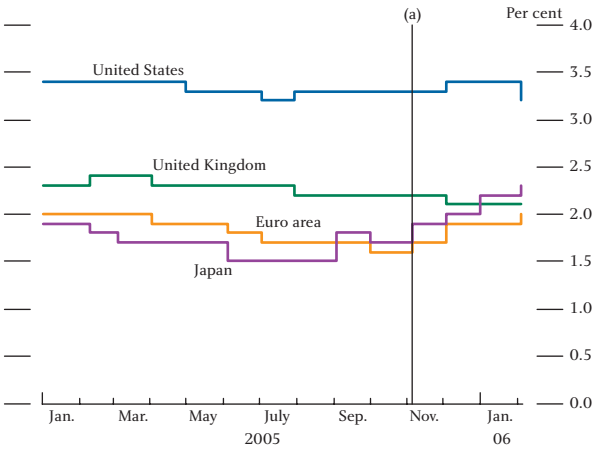
Markets and operations

This article reviews developments since the Winter Quarterly Bulletin *in sterling and global financial markets, in market structure and in the Bank's balance sheet.*(1)

- *Short-term sterling market interest rates fell, while short-term US dollar and yen market rates increased, as market participants revised upwards their expectations for official rates in these currencies.*
- *At longer horizons, real forward interest rates declined across the major currencies. At very long maturities, sterling real forward rates fell by more than rates in other currencies, possibly reflecting heightened demand by UK pension funds to match their expected liabilities with long-dated fixed income assets.*
- *Global equity prices rose and credit spreads narrowed, suggesting that investors' appetite to take risk remained strong.*
- *In January, as a further step towards the planned introduction of reforms to the Bank's operations in the sterling money markets, the Bank began lending using longer-term repos at market-determined interest rates.*

The global economy continued to grow robustly, with upward revisions to forecasters' views on future GDP growth in the euro area and Japan (Chart 1). Against this backdrop, global financial asset prices generally rose (Table A). Credit spreads narrowed, equity indices increased and volatility in many markets remained low.

Chart 1
Expected real GDP growth for 2006



Source: Consensus Economics.

(a) Observations on and to the left of the line were available at the time of previous *Bulletin*.

There was also evidence of market participants looking to invest in a wider range of assets. In particular, there were sizable inflows into commodities and emerging market assets.

Loan markets remained buoyant with companies able to borrow on more favourable terms. Perhaps reflecting this, leveraged buyout activity remained high.

There were some differences in behaviour across investor types over the period. In particular, trustees and corporate sponsors of defined benefit pension funds in the United Kingdom, and to a lesser extent elsewhere, have been looking to match better the characteristics of their assets with their expected liabilities. As a result, these investors may have become more averse to holding risky assets with high and visible short-term price volatility. At the same time, they may have become more willing to accept lower returns on long-dated government bonds, the cash flows on which better match those on their expected liabilities. In turn, this may have contributed to further falls in long-term risk-free interest rates.

(1) The period under review is 18 November 2005 (the data cut-off for the previous *Quarterly Bulletin*) to 17 February 2006.

Table A
Summary of changes in market prices

	18 Nov.	17 Feb.	*Change*
Dec. 2006 three-month interbank interest rates (per cent)			
United Kingdom	4.65	4.47	*-18 bp*
Euro area	3.08	3.06	*-2 bp*
United States	4.81	5.05	*24 bp*
Ten-year nominal forward rates (per cent)(a)			
United Kingdom	4.17	3.94	*-23 bp*
Euro area	4.11	3.91	*-20 bp*
United States	5.03	4.71	*-33 bp*
Equity indices			
FTSE All-Share	2765	2980	*7.8%*
DJ Euro Stoxx	315	351	*11.5%*
S&P 500	1248	1287	*3.1%*
MSCI Emerging Markets (US dollar)	658	779	*18.4%*
Exchange rates			
Sterling effective exchange rate	98.8	98.8	*0.0%*
Euro effective exchange rate	90.5	91.1	*0.7%*
US dollar effective exchange rate	98.7	96.9	*-1.8%*
Yen effective exchange rate	125.2	125.1	*-0.1%*
Global corporate credit spreads (basis points)			
Investment grade	71	67	*-4 bp*
High yield	367	331	*-36 bp*
Emerging market	262	196	*-66 bp*
Commodity prices (US dollars)			
Brent crude oil	53.1	58.2	*9.5%*
Gold (London PM fixing)	486	552	*13.6%*

Columns may not correspond exactly due to rounding.

Sources: Bank of England, Bloomberg and Merrill Lynch.

(a) Three-month forward rates, derived from the Bank's government liability curves. Estimates of the UK curve are published daily on the Bank of England's website at www.bankofengland.co.uk/statistics/yieldcurve/index.htm.

