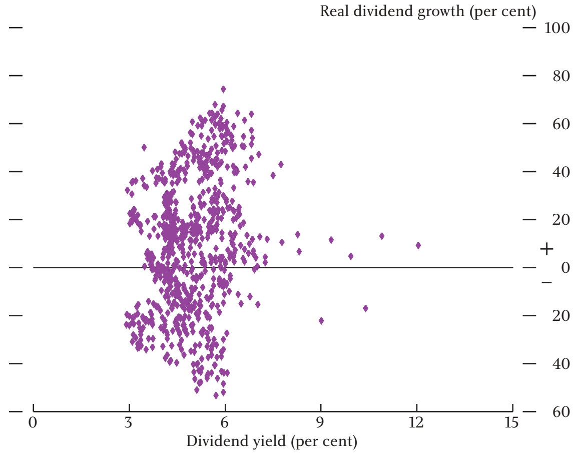
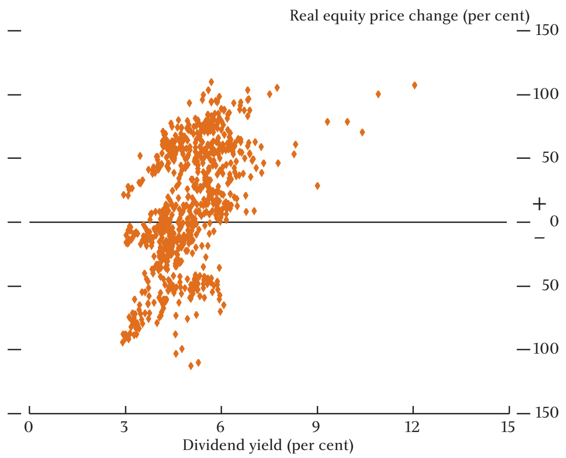


Chart 4
Dividend yield and ten-year real equity price change



(1) The underlying data are the same as presented in Chart 2, with the calculations in Charts 3 and 4 based on a sample from January 1927 to July 2002.

These scatter plots suggest that the dividend yield bears little relationship with future dividend growth (see Chart 3), but appears more related to future equity price changes (see Chart 4). This implies that historically, prices rather than dividends have been the driving force behind the observed mean reversion in the FTSE All-Share dividend yield. And since investors cannot predict future dividend growth, equation (1) indicates that they must have expected higher future returns on their equity investment.

Admittedly, the empirical evidence presented in Charts 3 and 4 is not overwhelming. But Campbell and Shiller (1998) reach a similar conclusion using historical data for the S&P 500. And a consensus has emerged in the academic literature that dividend growth is not forecastable,[1] but that dividend yields can tell us something about future equity prices.

If dividend yields bear some relationship with expected returns (r), can this relationship be attributed to either the equity risk premium (k) or to the real risk-free rate (r^f) components of expected returns? Though the academic debate on this issue is ongoing and far from resolved,[2] the dominant view at present is that stock price movements required to restore the dividend yield to its equilibrium level are brought about by changes in the equity risk premium.[3] In other words, mean reversion implies some degree of predictability in equity risk premia. But this raises new questions, namely why do risk premia change over time, and why are such changes often predictable? The next section outlines a theoretical model for thinking about the equity risk premium.

Mean reversion and equity risk premia

Before describing how equity risk premia contribute to mean reversion, it is important to bear in mind that investors base their valuations of equity on the expected or *ex ante* equity risk premium. This summarises their views on the risk inherent in future equity investments. Few direct estimates of this *ex ante* risk premium are available, so economists often use historical data on equity and bond returns to construct an *ex post* premium. But there is no reason to believe that this historical risk premium provides an unbiased estimate of the *ex ante* risk premium. That would imply that investors can correctly predict future asset returns. This may not always be true.

