

Interpreting equity price movements since the start of the financial crisis

By Mika Inkinen of the Bank's Foreign Exchange Division and Marco Stringa and Kyriaki Voutsinou of the Bank's Macro Financial Analysis Division.⁽¹⁾

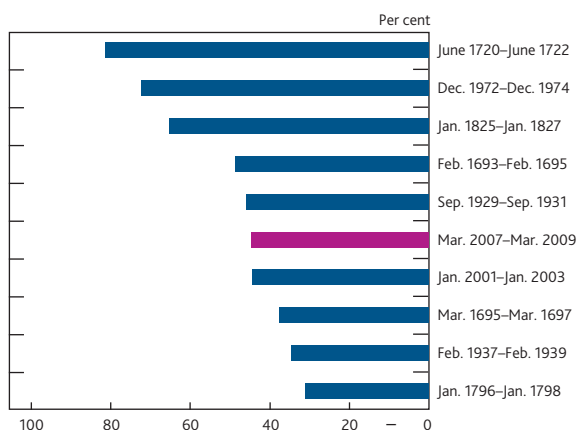
Equity markets have experienced large price movements since the financial crisis began in mid-2007. Understanding the factors that drive equity prices is important for policymakers as they may contain information about the future course of the economy. This article uses a simple model to decompose recent equity price movements into changes in earnings expectations, the risk-free rate and the equity risk premium. Indicative evidence suggests that changes in earnings expectations can account for some, but by no means all, of the shifts in equity prices since mid-2007. Policy actions by central banks and governments are likely to have supported equity prices, for example by lowering government bond yields and reducing the likelihood of more severe downside risks to the economy materialising. The latter may also have contributed to a fall in the implied level of the equity risk premium, which had increased sharply during the financial crisis.

Introduction⁽²⁾

There have been some historically large equity price movements since the financial crisis began in mid-2007. In the two years to their March 2009 trough, UK equity prices experienced one of their largest two-year falls since data were first recorded in 1693 (**Chart 1**). Since then, equity prices have risen sharply, experiencing the eighth largest eleven-month increase. This recovery in equity prices was accompanied by unprecedented policy actions, including the Bank of England's programme of asset purchases — sometimes referred to as quantitative easing.⁽³⁾ Nonetheless, real equity prices remain below previous peaks in 1999 and 2007 (**Chart 2**).

Equity prices can directly affect the economy via a number of channels. For example, they can influence consumer spending through their impact on both households' financial wealth and consumer confidence. They also affect the cost of capital raised in equity markets and, hence, companies' investment decisions. And large, persistent moves in equity prices may affect the resilience of market participants' balance sheets, potentially increasing the risks to financial stability. Aside from their effects on the economy, equity prices also provide policymakers with an insight into market participants' views about the outlook for companies, as well as the wider macroeconomic environment. This can in turn help policymakers with the significant challenge of identifying the types of shocks that have hit the economy.

Chart 1 Ten largest two-year falls in UK nominal equity prices^{(a)(b)}



Sources: Global Financial Data Inc. and Bank calculations.

(a) Composite index comprising of East Indies stock for 1693; Bank of England and East Indies shares from 1694 to August 1711; Bank of England, East Indies and South Sea shares from September 1711 to January 1811; Rostow's Total Index of Share Prices from 1811 to 1867; London and Cambridge Economic Service Index from 1867 to 1906; The Banker's Magazine Index from 1907 to May 1933; Actuaries General Index from June 1933 to April 1962; FTSE All-Share from April 1962 onwards.

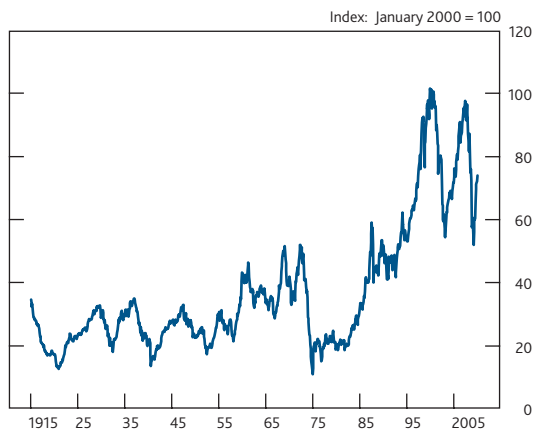
(b) Non-overlapping two-year falls.

It is therefore important to understand the factors that have driven changes in equity prices. This article focuses on the movements in equity prices since the start of the financial crisis in Summer 2007. As background, the next section briefly outlines some different approaches to analysing equity

(1) The authors would like to thank Adrien Auclert, Colombine Peze-Heidsieck and Matthew Tong for their help in producing this article.

(2) This article covers the period up to the Monetary Policy Committee's interest rate decision in February. The data cut-off is therefore 3 February 2010.

(3) For further information, see Benford *et al* (2009).

Chart 2 UK real equity prices^(a)

Sources: Global Financial Data Inc. and Bank calculations.

(a) Index as in footnote (a) of **Chart 1** deflated using the consumer prices index (CPI) as calculated by Global Financial Data Inc. Monthly averages.

prices. The following section then discusses the simple conceptual framework used in this article. The final two sections present the results of the analysis along with some sensitivity analysis.