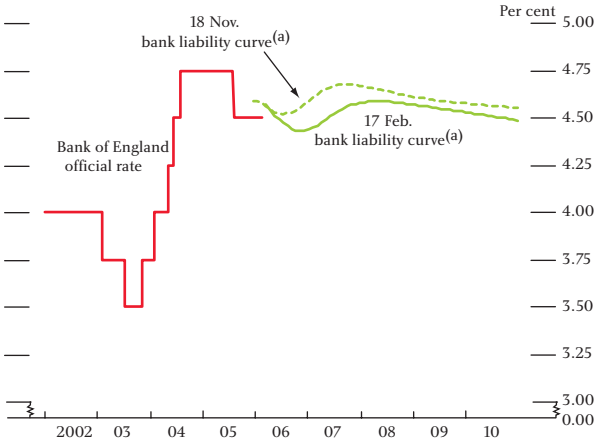
Overall, asset market developments suggested that investors' appetite to take risk had not diminished and that the 'search for yield' remained largely intact.(1) It is possible that, at least in part, the associated falls in term and risk premia on financial assets reflect structural changes, perhaps linked to greater macroeconomic stability. But such developments might also reflect a mispricing of risk. If this is the case, financial markets could remain vulnerable to a correction in asset prices.

Short-term interest rates

As had been widely anticipated, the FOMC increased official US dollar interest rates by 50 basis points, in two 25 basis point moves, continuing the gradual withdrawal of monetary accommodation that began in mid-2004. The ECB also raised its key policy rate by 25 basis points on 1 December, whereas sterling official interest rates remained at 4.5%.

Short-term sterling market interest rates fell over the review period. On 17 February, forward rates implied by market prices were consistent with market participants attaching some probability to a reduction in official rates during 2006 (Chart 2). And according to the Reuters survey of market economists' views (carried out in early February), the majority of economists expected the next move in sterling rates to be down.

Chart 2
Sterling official and forward market interest rates

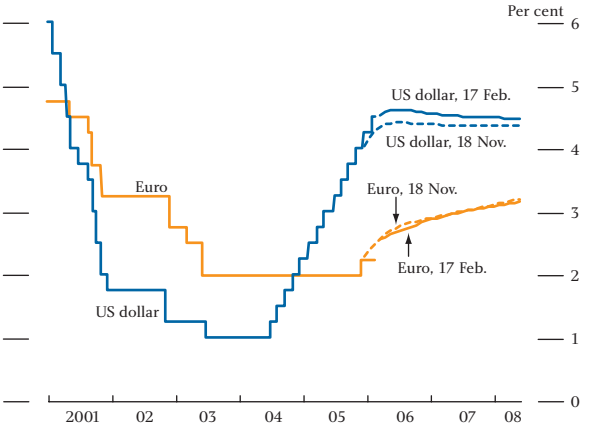


Sources: Bank of England and Bloomberg.

(a) One-day nominal forward rates implied by a curve fitted to a combination of instruments that settle on Libor.

Despite a slight slowdown in economic activity in some euro-area countries at the end of last year, euro short-term market interest rates suggested that the ECB was still expected to raise official rates over the next year or so (Chart 3).

Chart 3
Short-term official interest rates and nominal forward rates(a)



Sources: Bank of England and Bloomberg.

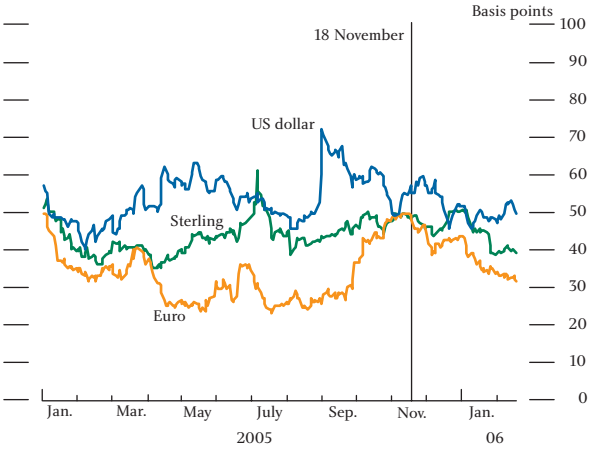
(a) One-day nominal forward rates implied by repo rates and government securities.

US dollar short-term market interest rates increased over the period, as market participants appeared to revise upwards their expectations for near-term policy rates. Most of the revision occurred towards the end of the review period, following slightly stronger-than-expected US economic data.

(1) For further discussion of the 'search for yield' see, for example, the Bank of England's *Financial Stability Review*, December 2005.