Moreover, no consensus exists about the level of the *ex ante* equity risk premium. One reason for this lack of agreement is that even estimates of the *ex post* risk premium vary widely. Dimson *et al* (2002) report estimates of the average UK equity risk premium for the period 1900–2000 between around 4% and 6.5%, depending on the method of calculation and the risk-free asset considered. For the United States, similar estimates range from about 4% to 9%.[4] Likewise, surveys of finance professionals report widely diverging opinions on the best estimate for the *ex ante* equity risk premium.[5] A survey of US academic financial economists conducted between 1997 and 1999 found that estimates tended to cluster between 5% and 9%.[6]

(i) Understanding equity risk premia

Over the past decades, developments in asset-pricing theory have led to a better understanding of the way in which observed patterns in equity risk premia relate to rational investors' behaviour.[7] In particular, this literature has emphasised how the equity risk premium is related, first, to the amount of risk represented by equities, and second, to the degree to which investors dislike this risk, ie their risk preferences. The previous section argued that variation in historical dividend yields has been associated with variations in expected returns. These in turn have been attributed to variations in equity risk premia. For equity risk premia to display such predictive time variation there would need to be some degree of predictive time variation in either the amount of risk or investors' risk preferences.

The amount of risk is typically measured by the comovement of stock returns and consumption. The intuition is that risk-averse investors will be content with a lower equity premium on assets that provide positive returns when they are most needed, namely when

(1) This is the dominant view in the academic literature (see for example Cochrane (2001)). For a recent contrarian view, see Lettau and Ludvigson (2002).
(2) The large literature that examines empirical models of long-horizon equity returns has recently started to question the statistical significance and robustness of the relationship between dividend yields and expected returns. Moreover, researchers have become aware of serious model selection issues.
(3) See for example Cochrane (2001) for some empirical evidence.
(4) See for example Fama and French (2001), Dimson *et al* (2002) and Mehra (forthcoming).
(5) See Dimson *et al* (2002).
(6) See Welch (2000).
(7) See for example Cochrane (2001) for an overview of this literature.

consumption growth is expected to be low. Statistically, the comovement of equity returns and consumption can be represented by three components: the variability of consumption, the variability of equity returns and the correlation between consumption and equity returns. It follows that predictable time variation over a long time horizon in the amount of risk can stem from time variation in one or all three of its components. An extensive academic literature has developed around this issue, yet has failed to find conclusive evidence of such long-horizon patterns.

Can changes in investors' risk preferences explain past movements in equity risk premia? For a long time, the asset pricing literature was content to assume that risk preferences would be constant over time. But recent work suggests that they might change over time in a predictable manner. Habit-formation models explore the possibility of business cycle variation in risk preferences.(1) In these models, investors seek protection against unexpected developments that would move them away from their usual spending habits. When investors see their consumption sliding closer to this habit level, and hence an increasing possibility of it falling below, they become more risk averse and demand a higher excess return. So, in this framework, a countercyclical pattern emerges: in booms consumption rises, and risk aversion and risk premia fall, whereas the opposite happens in recessions.(2)

Some researchers have also argued that investors' risk aversion is likely to be influenced by fluctuations in their financial wealth, in addition to fluctuations in consumption growth. Past financial losses are thought to increase an investor's risk aversion going forward, whereas past gains might make him less risk averse.(3) In yet another explanation, it is argued that patterns in the equity risk premium could stem from variations in labour income risk, primarily the risk of becoming unemployed. In these models, risk aversion increases in economic downturns, as labour income risk is higher in such situations.(4) These models often incorporate market imperfections (such as borrowing constraints or high transaction costs) to explain why income risk cannot be fully insured.

(ii) Equity risk premia and mean reversion: have historical benchmarks changed?

The previous subsection suggested that time-varying risk preferences, through their influence on the risk premium, could be an important factor behind mean reversion in dividend yields or price-earnings ratios. But Charts 1 and 2 raised the question whether it is reasonable to believe that valuation ratios always revert to the same, long-run historical mean. Could these means change periodically, implying a different pattern of mean reversion? Such structural shifts in the mean could be the result of permanent changes in investors' risk preferences. For example, if investors became less risk averse in the 1990s, thereby demanding a lower equity risk premium, equations (3) and (4) demonstrate that—other things equal—a lower dividend yield and a higher price-earnings ratio could be supported. A number of explanations have been put forward to argue that risk preferences may indeed have changed in the 1990s.