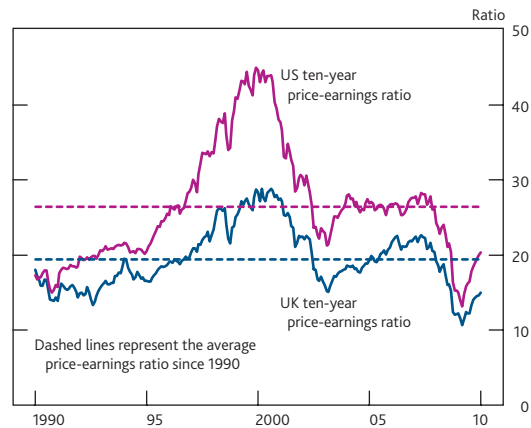
Interpreting equity price movements

There is a vast academic literature on methods for evaluating equity prices, as well as a variety of approaches used by practitioners. For example, behavioural finance theory suggests that psychological influences can affect the behaviour of investors and subsequently asset prices. Such influences include herding behaviour, where individual investors join the crowd of others in a rush to buy or sell assets (Brunnermeier (2001)), and so-called 'cognitive dissonance', where investors ignore information that conflicts with their prior expectations (Drees and Eckwert (2005)).

Many approaches, however, adopt a common foundation. They are based on the idea that the price of any asset should reflect the present value of its future stream of income, discounted using a risk-free rate plus an additional compensation that captures the risk of holding the asset — in the case of equities, the so-called equity risk premium. The extra compensation follows from investors' aversion towards risk. Investors require higher returns than the risk-free rate to hold assets that provide uncertain pay-offs and that tend to be positively correlated with the business cycle and with other assets.⁽¹⁾

Among the simplest and best known of these approaches are the so-called 'ratio variables'. They generally express equity prices as a proportion of current or expected future income. These ratios are generally compared to their long-run averages to assess the most recent data against a historical standard. One of the most commonly used ratio variables is the price-earnings ratio which compares current equity prices to

companies' earnings (**Chart 3**).⁽²⁾ But ratio variables are very simplistic. For example, the price-earnings ratio generally uses past earnings rather than the expected future stream of income, and it also ignores changes in both the risk-free rate and the equity risk premium.

Chart 3 Price-earnings ratios^{(a)(b)}

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

(a) Monthly averages. The equity markets are proxied by using the following indices: FTSE All-Share for the United Kingdom and S&P 500 for the United States.

(b) As earnings vary considerably through the business cycle, the ratio of real equity prices to a ten-year trailing average of real earnings is used. The deflator used is the CPI as calculated by Global Financial Data Inc. for the United Kingdom and the Datastream CPI for the United States.

Instead, this article uses the so-called dividend discount model (DDM), which is a simple but flexible accounting framework that addresses some of these shortcomings. It is based on the notion discussed earlier that equity prices represent the risk-adjusted present value of the future cash flows that shareholders expect to derive from equities. An increase in expected future cash flows, holding everything else constant, should have a positive effect on equity prices. By contrast, a rise in the risk-free rate implies a higher rate at which future cash flows are discounted, and should have a negative effect on equity prices. Similarly, a higher equity risk premium should lead to a fall in equity prices. But while these components are treated separately in the model, in practice they are likely to be affected by common factors and so to be intrinsically linked (see Kiley (2000)).

An application of the dividend discount model

The DDM requires a number of inputs — namely expected future cash flows, the risk-free rate and the equity risk premium. These variables are however unobservable, so various assumptions and proxy measures are used instead. As a result, any conclusion drawn from the output of the DDM depends crucially on the plausibility of these assumptions and proxies, which could change over time. This section outlines

(1) The complexity of these approaches varies greatly from simple valuation measures to the evaluation of equities in a general equilibrium framework (Cochrane (2005)).

(2) For more detail, see Vila Wetherilt and Weeken (2002).

the baseline assumptions for the DDM used in this article. This model extends previous Bank work (Panigirtzoglou and Scammell (2002)) and is discussed in more detail in the annex.⁽¹⁾

Expected future cash flows

Expected future cash flows are a function of the current level of cash flows and their expected future growth. As is common practice, this article makes two simplifying assumptions. First, current cash flows are proxied by dividends.⁽²⁾ Hence, an increase in current dividends, holding everything else constant, should boost equity prices since cash flows are expected to grow from a higher level. Second, the ratio of dividends to earnings (the payout ratio) is kept constant going forward. So dividends are assumed to rise at the same rate as earnings.⁽³⁾ This means it is possible to use projections for the growth in companies' earnings to capture changes in the expected future income stream derived from holding equities.

A further assumption often made is that the expected growth rate of dividends is constant. Although this assumption greatly simplifies the present value calculations, it may lead to misleading conclusions, particularly when economic prospects are changing dramatically such as over the past two years. Hence, this article extends previous Bank work and allows dividends growth to vary in the near and medium term before reverting back to a long-run growth rate.

Investors' earnings expectations are not directly observable, but over the short and medium term there exist surveys of analysts' expectations. Some of the most widely used survey-based measures for earnings expectations are published by the Institutional Brokers' Estimate System (IBES). These are consensus forecasts of quoted companies' earnings per share which can be used to generate earnings projections.

In contrast, it is hard to obtain publicly available estimates for earnings expectations over the long term. But long-term earnings can be proxied in a number of ways. One approach relates the expected future long-term growth rate to current and past observable variables. But while this allows the long-term growth rate to be calibrated within the DDM, it can sometimes lead to unrealistic results (see annex). An alternative is to express the long-term growth rate as a function of long-term forward interest rates such as overnight index swap (OIS) rates.⁽⁴⁾ OIS rates will contain expectations of future interest rates, so they may be closely linked to the expected long-term growth rate of the economy. But long-term sterling OIS rates were relatively illiquid before mid-2008 and so may have provided a poor guide to expected future interest rates.