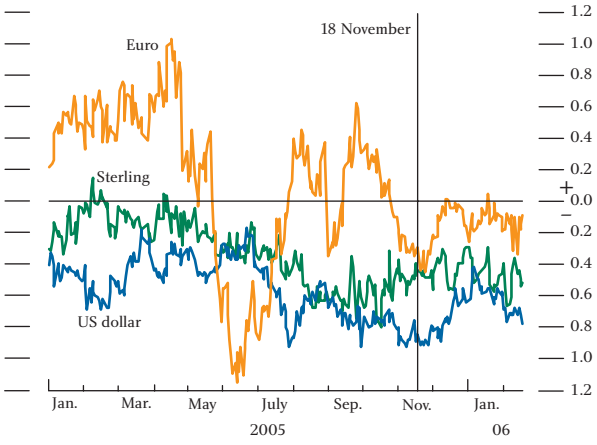
Uncertainty surrounding market participants' expectations for sterling, euro and dollar short-term rates, as measured by implied volatilities on interest rate options, fell slightly over the review period (Chart 4). The implied skew of the distribution of possible interest rate outcomes for near-term sterling, euro and dollar rates remained negative (Chart 5). This suggested that market participants continued to attach a greater probability to a sharp downward move in short-term interest rates than a comparable upward move.

Chart 4
Six-month implied volatility from interest rate options



Sources: Bank of England, Chicago Mercantile Exchange (CME) and Euronext.liffe.

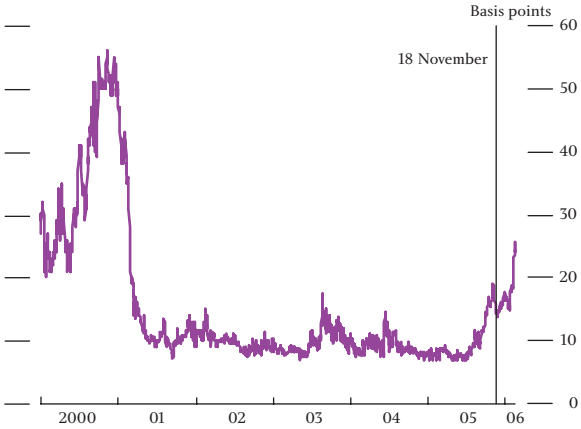
Chart 5
Six-month implied skew from interest rate options



Sources: Bank of England, CME and Euronext.liffe.

Japanese monetary policy did not change over the period. But market speculation grew stronger that the Bank of Japan might be close to ending its 'quantitative easing' policy, which was introduced in March 2001. With signs that the economic recovery in Japan may have become more firmly established and broadly based — real GDP rose in 2005 Q4 for the fourth successive quarter — market expectations of future yen interest rates have increased (Chart 6).

Chart 6
One-year yen swap rate

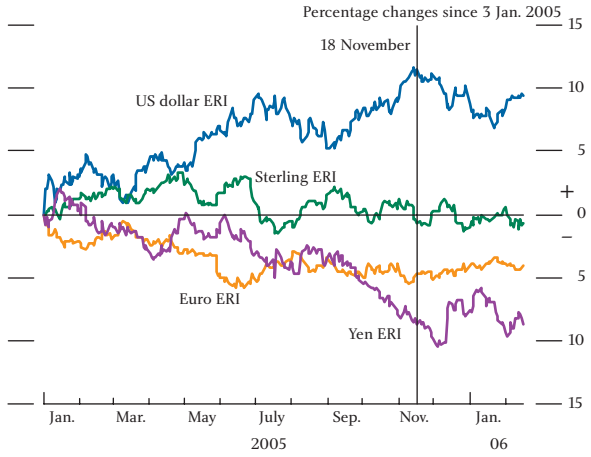


Source: Bloomberg.

Foreign exchange markets

Given these developments in short-term interest rates, changes in the major exchange rate indices were relatively small. The sterling exchange rate index (ERI) was broadly stable over the review period and remained in the relatively narrow range observed throughout 2005 (Chart 7).

Chart 7
Cumulative changes in effective exchange rate indices



The value of the US dollar fell against both sterling and the euro. As a result, over the period as a whole, the dollar ERI fell by around 2%, although it remained around 10% higher than at the start of 2005.

Some of the strength of the US dollar during 2005 may have reflected increases in short-term dollar interest rates relative to interest rates on other currencies.(1) In

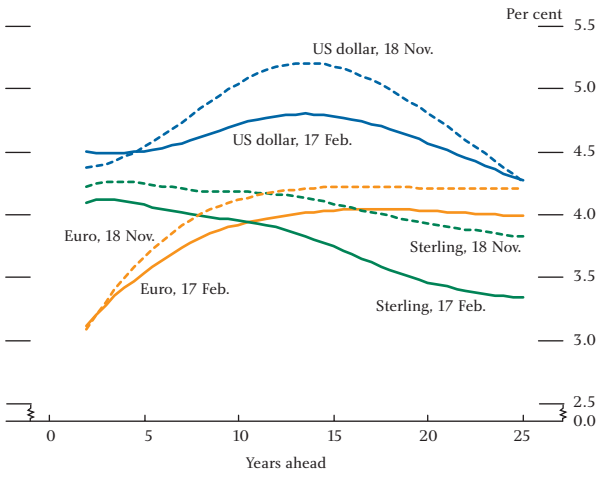
(1) In theory, the uncovered interest parity condition suggests that only *unexpected* movements in dollar interest rates relative to those in other currencies should have influenced the value of the dollar. But, in practice, the rise in short-term US dollar interest rates may have discouraged so-called 'carry trades' funded out of US dollars.

addition, market contacts have suggested that repatriation of funds related to the United States' Homeland Investment Act (HIA) were a factor. But with the deadline for the repatriation of funds under the HIA having drawn closer,(1) and with market participants seemingly perceiving that US dollar official rates may be close to their local peak, some commentators have suggested that these factors may provide less support for the dollar in the future.