First, greater risk tolerance of the post World War II baby-boom generation is often cited as a factor contributing to a lower equity risk premium. It is possible that baby boomers invest more readily in equities and accept a lower equity risk premium, perhaps because they do not remember the 1930s.(5) A related argument is that, as ageing baby boomers started saving for their retirement, demand for high-return assets increased substantially and pushed up equity prices. Research undertaken in the United States further suggests that investors' risk aversion declines as they enter their early middle age. Given the size of the baby-boom generation, this could have contributed to a lower equity risk premium. But the retirement of the baby-boom cohorts could produce a higher equity risk premium if ageing baby boomers decided to shift their wealth from equities to bonds, thereby pushing down the returns on bonds relative to equities.(6) Empirically, however, it has proved difficult to find any conclusive evidence of a systematic relationship between asset returns and age structure.(7)

A second argument starts with a well-known result from portfolio theory that states that, although investors

(1) See for example Campbell and Cochrane (1999).
(2) There is some indirect evidence to support this. For example, it is well documented that expected returns (which are commonly proxied by the dividend yield) are highly correlated with variables that covary positively with the business cycle, such as credit and term spreads (Fama and French (1989)). But Mehra (forthcoming) questions whether investors' risk aversion displays the large business cycle variation implied by some of the habit-formation models.
(3) See for example Barberis, Huang and Santos (2001).
(4) See for example Constantinides and Duffie (1996).
(5) See for example Campbell (2001).
(6) See for example Brooks (2000) and Young (2002).
(7) See for example Poterba (2001) for a detailed survey of both the empirical and theoretical literature.

cannot reduce systemic risk, portfolio diversification reduces the exposure to firm-specific risk. Financial innovations, such as unit trust funds and on-line trading technology, together with increased competition between financial intermediaries, may have lowered the cost of portfolio diversification, thereby allowing more people to hold diversified portfolios. This may have reduced aggregate risk aversion and lowered the equity risk premium.(1)

Mean reversion, growth and real interest rates

The previous section has shown how structural changes in investors' risk preferences via the resulting changes in the equity risk premium, could support a new benchmark level for equity valuations. But equations (3) and (4) have shown that—apart from a lower equity risk premium—a lower real risk-free interest rate or a higher growth rate could also support a lower dividend yield and a higher price-earnings ratio. This section discusses the effects of changes in the real risk-free interest rate and growth rates.(2)

Expectations of higher productivity and output growth resulting from the increased usage of information technology were frequently cited as factors supporting rapidly rising share prices in the late 1990s. But such 'New Economy' arguments have received weak support from UK data. Survey data do not show a marked upward revision of expectations for long-term output growth in the United Kingdom. For example, forecasts for real GDP growth from Consensus Economics six-to-ten years ahead, rose to 2.4% in 1999 and have remained close to this rate since. This compares to a low of 2.1% in 1996, but remains below the 2.6% recorded in 1990.

Expectations of higher productivity growth are also difficult to reconcile with the observed fall in real interest rates. Higher productivity growth would raise the marginal product of capital and—for a given supply of savings—lead to higher interest rates. But Chart 5 shows that real interest rates, as measured by the yields on index-linked gilts, fell markedly during the 1990s.(3) Lower interest rates could, however, provide further support for a lower benchmark dividend yield (or a higher benchmark price-earnings ratio).

Chart 5
UK ten-year spot real interest rates

To summarise, this and the previous section have shown how lower equity risk premia or lower real interest rates could support a new benchmark level for valuation measures. The next section examines the implications of changes in real interest rates and the equity risk premium for two other popular valuation measures: the dividend discount model and the 'Fed Model.'