A simpler approach is to assume that the expected long-term growth rate is constant and equal to an estimate of the potential growth of the economy. This article uses this latter

approach, while recognising that the choice is essentially arbitrary.

The risk-free rate

The risk-free rate is usually proxied by government bond yields, given that in general these are the safest long-term assets available to investors. In this article, the baseline case uses rates inferred from zero-coupon government bond yield curves at maturities up to ten years.⁽⁵⁾ But other proxies for the risk-free rate could be used. One option is to use OIS rates after mid-2008; this will be discussed further in the sensitivities section later in the article.

The equity risk premium

The equity risk premium is also unobservable, but it can be extracted as a residual from the DDM using observed equity prices and the inputs already discussed. In other words, an implied level of the equity risk premium can at each point in time be backed out from the DDM using the observed level of equity prices and the inputs used for investors' expected future earnings and the risk-free rate. In this way, contributions to moves in equity prices due to shifts in the implied risk premium can be inferred.

Accounting for recent large movements in equity prices

The DDM provides a framework to assess the factors that might account for the observed large movements in equity prices since mid-2007, prior to the start of the financial crisis. Based on the inputs discussed previously, **Chart 4** shows an indicative breakdown of the contributions to the changes in international equity prices between mid-2007 and early February 2010. The decomposition suggests that UK and euro-area equity prices have been supported by lower government bond yields. But, over the same period, realised dividends and earnings expectations have generally fallen, which other things equal would suggest a lower contribution to equity prices.⁽⁶⁾ For all three indices, prices fell by considerably more than can be attributed to changes in the perceived outlook for earnings or government bond yields, suggesting that higher equity risk premia also probably played a role.

Although **Chart 4** provides useful insights into the total fall in equity prices since mid-2007, it does not address what could account for the large fall in equity prices to their March 2009 trough and their subsequent partial rebound (**Chart 5**).

(1) The model incorporates more detailed and new information on earnings prospects and the term structure of government bond yields.

(2) Companies can distribute their earnings to shareholders by paying dividends or by buying back shares (Wadhvani (1999)).

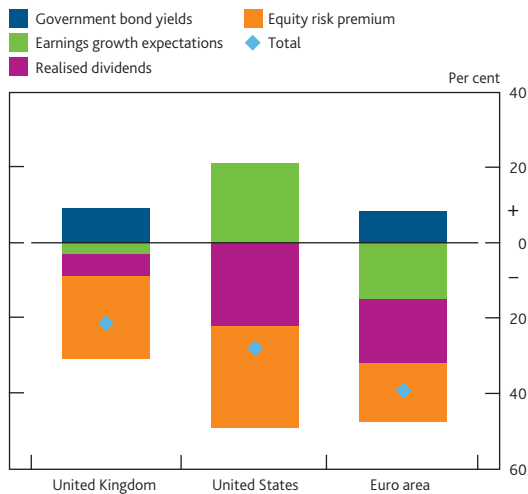
(3) Throughout this article the term 'earnings' refers to companies' annual net profits.

(4) For further information, see Joyce and Meldrum (2008).

(5) The model approximates the long-term interest rate used in the last stage of the DDM with the five-year, five-year forward rate.

(6) The positive contribution of earnings expectations for US equities may reflect a rebound from the larger fall in realised dividends.

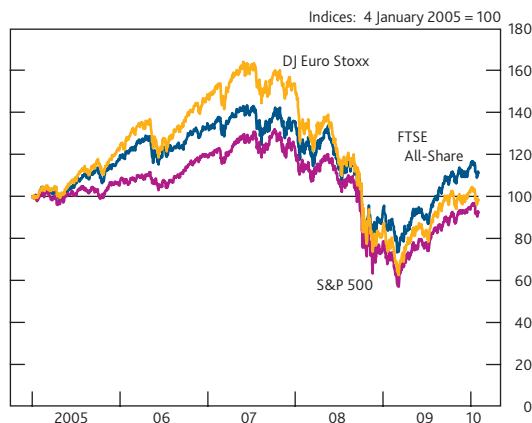
Chart 4 Indicative contributions to changes in international equity indices from 5 July 2007 to 3 February 2010^{(a)(b)}



Sources: Bank of England, Thomson Datastream and Bank calculations.

- (a) The equity markets are proxied by using the following indices: FTSE All-Share for the United Kingdom, S&P 500 for the United States and DJ Euro Stoxx for the euro area. All are in local currencies.
- (b) The above decomposition reflects the contribution of changes to individual variables in the model, scaled to match the total change in the equity index over the period.

Chart 5 International equity indices^(a)



Sources: Thomson Datastream and Bank calculations.

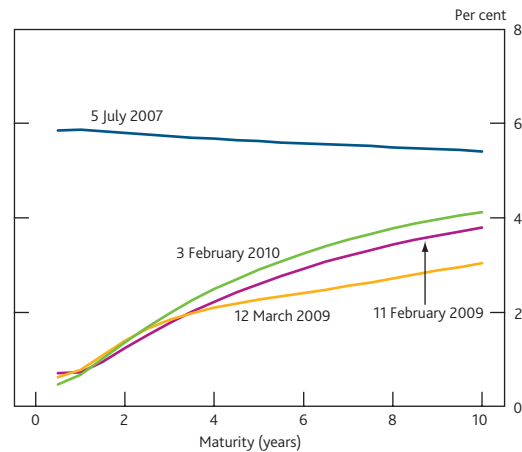
- (a) Local currencies.