Long-term interest rates

At longer horizons, international nominal forward rates fell, particularly in sterling (Chart 8). The sterling nominal forward curve became more inverted over the period and the US dollar and euro forward curves flattened.

Chart 8
International nominal forward rates(a)

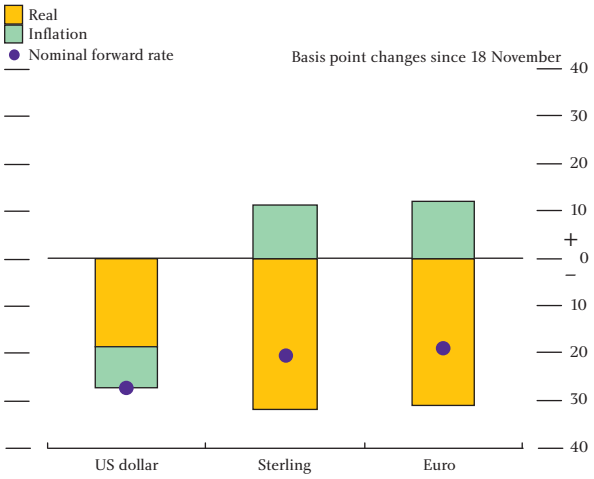


(a) Instantaneous forward rates derived from the Bank's government liability curves.

The falls in nominal forward rates largely reflected declines in real rates (Chart 9), continuing the drift down in global real forward rates that began at the end of 2003 (Chart 10).

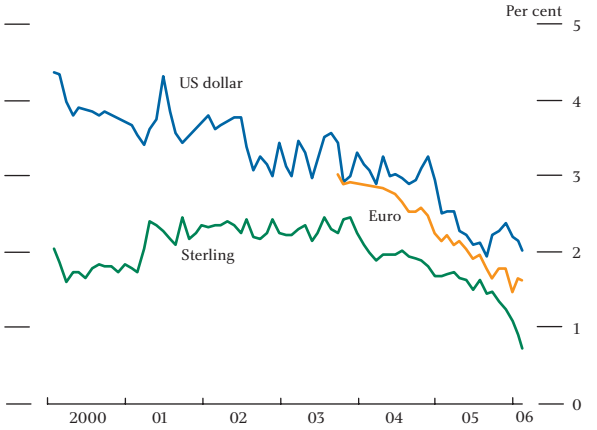
As mentioned in previous *Bulletins*, possible explanations for the decline in global long-term real interest rates include: a glut of global savings and/or a dearth of global investment opportunities;(2) a build-up in global money balances;(3) and lower-term premia.(4)

Chart 9
Changes in nine-year forward rates(a)



(a) Real component of euro rates implied by nominal government bond yields less inflation swap rates. Sterling and dollar real rates derived from the Bank's government liability curves.

Chart 10
International nine-year real forward rates(a)



(a) Real component of euro rates implied by nominal government bond yields less inflation swap rates. Sterling and dollar real rates derived from the Bank's government liability curves.

Another factor, frequently cited by market contacts, is that increased demand from defined benefit pension funds may have pushed up prices of long-dated government bonds, thereby reducing their yields.(5) Rising pension deficits across countries may have prompted funds to increase their holdings of long-dated government debt and accept lower expected returns in order to match more closely the characteristics of their assets and liabilities. The box on pages 8–9 outlines in more detail the factors affecting defined benefit pension fund asset allocation decisions.

(1) Under the HIA, firms could repatriate funds and benefit from tax relief during their first taxable year beginning on or after 22 October 2004, or in the last taxable year that began before that date.
(2) The low level of long-term global interest rates was discussed in a recent speech by the Governor reprinted on pages 80–82 in this *Bulletin*. It has also been discussed in the boxes 'The fall in global long-term real interest rates' in the Spring 2005 *Quarterly Bulletin* and 'The economics of low long-term bond yields' in the May 2005 *Inflation Report*.
(3) See the box entitled 'Excess global liquidity, asset prices and inflation' in the February 2006 *Inflation Report*.
(4) See the box entitled 'Real interest rates and macroeconomic volatility' in the Autumn 2005 *Quarterly Bulletin*.
(5) See 'Markets and operations' (2005), *Bank of England Quarterly Bulletin*, Winter, pages 412–13.