The 'Fed Model' and the dividend discount model

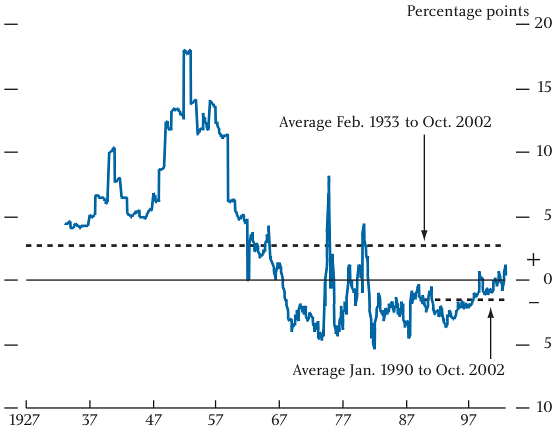
(i) The 'Fed Model'

The previous section has shown that a change in the risk-free rate will affect the dividend yield and the price-earnings ratio. The 'Fed Model' explicitly takes this relationship into account by considering the difference between the earnings yield (the inverse of the price-earnings ratio) and the risk-free rate. The latter is commonly proxied by a ten-year government bond yield. The 'Fed Model,' as shown in Chart 6,(4) is then commonly interpreted as suggesting that a deviation of this difference from its long-term average requires an adjustment in equity prices. For example, with reference

(1) See for example Heaton and Lucas (1999).
(2) It should be noted that equations (1) to (6) were not derived in a general equilibrium context. The effects of independent changes in the growth rate (g) or the real risk-free interest rate (r) on equity prices are thus only partial effects. A general equilibrium model that endogenises these variables, thereby allowing for the interdependence between r and g, would provide a more comprehensive picture.
(3) Real interest rates are derived from index-linked gilts using the variable roughness penalty (VRP) method described in Anderson and Sleath (1999). Scholtes (2002) discusses why these rates are an imperfect measure of the risk-free rate.
(4) Various measures of the earnings yield have been used to construct the 'Fed Model'. Lander *et al* (1997) use a weighted average of IBES estimates of earnings in the previous calendar year, and forecasts for the current and next calendar years. The Board of Governors of the Federal Reserve System (1997) uses IBES forecasts of earnings over the next twelve months. IBES forecasts of earnings are not available for the FTSE All-Share index and are only available since the end of the 1980s for the FTSE 100. To construct Chart 6 the inverse of the price-earnings ratio shown in Chart 1 was used.

to the long-term average it has been argued that equities are 'expensive' relative to bonds, while the opposite argument has been made with reference to the average over the 1990s. And some have argued that because the difference between the earnings yield and bond yields is small equities are fairly valued relative to bonds.

Chart 6
FTSE All-Share earnings yield minus long-term bond yield

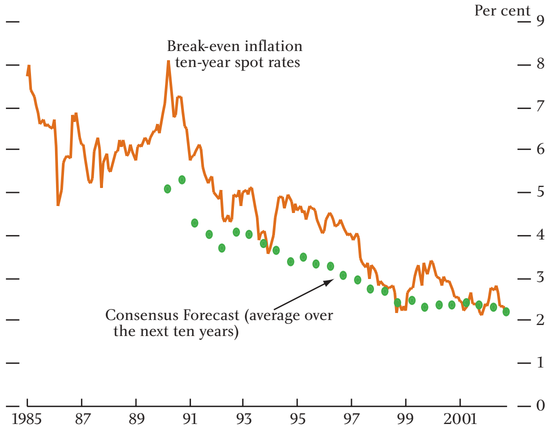


Sources: Global Financial Data, Inc. and Thomson Financial Datastream.

But such interpretations can be misleading for a number of reasons. First, although the previous section discussed—among others—the relationship between the price-earnings ratio or dividend yield and the *real* interest rate, the 'Fed Model' shows the relationship between the earnings yield and a *nominal* risk-free rate. The difference between nominal and real interest rates, inflation expectations (π^e), appears on the right-hand side of equation **(6)**. A fall in inflation expectations would—other things equal—support a higher valuation level than in the past, using the 'Fed Model'. Long time series for inflation expectations are not available for the United Kingdom. But Chart 7 shows a short sample of such expectations, one market based and one survey based. These are measured as an average of inflation expectations over the next ten years, the time period relevant for a ten-year bond.(1) The chart shows that inflation expectations have fallen substantially over the past 10–15 years. On that basis, there is no reason to expect equity valuations to return to the average level suggested by the 'Fed Model' in the past.