The rebound in equity prices was preceded and accompanied by unprecedented policy actions to support monetary and financial stability. In the United Kingdom, for example, a number of measures were put in place to support the banking sector, including liquidity insurance, additional capital investment and asset protection schemes.⁽¹⁾

In addition, the Monetary Policy Committee cut Bank Rate to historic lows and embarked upon a programme of asset purchases aimed at supporting nominal spending in order to keep inflation close to target. Besides purchasing private sector corporate debt securities, which were undertaken with the aim of improving the functioning of the UK commercial paper and corporate bond markets, the Bank of England's Asset Purchase Facility has purchased £198 billion of UK government bonds.⁽²⁾ These purchases, together with the cuts in Bank Rate,

are likely to have pushed down on government bond yields (**Chart 6**) and, other things equal, might have reduced the rate at which to discount future cash flows.⁽³⁾ Indeed, government bond yields fell to be around their lowest levels since the mid-1950s. Moreover, it is likely that the policy actions helped to improve earnings expectations.

Chart 6 UK government nominal spot rates

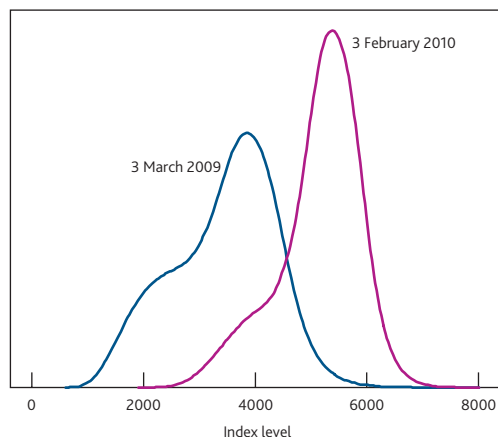


Market contacts have suggested that these policy actions by central banks and governments are likely to have prevented more severe downside risks from materialising. And the asset purchase scheme, along with those implemented by other countries, is likely to have encouraged investors to rebalance their portfolios away from government bonds towards riskier assets such as equities.⁽⁴⁾ Each of these would have reduced the risk premium investors require to invest in equities, which appears consistent with information from option prices. For example, the implied distribution of future equity prices narrowed, implying that investors became less concerned about large future falls in equity indices (**Chart 7**).

However, the impact of those recent unprecedented policy actions cannot be precisely quantified. Therefore, it is difficult to draw firm conclusions about the relative contributions of policy to the factors that have driven changes in equity prices. Rather than focusing on the effect of these exceptional measures, the rest of this section looks into decomposing UK equity price movements in greater detail. It examines first the factors that drove the decline in equity prices up to March 2009, before moving on to consider what contributed to the subsequent recovery in equity prices. In doing so it focuses on three distinct periods:

(1) The UK Government has put in place an Asset Protection Scheme designed to protect financial institutions against exposure to exceptional future credit losses on certain portfolios of assets. For more details see Table 1.B on page 17 of the June 2009 *Financial Stability Report*, available at www.bankofengland.co.uk/publications/fsr/2009/fsrfull0906.pdf.
 (2) For more details, see www.bankofengland.co.uk/markets/apf/index.htm.
 (3) The price of bonds is inversely related to the yield. So a rise in bond prices is associated with lower yields.
 (4) See Dale (2009).

Chart 7 Six-month option-implied FTSE 100 probability density functions^(a)



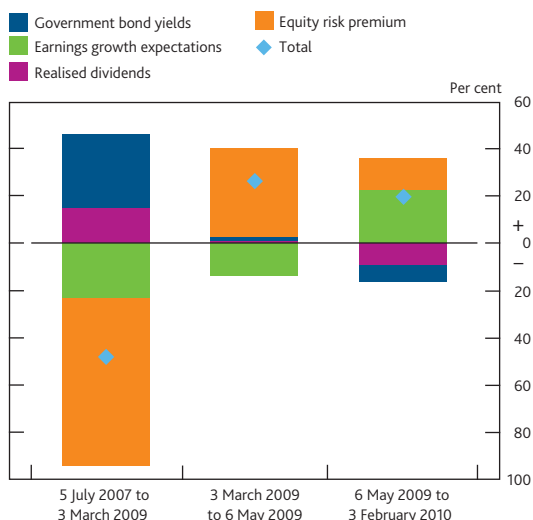
Sources: Euronext.liffe and Bank calculations.

(a) For more details, see Clews, Panigirtzoglou and Proudman (2000).

- 5 July 2007 to 3 March 2009;
- 3 March 2009 to 6 May 2009; and
- 6 May 2009 to 3 February 2010.

The indicative decomposition suggests that the fall in equity prices from the pre-crisis levels to the March 2009 trough can be accounted for by falling earnings expectations and higher equity risk premia, partially offset by lower government bond yields (Chart 8). The implied equity risk premium picked up markedly during the worst of the financial crisis in 2007–08, as investors became increasingly concerned about the risks associated with holding equities.

Chart 8 Indicative contributions to changes in the FTSE All-Share^(a)



Sources: Bank of England, Thomson Datastream and Bank calculations.

(a) The above decomposition reflects the contribution of changes to individual variables in the model, scaled to match the total change in the equity index over the period.