Increased holdings of long-dated government bonds would tend, on average, to reduce a pension fund's expected asset returns. At the same time, pension funds may have become less willing to hold higher-yielding assets (such as equities) with relatively high and easily observed price volatility. In an attempt to maintain returns, these investors are reported to have increasingly looked to so-called 'alpha' generating investment strategies, which aim to provide predictable returns without relying on exposure to the market portfolio, and may involve investing in 'alternative' assets such as hedge funds and private equity.(1)

Some market contacts have suggested that regulatory developments in 2005 may also have influenced UK pension fund behaviour and, in turn, contributed to the recent falls in long-dated UK government bond yields. The box on page 10 outlines recent developments in UK pension fund regulation.

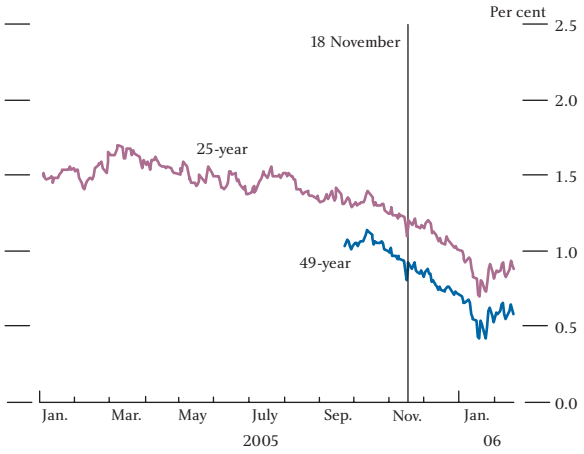
Despite these developments, contacts differ in their opinion about the actual scale of pension-related sterling bond purchases and swap transactions during the current review period. However, given a limited supply of long-dated gilts, large flows may not be required to generate significant movement in yields.

An example of large moves in long-dated index-linked gilt yields being amplified by liquidity and/or supply constraints occurred in mid-January. A fall in long yields, perhaps initially triggered by pension fund activity, was rumoured to have prompted other investors to cover short positions (ie buy long-dated government bonds), increasing downward pressure on yields. As a consequence, the implied 49-year sterling real spot rate fell to around 0.4%,(2) and a few market contacts reported mildly disorderly market conditions. This episode was short-lived, however, and long rates subsequently rose (Chart 11).

To the extent that yields on government bonds influence the discount rates that pension funds use to assess their future liabilities, the recent falls in real interest rates could have further widened deficits between the value of their assets and liabilities. In turn, this may have reinforced the demand for long-dated assets.

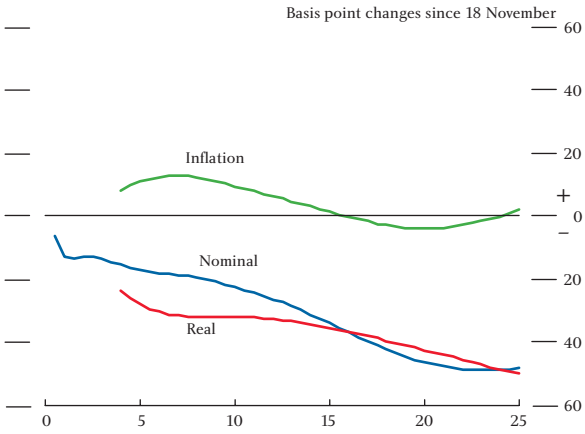
At long horizons, both real and nominal sterling forward rates fell over the review period such that the impact on implied inflation was fairly small (Chart 12). This suggests inflation expectations remained stable. It may also be consistent with pension funds being primarily concerned with matching the duration of their assets and liabilities, rather than hedging their inflation exposure, or with dealers and other market participants being prepared to take on the long-dated inflation risk.

Chart 11
Sterling real spot rates(a)



(a) Spot rates derived from the Bank's government liability curve.

Chart 12
Changes in sterling forward rates(a)



(a) Instantaneous forward rates derived from the Bank's government liability curve.

Equity markets

Consistent with the fall in long-term real interest rates, which, other things equal, would tend to lead to higher asset prices via lower discount rates, equity prices increased over the review period (Chart 13).

(1) For more details on 'alpha', see the box entitled 'Search for alpha' on pages 272–73 of the Autumn 2004 *Quarterly Bulletin*.
(2) Note that index-linked gilts are indexed to the retail prices index. Alternative measures of inflation would lead to different levels for the implied real interest rate.

Pension fund valuation and liability driven investment strategies

This box outlines the factors affecting the valuation of defined-benefit (DB) pension fund assets and liabilities and the investment strategies that may be used to hedge some of the risks faced by schemes.