Equation **(6)** also shows that, similar to the price-earnings ratio and the dividend yield, the 'Fed Model' is related to the equity risk premium. So the

Chart 7
UK inflation expectations and break-even inflation rates



Notes: (a) Prior to April 1997, the twice-yearly Consensus Forecast inflation expectations refer to the general index of retail prices (RPI). They refer to the retail price index excluding mortgage interest payments (RPIX) since the April 1997 survey.
(b) Break-even inflation rates refer to the RPI.

Sources: Consensus Economics and Bank of England.

same arguments about the equity risk premium discussed earlier also apply to the 'Fed Model'. Finally, compared with equation **(3)** and **(4)** the restrictive assumption of a payout rate of 100% (implying zero long-term growth) has to be made in order to obtain the 'Fed Model'.

(ii) The dividend discount model

The ratio of observed equity prices to those implied by the 'Gordon growth model' (equation **(2)**) is itself another popular valuation measure. If the 'Gordon growth model' is the true representation of the value of equity, and if investors use this model correctly, then any deviation between prices implied by the model and actual prices will not persist. In other words, observed prices will adjust to bring the ratio of observed to implied prices back to unity.

Equity prices implied by the 'Gordon growth model' are usually estimated by making assumptions about the growth rate of dividends and the appropriate equity risk premium. It can be shown(2) that in the steady state the growth rate of dividends equals:

$$g = (k + r^f)(1 - \theta) \qquad \textbf{(7)}$$

The intuition of equation **(7)** is that—other things equal—the higher the payout ratio θ, the lower the share of earnings used for investment and hence the lower the growth rate of future earnings. Substituting

(1) These measures of inflation expectations are discussed in detail in Scholtes (2002).
(2) See Panigirtzoglou and Scammell (2002).

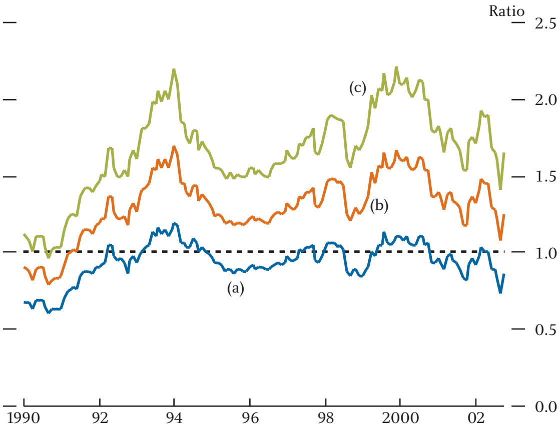
equation (7) into the 'Gordon growth model', equation (2) becomes:

$$P_t = \frac{D_t(1+(k+r^f)(1-\theta))}{(k+r^f)\theta} \qquad (8)$$

Equation (8) shows that the ratio of observed to implied prices will crucially depend on the assumption made about the equity risk premium (k).

This is illustrated in Chart 8, which shows this ratio for three different proxies of the unobservable equity risk premium: an equity risk premium of 4%, as in Panigirtzoglou and Scammell (2002), and of 2% and 6%. It shows that the ratio based on the highest equity risk premium has remained well above unity despite the earlier falls in equity prices, whereas the ratio using the lowest equity risk premium has fallen below unity.