The recovery in UK equity prices appears to have been a story of two halves. The period between March and May 2009,

when the UK index increased by around 25%, seems to have been characterised by a falling risk premium, while earnings expectations decreased further. Since May 2009, earnings expectations have recovered, providing substantial support to equity prices, and the equity risk premium has fallen further.⁽¹⁾

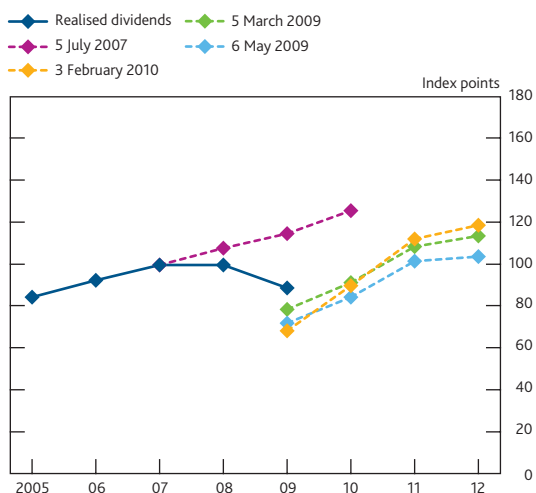
Sensitivity analysis

The results are sensitive to the different assumptions and proxies imposed on the model so applying the DDM in such a mechanical way could lead to misleading conclusions. Consequently, this final section uses some alternative proxies to assess the sensitivity of the results to the accuracy and timeliness of the DDM inputs.

Different proxies for earnings expectations

According to IBES figures, earnings expectations were revised downwards in the initial phase of the recovery in equity prices between March and May 2009 (Charts 8 and 9). But these earnings forecasts are imperfect proxies of expected cash flows. And evidence from academic studies and market intelligence suggest that they may lag actual changes in investors' expectations.⁽²⁾

Chart 9 Realised and projected dividends based on IBES earnings per share growth forecasts for the FTSE All-Share^(a)



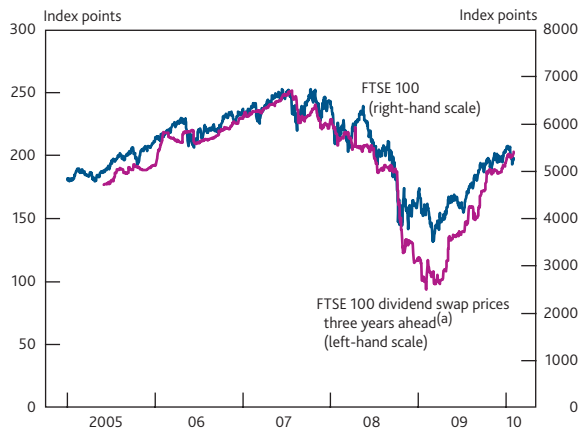
Sources: Thomson Datastream and Bank calculations.

(a) Realised dividends for each year are extracted from the dividend yield ratio using the monthly average for December. Changes in dividends are generally announced following the release of companies' accounts. Hence, extracted dividends are likely to reflect changes in companies' performance with a lag. This may be a reason behind the wedge between the latest realised dividends and earnings expectations for 2009.

- (1) The results can be sensitive to the precise specifications of the model. For example, using the DDM based on Panigirtzoglou and Scammell (2002), the December 2009 *Financial Stability Report* finds that lower real interest rates could account for some of the rise in UK equity prices since March 2009 (Bank of England (2009)).
- (2) According to O'Brien (1988), the average reporting lag between analysts' forecast dates and IBES reporting dates is 34 trading days with a standard deviation of 44.5 trading days.

Dividend swaps — contracts that are directly linked to future dividends (see the box on page 30) — may provide an alternative proxy for investors’ expected cash flows. After falling sharply in 2008, dividend swap prices rebounded in 2009, broadly consistent with the recovery in equity markets in March 2009 (Chart 10).⁽¹⁾ This contrasts with IBES forecasts, which continued to be revised downwards until May 2009.

Chart 10 FTSE 100 dividend swap prices and equity index



Sources: Barclays Capital, Bloomberg and Bank calculations.

(a) Calculated from a FTSE 100 three-year dividend yield index using the concurrent equity index level for simplicity. The swaps reference dividends paid in a calendar year between two and three years ahead.

If dividend swap prices were to be used in the DDM instead, downward revisions to earnings expectations might have accounted for a larger proportion of the fall in equity prices up to their March trough. And the contributions of a falling equity risk premium and higher earnings expectations could perhaps correspondingly be more balanced between the two recovery phases in 2009.

However, dividend swap prices may be affected by risk premia due to the uncertainty around future dividends, and could also contain liquidity premia, among other factors. The lack of longer-run dividend swap data complicates the task of estimating the scale of these risk premia. Hence, the rebound in dividend swaps in March 2009 may have been driven by either improved earnings expectations or a change in risk premia, or a combination of the two.

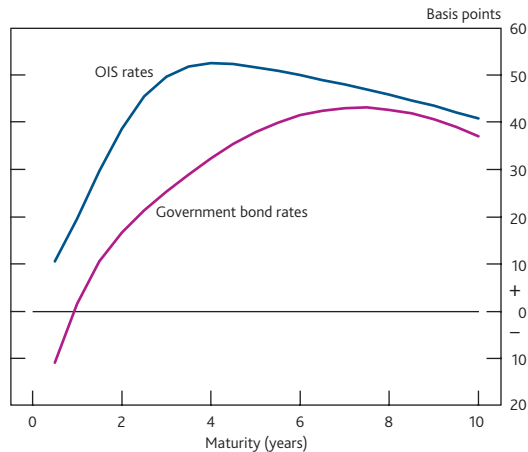
Alternative risk-free rate

The decomposition shown in Chart 8 implies that lower nominal government bond yields mitigated some of the fall in equity prices from July 2007 to the trough.