Pension fund asset and liability valuation

The assets of a DB pension fund depend on the contribution rate of the sponsoring company and the expected rate of return on the invested assets. The surplus/deficit on any fund is the difference between the present value of a fund's assets and the present value of its liabilities.(1)

An important risk faced by a DB pension fund (and therefore the sponsoring company) is that its assets will be insufficient to meet its liabilities. This *shortfall risk* depends on the uncertainty surrounding the future value of the fund's assets, and also changes in the factors used to value its liabilities. On the liability side, a fund faces the following risks:

- *Interest rate risk*. The present value of a pension fund's future liabilities depends on the discount rate used: the lower the discount rate, the higher the liabilities. Because pension fund liabilities last many years into the future, they have a long duration, and so liability valuations can be highly sensitive to changes in the interest rate used for discounting.

- *Longevity risk*. A rise in the life expectancy of the members of a scheme will increase the amount a fund will expect to pay out in pensions. In turn, this raises the value of the scheme's liabilities.

- *Inflation risk*. In the United Kingdom, on retirement a member's pension is typically linked to a measure of retail price inflation.(2) A rise in the expected rate of inflation increases the liabilities of the fund.

- *Wage risk*. As a DB pension is typically a function of the member's final salary, higher assumed wage inflation is associated with higher liabilities. To some extent wage growth is correlated with the inflation rate, although average earnings should normally grow a little faster, broadly linked to growth in labour productivity.

In deciding its asset portfolio, a pension fund faces a trade-off. By investing in assets that offer, on average, high expected returns, a pension fund may reduce the expected contribution rate of the sponsoring company. However, assets that offer high expected returns are typically riskier, ie the returns are more uncertain. This greater uncertainty increases the probability that losses on the assets could lead to a deficit on the pension fund, which would ultimately require higher contributions to make up the shortfall. In contrast, investing in assets that match the characteristics of the liabilities will reduce the shortfall risk, but the expected contribution rate of the sponsoring company is likely to be higher.

Recently, increasing numbers of pension fund managers have been given mandates to, at least partially, match expected liabilities and consequently reduce the shortfall risk of the fund. These have been termed 'liability driven investment' (LDI) strategies.

LDI strategies

In its purest form, an LDI strategy would seek to invest in assets that exactly match the characteristics of the pension fund's liabilities. Currently, however, no financial market instrument linked directly to wage inflation exists, and the market for longevity bonds is relatively limited.(3) Pension funds can, however, invest in assets that reduce their exposure to interest rate and consumer price inflation risk.

Full matching of interest rate and inflation risk would leave the value of the fund neutral to changes in discount rates or inflation. However, as many funds currently have deficits, full matching would be costly as it would 'lock in' the need for higher contributions. Instead, many schemes seem to have sought to hedge part of their interest rate and inflation risk, while

(1) In contrast, a defined-contribution (DC) pension fund makes no commitment to the size of the individual's pension on retirement. This is determined by the return generated by the pension fund over the pensioner's working life. The liabilities of such a fund are therefore equal to the assets of the fund.
(2) This is typically based on Limited Price Indexation which involves using an RPI-based index but with an upper bound on inflation.
(3) See the Governor's speech, 'What fates impose: facing up to uncertainty', the Eighth British Academy Annual Lecture, 2004.

leaving part of their portfolio in riskier assets with higher expected long-term returns.

Reducing interest rate risk

Interest rate risk can be reduced by investing in assets with a market value that moves closely with the interest rates used to discount the pension fund's liabilities. Long-maturity government and corporate bonds have a high duration and therefore provide a relatively good match to the duration of a pension fund's liabilities. Many funds have reportedly been increasing their bond allocation in recent years.

However, bonds are not the only instruments that schemes can use to manage interest rate risk. Contacts have also reported increasing use of long-maturity interest rate swaps. These offer pension funds a number of advantages over investment in bonds. First, being derivative instruments, they enable cash flows to be tailored more closely to liabilities than allowed by bonds. Second, as there is no exchange of principal, using swaps means that more of the fund can be invested in risky assets to earn higher returns. However, not all pension funds have mandates or the capability to invest in derivative products.

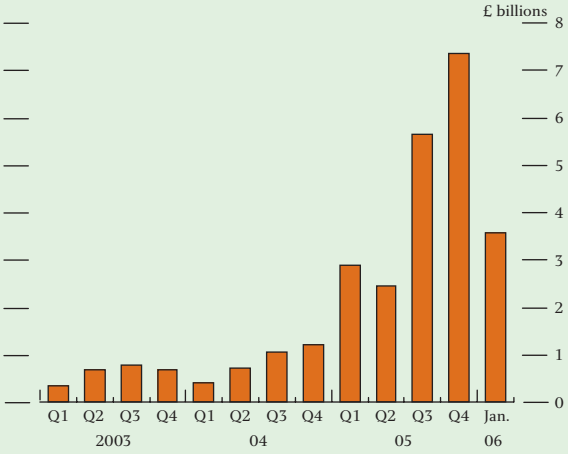
Reducing inflation risk

Part of an LDI strategy often involves some investment in index-linked products to reduce inflation risk, although the reduction of interest rate risk has reportedly been of greater concern to some pension funds.