Chart 8
FTSE All-Share: valuation ratios implied by simple dividend discount model

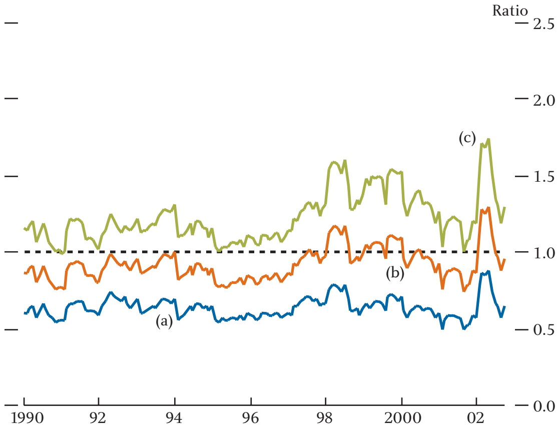


Based on equity risk premium of (a) 2%, (b) 4% and (c) 6%.

The simple dividend discount model in equation (8), together with the other valuation measures presented in equations (2) to (6), is restrictive in that it does not allow for periods of supernormal profit growth. But at times of rapid technological progress, firms may temporarily experience periods of market power and exceptionally strong profit growth before competition drives these supernormal profits to zero. To allow for this possibility, practitioners have used multi-period dividend discount models. Panigirtzoglou and Scammell (2002) describe such a model that uses Institutional Brokers Estimate System (IBES)(1) sell-side analysts forecasts of medium-term earnings per share growth. They find that equity prices implied by their model have tended to be higher than those implied by a simple dividend discount model, so that the ratio of the actual price to that given by the model would be lower.

This is reflected in Chart 9,(2) which shows that—for a given risk premium—the valuation ratios based on the multi-period dividend discount model (DDM) have been lower than those based on the simple DDM (Chart 8).(3) Indeed, except for the highest equity risk premium, the valuation ratios based on the multi-period dividend discount model are below unity.

Chart 9
FTSE 100: valuation ratios implied by multi-period dividend discount model



Based on equity risk premium of (a) 2%, (b) 4% and (c) 6%.

Note: IBES forecasts are not available for the FTSE All-Share index.

So this section further emphasises how sensitive equity valuation measures are with respect to the assumptions made about the level of the unobservable equity risk premium. In addition, measures using the dividend discount model—and by extension the other valuation measures based on the same accounting framework—are sensitive to the assumptions made about the existence and duration of supernormal profits.

Measurement issues and valuation ratios

The previous sections have shown that many of the commonly employed summary statistics for equity

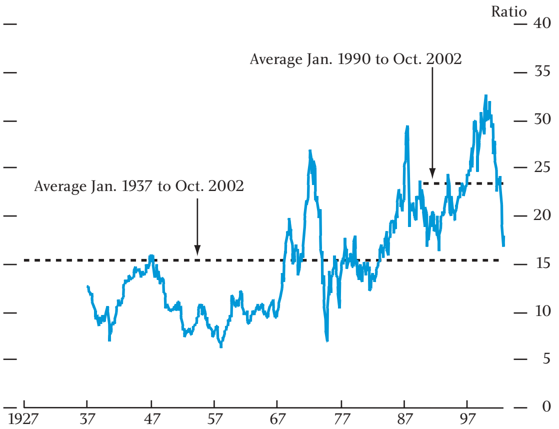
(1) Panigirtzoglou and Scammell (2002) show that there are indications that these IBES forecasts may be biased, but conclude that this could be the result of the small sample available.
(2) A long time series of IBES forecasts is available for the FTSE 100, but not for the FTSE All-Share index. Therefore, the multi-period DDM is shown for the FTSE 100 instead (Chart 9).
(3) In deriving the multi-stage DDM measure, the following assumptions were made: (i) in the first four years, g is equal to the IBES medium-term growth rate; (ii) in the next eight years, g declines linearly towards its long-run rate; and (iii) this long-run rate is computed using equation (7).

valuations are only of limited use, unless care is taken in their interpretation. Moreover, the quality of the data on earnings and dividends imposes some practical limits on the usefulness of these summary statistics. These are discussed below.