But government bond yields may not provide a good proxy for the risk-free rate. For example, they may reflect other factors such as the supply of government bonds and investors’ preferences. And the government bond market has been affected recently by unprecedented policy measures, including the Bank’s Asset Purchase Facility. One option is to use OIS

rates instead. But, as discussed earlier, long-term OIS rates are only available since mid-2008 so can only be used over the recovery phase. Since the trough in equity prices in March 2009, OIS rates have increased by more than government bond yields (Chart 11). This suggests that, were OIS rates to be used instead of government bond yields, the risk-free rate contribution would become more negative.

Chart 11 Changes in spot rates since 3 March 2009



Sources: Bank of England and Bank calculations.

Plausibility of equity risk premium

The implied equity risk premium is derived as a residual, and so depends crucially on the other model inputs. The model can be used to compare changes in the level of the equity risk premium over time. The baseline model suggests that the rise in the equity risk premium during the recent recession is similar to that following the equity price fall in 2001–03 (Chart 12).⁽²⁾ That may appear surprising, given the severity of the financial crisis and the magnitude of the fall in UK and world output since the start of the recession.

One possible explanation is that expectations for UK-quoted companies’ earnings were revised down more sharply during the recent period than earlier in the decade, reflecting the more severe domestic and global downturn (Chart 13).⁽³⁾ This larger revision in IBES earnings forecasts during the recent period can therefore account for a greater proportion of the fall in equity prices. That in turn mechanically implies a smaller rise in the equity risk premium than would otherwise be the case. In addition, policy actions by both central banks and governments are likely to have reduced the likelihood of more severe downside risks to the economy materialising. And that will also have limited the extent of the rise in the equity risk premium.

(1) Dividend swaps are most commonly traded on the narrower FTSE 100 index, rather than the FTSE All-Share.
 (2) As shown in Chart 1 the two-year fall in UK equity prices in 2001–03 was similar to that in 2007–09.
 (3) Indeed, in March 2009 IBES implied cumulative four-year earnings growth was the lowest since 1998, when data became available for the FTSE All-Share index.

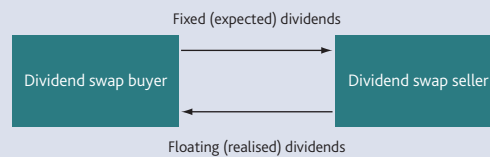
Dividend swaps

A dividend swap is a financial contract that is directly linked to the dividends paid by a specific equity or basket of equities. It has zero value at inception, and the final payment is determined by the actual, or realised, level of dividends paid over the time period specified by the contract (usually a calendar year).

Typically, dividend swaps have been traded 'over the counter' as private contracts between counterparties. However in June 2008, Eurex introduced exchange-traded dividend futures that reference the weighted aggregate level of dividends paid by the companies included in the DJ Euro Stoxx 50 index. And in May 2009 Euronext.liffe introduced similar dividend futures referencing the FTSE 100.

The mechanics of dividend swaps are similar to fixed-for-floating interest rate swaps. The buyer in a swap agrees to make a fixed payment at expiry, which embodies expectations of future dividends. The seller in the swap agrees to pay at that future date the realised dividends accrued over the period (**Figure 1**). Hence, the buyer of the swap makes a profit if the realised dividend is greater than the agreed fixed payment.

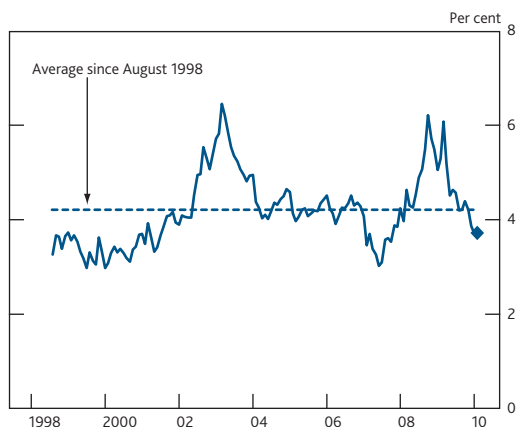
Figure 1



Generally, ordinary dividends accrued by companies in the reference index over the life of the swap are included in the pay-off. Other cash flows to equity holders, such as share buy-backs and large irregular dividend payments (so-called 'special' dividends) are typically excluded. Some contracts also exclude dividends paid as equity to existing equity holders.

As the present value of expected cash flows on the dividend swap changes over time, the price of the contract may fluctuate. Since the final payment is uncertain, the appropriate discount rate for the future cash flows will include an adjustment for risk. This means that the market price of the swap reflects not only investors' expectations about future dividends but also incorporates some compensation for the perceived uncertainty around those expectations. In addition, other factors such as liquidity premia could affect dividend swap prices.