For a fund that wishes to reduce inflation risk, there are a number of investment options available. First, the pension fund can shift part of its portfolio directly into inflation-linked gilts. This provides RPI-linked cash flows that are free from default risk.

Institutions can also use the inflation derivative market, including inflation swaps, to hedge inflation risk. Turnover in sterling inflation swaps increased considerably towards the end of 2005 and remained high in January (Chart A). Inflation swaps offer a fund increased flexibility to tailor inflation-linked cash flows as required, although as with interest rate swaps, some funds will face constraints on their ability to use the inflation swaps market.

Chart A
Notional value of UK RPI inflation swaps traded



Source: ICAP estimates.

At longer horizons, however, there are only a limited number of 'natural' payers of inflation. In the sterling market, a relative demand/supply imbalance is reflected in implied breakeven inflation forward rates derived from inflation swaps being currently higher than breakeven inflation rates implied by government bonds (Chart B). This makes hedging inflation exposure using the inflation swap market more expensive than investing directly in index-linked government bonds.

Chart B
UK RPI inflation forward curves on 17 February

Sources: Bank of England and Bloomberg.

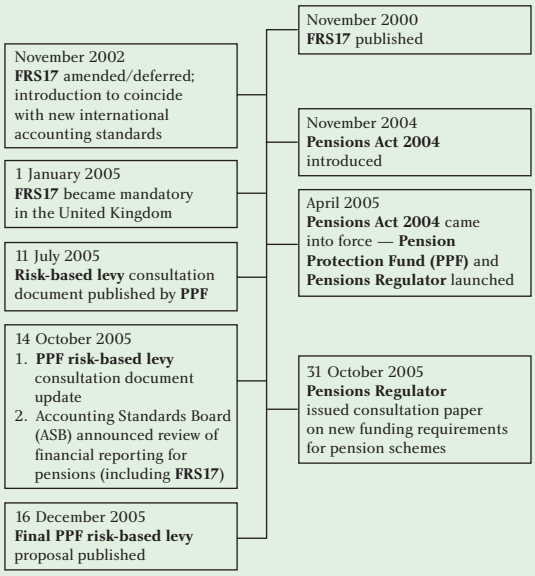
Hedge funds and dealers are said to be involved in trades designed to exploit the difference between the two inflation curves.(4)

(4) See Hurd, M and Relleen, J (2006), 'New information from inflation swaps and index-linked bonds' on pages 24–34 of this *Bulletin*.

Recent developments in UK pension fund regulation

Market contacts have suggested that regulatory changes may have increasingly influenced UK pension funds' asset allocation decisions over the past year or so. Diagram 1 highlights some of the recent developments in UK pension fund regulation.

Diagram 1
Timeline of recent key regulatory and accounting developments affecting UK pension funds



The FRS17 'Retirement benefits' standard was first issued in November 2000 by the UK Accounting Standards Board (ASB). The key components were: the measuring of pension scheme assets at market value; the discounting of liabilities using the rate of return on a high quality corporate bond of equivalent term; and the full recognition of pension scheme surpluses/deficits on the balance sheet and acknowledgement of movements in this surplus/deficit in other financial statements. This standard was effective from the start of 2005.

The Pensions Act 2004 came into effect in April 2005. As part of the Act, new funding regulations[1] came into force from the end of December 2005, and pension fund trustees were given up to 18 months to complete their valuation of funds on this new basis. Other key components of the Act were the introduction of a new Pensions Regulator and the Pension Protection Fund (PPF). The new Pensions Regulator requires fund trustees and company sponsors to address issues of underfunding — the Regulator has indicated that most schemes should aim to eliminate deficits within ten years. In addition, the regulator has powers to make the reduction of a pension deficit a condition of any takeover or leveraged buyout. This may provide an incentive for firms involved in such deals to take steps to address deficits. Market contacts have cited this as a significant factor behind some recent pension fund investment flows.

The PPF is a statutory fund set up to protect members of defined-benefit pension schemes by paying compensation if their employer becomes insolvent and the pension scheme is underfunded. To assess the level of funding for a pension scheme, the discount rates used by the PPF to value a scheme's liabilities are linked to yields on FTSE Actuaries gilt indices. For many schemes these are rates derived from long-maturity index-linked gilts.