(i) Price-earnings ratios and earnings estimates

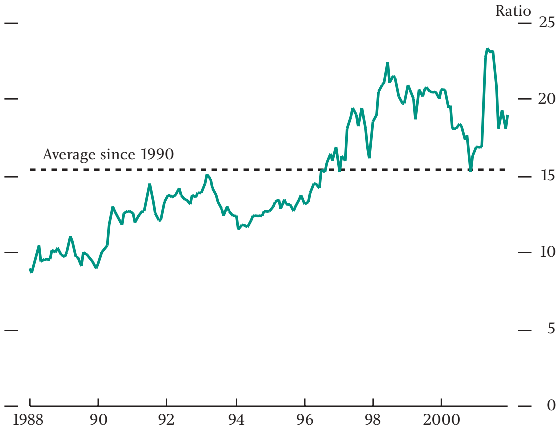
First, there are a number of possible measures for the price-earnings ratio. Current earnings, as used in the calculations in Chart 1, are strongly affected by cyclical conditions. For example, in an economic slowdown current earnings are likely to be temporarily depressed. This may lead to an unusually high price-earnings ratio in a slowdown, with the reverse happening in a boom. To adjust for such temporary fluctuations, Shiller (2000) uses a ten-year moving average of earnings to calculate a price-earnings ratio for the S&P 500 index. Chart 10 shows such a price-earnings ratio for the FTSE All-Share index. This trailing price-earnings ratio has recently been below its average for the 1990s and much closer to its long-term average than the price-earnings ratio shown in Chart 1.

Chart 10
FTSE All-Share: ten-year trailing price-earnings ratio



Another widely used price-earnings ratio is based on IBES forecasts of earnings. A long time series of IBES forecasts for the FTSE All-Share index is not available, so Chart 11 shows a price-earnings ratio based on IBES forecasts for FTSE 100 earnings instead (going back to 1988). In contrast to the trailing earnings presented in Chart 10, this forward-looking measure remains above its average for the 1990s.

Chart 11
IBES twelve-months ahead price-earnings ratio for FTSE 100



Source: Thomson Financial Datastream.

Second, earnings depend on accounting conventions. This issue is discussed in detail in Cortes *et al* (2002) but a number of issues are worth drawing out here.

Estimates of price-earnings ratios for the S&P 500 index show that accounting conventions can make a large difference.(1) For example Nakamura (1999) argues that price-earnings ratios in the United States are overstated because research and development (R&D) is treated as an expense (thereby reducing earnings) rather than investment. Since the share of R&D in corporate GDP has increased over time, this would also distort the time profile of price-earnings ratios.

On the other hand, Liang and Sharpe (1999) argue that stock options—although they dilute the claims on earnings of existing shareholders—are not regularly treated as an expense. This leads to an understatement of price-earnings ratios and—with the usage of stock options having increased over time—again distorts the time profile of price-earnings ratios.

Accounting conventions may also explain some of the differences between price-earnings ratios in Charts 1 and 10 and the IBES estimates in Chart 11. Charts 1 and 10 are based on reported earnings, whereas Chart 11 is based on operating earnings, ie a corporation's net income from ongoing operations.

More recently, the revelation of accounting malpractice at some companies in the United States and Europe has created uncertainty about the quality of earnings. Some

(1) For example on 30 October 2002, the price-earnings ratio for the S&P 500 calculated by Thomson Financial Datastream was 21.5; the measure published by Standard and Poor's was 33.3. The differences mainly reflected the different treatment of goodwill and losses of individual firms.

commentators have argued that this makes the dividend yield a preferable summary statistic to the price-earnings ratio.

(ii) Dividend yields

In contrast to earnings, dividends generate an observable cash flow. They tend to be less volatile than earnings. This may reflect companies' practice of only changing dividends when they expect changes in long-run sustainable earnings.(1) As such, dividend yields are less affected by cyclical factors than price-earnings ratios.