Chart 12 DDM implied equity risk premium for the FTSE All-Share since August 1998^(a)

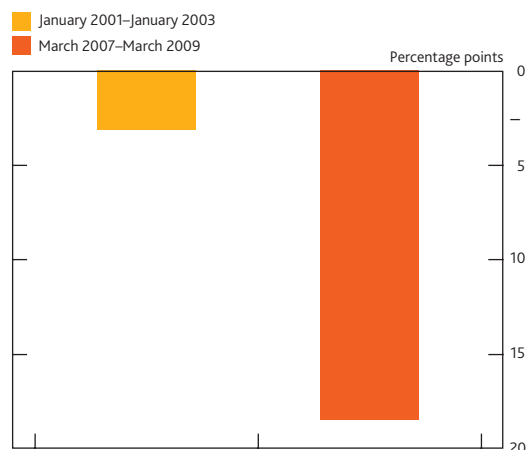


Sources: Bank of England, Thomson Datastream and Bank calculations.

(a) Monthly averages. Diamond represents point at 3 February 2010.

Alternative indicators of the equity risk premium can also help to assess the plausibility of the profile implied by the DDM. One such market indicator is option-implied volatility, which is often used as a proxy for market participants' uncertainty about future equity prices. However, measures of implied volatility and the model-implied equity risk premium are not directly comparable. For example, option-implied volatility captures the uncertainty over the maturity of the option (for example twelve months), whereas the model-implied risk premium captures the uncertainty over the whole life of

Chart 13 Changes in four-year cumulative growth in earnings per share forecasts implied by IBES forecasts for the FTSE All-Share^(a)



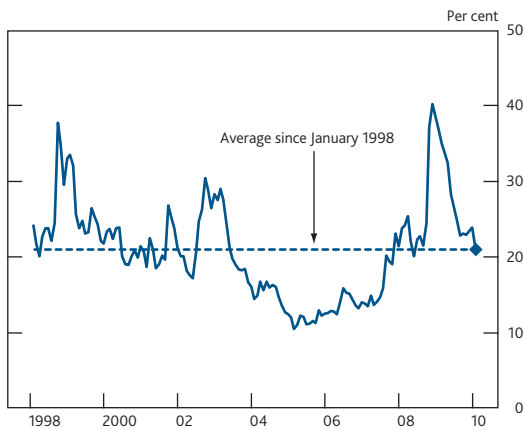
Sources: Thomson Datastream and Bank calculations.

(a) Change in IBES forecasts over the same periods as those used in Chart 1. Four-year growth based on 'year-on-year' IBES earnings per share growth projections for the first three years and the 'over-the-cycle' projection for the fourth year.

equities, which can be thought of as perpetuity. Furthermore, options are most commonly traded on the narrower FTSE 100 as opposed to the FTSE All-Share.

Chart 14 shows the level of twelve-month FTSE 100 option-implied volatility. The sharp increase and subsequent fall of this measure towards its average since 1998 is broadly consistent with the changes in the implied level of the equity

Chart 14 Twelve-month FTSE 100 option-implied volatility^(a)



Sources: Euronext.liffe and Bank calculations.

(a) Monthly averages. Diamond represents point at 3 February 2010.

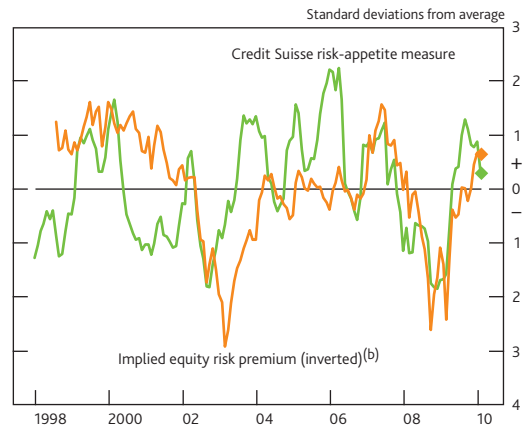
risk premium. However, option-implied volatility increased to a higher level than that reached in 2002.

Another way of gauging whether the implied level of the equity risk premium is plausible is to compare it against a measure of investors' risk appetite, derived for example from an econometric model. Such a measure should be inversely correlated with the equity risk premium — when risk premia are lower (higher) risk appetite should be higher (lower). Measures of risk appetite are typically volatile and should be interpreted with caution. But the profile of the DDM-implied equity risk premium would seem to show a similar pattern to one such measure of risk appetite (Chart 15).

Conclusion

This article has discussed the factors that might help explain the large equity price movements observed over the past couple of years. It has used an extended dividend discount model to decompose the changes in equity prices into what

Chart 15 Investors' risk appetite and the FTSE All-Share implied equity risk premium^(a)



Sources: Credit Suisse, Thomson Datastream and Bank calculations.

(a) Monthly averages. Diamonds represent points at 3 February 2010.
 (b) Adjusted so that positive (negative) numbers indicate higher (lower) risk appetite.

might be attributable to changes in earnings expectations, government bond yields and shifts in equity risk premia.

On balance, it appears that a combination of factors can help explain the observed large equity price movements. First, changes in earnings expectations might account for a part of the observed equity price movements. Second, the excess return required by market participants to compensate for the risk of holding equities — the implied equity risk premium — picked up sharply during the worst of the financial crisis before falling back to around its average over the past eleven years. Third, policy actions are also likely to have had an impact by both lowering government bond yields and reducing the likelihood of more severe downside economic risks materialising, and thereby compressing the required equity risk premium. There remains substantial uncertainty about the precise role and timing of each factor. But all appear to have contributed to a varying degree to recent moves in equity prices.