But the dividend yield also has its drawbacks. The present value formula in equation (1) discounts all future cash flows *D*, not just dividends. Historically, these cash flows have primarily been distributed in the form of dividends. But in recent years share buy-backs have gained in popularity as a means to distribute cash flows to investors. Jagannathan *et al* (2000) point out that, in contrast to dividends, which tend to increase steadily over time, share buy-backs tend to be very procyclical and are seen as a means to distribute temporarily high cash flows, without implicitly committing the firm to continue such payments. Nevertheless, if a large part of cash flow is distributed to shareholders by means other than dividends, the usefulness of the dividend yield as a summary statistic for valuations is reduced. Liang and Sharpe (1999) analyse the importance of share repurchases for the largest 144 companies in the S&P 500 index. They show that, when adjusting for the proceeds from the exercise of stock options, the net cash outflow associated with share repurchases accounted for 1.5% of market value in 1998. This compares with a dividend yield of 1.4%.(2)

Finally, the capacity of a company to pay dividends depends on its capacity to generate earnings. If the quality of published earnings is impaired to a degree that a company's present situation and future prospects cannot be analysed, little can be said about dividend growth.

Conclusion

Valuation measures, such as the dividend yield, the price-earnings ratio, the 'Fed Model' and various forms of the dividend discount model, have been at the heart of the debate on equity valuations for many years. This article has shown that all these measures are special cases of the simple present value concept and that they are therefore affected by the same underlying variables. It has also shown that to use them as simple summary statistics to be compared with past averages may lead to invalid conclusions, if some of the underlying variables, such as the risk premium, have changed. Moreover, the quality of the data on earnings and dividends further affects the usefulness of these valuation measures. The article concludes that the valuation measures described cannot serve as a substitute for a careful analysis of the data and the underlying economic developments driving them. But this is not to say that such measures are without their use. On the contrary, unusual movements or large deviations from past averages in equity valuation measures may prompt us to reflect on the fundamental factors driving asset prices and may in turn help to understand changes in the behaviour of economic agents.

(1) See Marsh and Merton (1987) for the United States.
(2) This view is not uncontroversial. For example Arnott (2002) argues that during the late 1990s share buy-backs were outstripped by new share issuance.

Appendix
The present value model

Stock prices (P_t) are equal to the present discounted value of future expected cash flows (D_t):[1]

$$P_t = E_t \sum_{j=1}^{\infty} \frac{(D_{t+j})}{\prod_{k=1}^{j}(1+R_{t+k})} \qquad \textbf{(a.1)}$$

where (R_t) is the required real return.[2] Campbell and Shiller (1988) show that this expression can be simplified, without forgoing time variation in the discount rate.[3] Linearising equation **(a.1)** with a Taylor expansion, one obtains the following expression for stock prices:

$$p_t = E_t \sum_{j=0}^{\infty} \rho^j [(1-\rho)d_{t+j+1} - r_{t+j+1}] + \kappa \qquad \textbf{(a.2)}$$

In equation **(a.2)**, p and d are the log price and dividend, respectively, r the log real return, ρ a discounting parameter ($\rho < 1$) and κ a constant coming from the linear approximation. Equation **(a.2)** can be rearranged so that one obtains an expression for the dividend yield ($d_t - p_t$):

$$d_t - p_t = E_t \sum_{j=0}^{\infty} \rho^j [-\Delta d_{t+j+1} + r_{t+j+1}] - \kappa \qquad \textbf{(a.3)}$$

One can further rearrange equation **(a.2)** to obtain a relationship between prices and earnings, shown in equation **(a.4)**:

$$p_t - y_t = E_t \sum_{j=0}^{\infty} \rho^j [\Delta y_{t+j+1} - r_{t+j+1} + (1-\rho)(d_{t+j+1} - p_{t+j+1})] + \kappa \qquad \textbf{(a.4)}$$

(1) In equation **(a.1)**, the possibility of a so-called bubble is ruled out by the following limiting condition:

$$E_t\left[\frac{P_{t+T}}{(1+R_T)^T}\right] \to 0 \text{ as } T \to \infty.$$

(2) The notation used in this appendix differs slightly from that in the main article. Here 'R' is the real return and 'r' is the *log* real return.

(3) The interested reader is referred to Cochrane (2001) for a careful derivation of equations **(a.2)** to **(a.4)** (pages 395–97).

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