Annex

Description of the dividend discount model

The dividend discount model (DDM) is based on the notion that equity prices should reflect the present value of the future expected stream of income, discounted using a risk-free rate (r) and an additional compensation that captures the risk of holding equities — the equity risk premium (erp). The future stream of income should capture the cash flows accruing to shareholders in the form of dividends and other pay-offs such as share buy-backs. But a common simplifying assumption (also used in this article) is to proxy the cash flows with dividends (D). In this framework, the fundamental value of an infinitely lived equity (P) is given by:

$$P_t = E_t \left[\frac{D_{t+1}}{(1+r_{t+1} + erp_{t+1})} + \frac{D_{t+2}}{(1+r_{t+2} + erp_{t+2})^2} + \dots \right]$$

$$= E_t \sum_{i=1}^{\infty} \frac{D_{t+i}}{(1+r_{t+i} + erp_{t+i})^i}$$

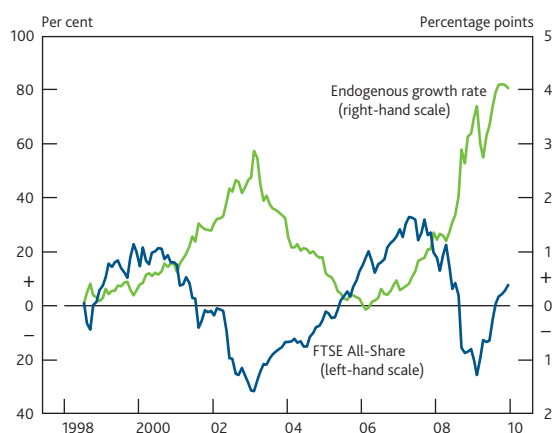
The DDM used in this article, which extends previous Bank work (Panigirtzoglou and Scammell (2002)), approximates the above equation. Dividends are assumed to move in line with expectations of future earnings. Dividend growth varies over the first four years, before reverting back to a long-run growth rate. The term structure of the equity risk premium is assumed to be flat.

This article extends the earlier model in two ways. First, the DDM in this article proxies the risk-free rate using government bond yields up to ten years, rather than assuming a flat term structure of interest rates. This article also uses nominal rates rather than real rates, thereby benefiting from greater data availability at shorter maturities and avoiding the need to transform IBES forecasts into real terms.

Second, the model incorporates more detailed information on earnings prospects. It includes 'year-on-year' IBES 'earnings per share' growth projections for the first three years and the 'over-the-cycle' IBES projection for the fourth year. By contrast Panigirtzoglou and Scammell (2002) used 'over-the-cycle' projections for all four years. 'Year-on-year' projections are based not only on a larger number of forecasts per company (on average 9 versus 1.5 over 2009) but they also cover a larger proportion of companies in the FTSE All-Share than the 'over-the-cycle' projections (70% versus 36% on average over 2009). Indeed market contacts consider the 'year-on-year' projections to be of higher quality than the 'over-the-cycle' forecasts.

This article adopts the simplifying assumption that the expected long-term growth rate of earnings is constant. It is possible to generate a long-term growth rate within the DDM by assuming that, over the long run, (i) companies' return on equity equals the cost of capital, and (ii) companies maintain a stable dividend policy and earn a stable return on investments.⁽¹⁾ But this 'endogenous growth rate' will change in line with the equity risk premium, which can lead to counterintuitive results. For example, the endogenous growth rate points to an unlikely sharp increase in long-term earnings expectations for UK-quoted companies during the worst period of the financial crisis (**Chart A**).

Chart A Changes in the endogenous long-term growth rate and FTSE All-Share since August 1998^(a)



Sources: Thomson Datastream and Bank calculations.

(a) Monthly averages.

(1) See Panigirtzoglou and Scammell (2002) for the derivation of this endogenous growth rate.

References

Bank of England (2009), *Financial Stability Report*, December.

Benford, J, Berry, S, Nikolov, K, Robson, M and Young, C (2009), 'Quantitative easing', *Bank of England Quarterly Bulletin*, Vol. 49, No. 2, pages 90–100.

Brunnermeier, M (2001), *Asset pricing under asymmetric information: bubbles, crashes, technical analysis, and herding*, Oxford University Press.

Clews, R, Panigirtzoglou, N and Proudman, J (2000), 'Recent developments in extracting information from options markets', *Bank of England Quarterly Bulletin*, February, pages 50–60.

Cochrane, J H (2005), *Asset pricing (revised edition)*, Princeton University Press.

Dale, S (2009), '2009: a review of the economic year', remarks at the Chairman's Annual Breakfast, Essex Institute of Directors, Billericay.

Drees, B and Eckwert, B (2005), 'Asset mispricing due to cognitive dissonance', *IMF Working Paper WP/05/9*.

Joyce, M and Meldrum, A (2008), 'Market expectations of future Bank Rate', *Bank of England Quarterly Bulletin*, Vol. 48, No. 3, pages 274–82.

Kiley, M (2000), 'Stock prices and fundamentals in a production economy', *FEDS Working Paper No. 2000-05*.

O'Brien, P (1988), 'Analysts' forecasts as earnings expectations', *Journal of Accounting and Economics*, Vol. 10, No. 1, pages 53–83.

Panigirtzoglou, N and Scammell, R (2002), 'Analysts' earnings forecasts and equity valuations', *Bank of England Quarterly Bulletin*, Spring, pages 59–66.

Vila Wetherilt, A and Weeken, O (2002), 'Equity valuation measures: what can they tell us?', *Bank of England Quarterly Bulletin*, Winter, pages 391–403.

Wadhvani, S B (1999), 'The US stock market and the global economic crisis', *National Institute Economic Review*, Vol. 167, No. 1, pages 86–105.