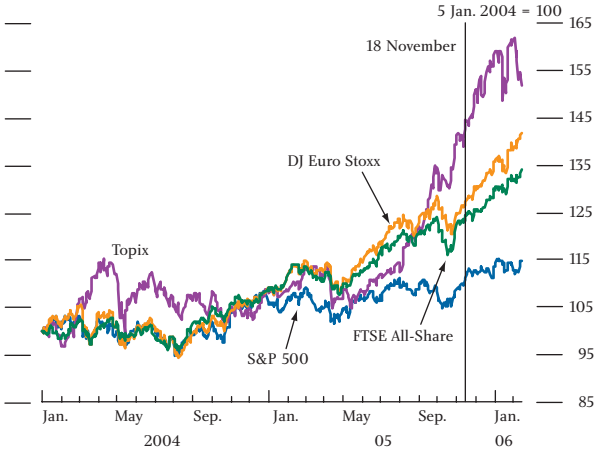
The PPF will be financed by charging compulsory levies on the pension schemes, with 80% of a fund's levy to be related to the risk of it not being able to meet its liabilities. As a result, firms with low funding levels will be required to make larger contributions to the PPF than those with smaller deficits, providing a financial incentive for firms to address shortfalls. However, market participants have suggested that, so far, this has had a relatively limited impact on pension funds' investment decisions.

The combined effect of these regulations has been:

- The introduction of more market-based (rather than actuarial-based) valuation methods for assessing pension funds' liabilities.
- The recognition of pension fund valuations explicitly on the balance sheet and other accounting statements of the sponsoring company.
- The introduction of regulatory valuation methods for assessing pension scheme funding levels that go beyond those specified for accounting purposes.

(1) These replaced previous funding requirements under the Minimum Funding Requirement (MFR).

Chart 13
International equity indices, domestic currency

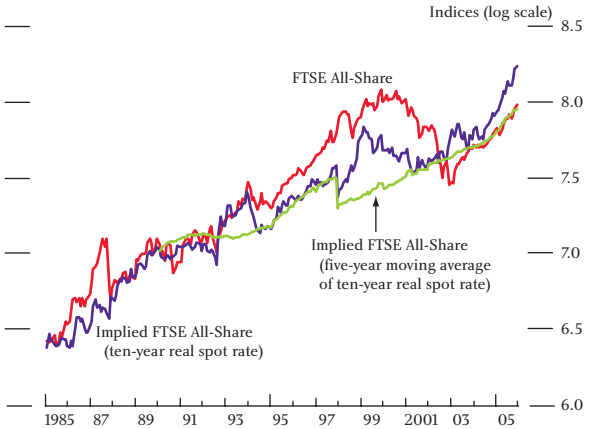


Sources: Bloomberg, Thomson Financial Datastream and Bank calculations.

In principle, the potential impact of the recent falls in long-term risk-free interest rates on equity prices can be gauged using a simple dividend discount model (DDM). Assuming real dividends grow at a fixed rate from their current levels and a constant equity risk premium, implied equity prices can be calculated by discounting the future dividend payments using long-term real interest rates from index-linked government bonds.

Chart 14 shows the observed level of the FTSE All-Share and its level implied by a simple DDM.(1) It suggests that the rise in the FTSE All-Share over recent months could be accounted for by changes in dividends and real sterling interest rates. Indeed, over the past year or so, the model would have predicted a more pronounced rise in UK equity prices. This might suggest that there have been changes in investors' expectations for dividend growth and/or required risk premia. Alternatively, it may be that equity investors assume a higher risk-free discount rate than that currently implied by the yields on index-linked UK government bonds. As an illustration, if a five-year moving average of the long-term real interest rate is used as the discount factor in the model, the implied and observed rises in UK equity prices have tracked each other more closely over the past year or so.

Chart 14
FTSE All-Share index and level implied by simple dividend discount model(a)



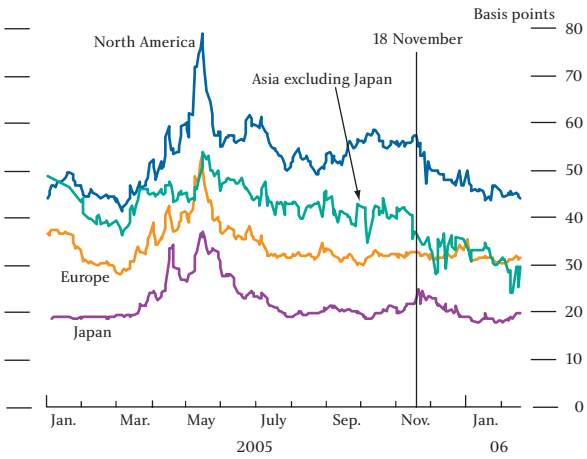
Sources: Bloomberg and Bank calculations.

(a) The implied levels are calculated using a Gordon growth model, assuming constant and arbitrary values for the equity risk premium and real dividend growth rate. The jump down in implied levels in January 1998 reflects a break in the dividend series to incorporate changes to advance corporation tax.

Corporate credit markets

Some contacts have suggested that equity prices have been boosted by firms taking advantage of low interest rates and issuing debt in order to finance acquisitions and to return cash to shareholders, either through share repurchases or higher dividends. To the extent that this has increased leverage, such activity might have been expected to widen credit spreads. But over the review period, spreads on credit default swap (CDS) indices have narrowed slightly (Chart 15) and corporate bond spreads generally remained narrow by historical standards.

Chart 15
International credit default swap index spreads



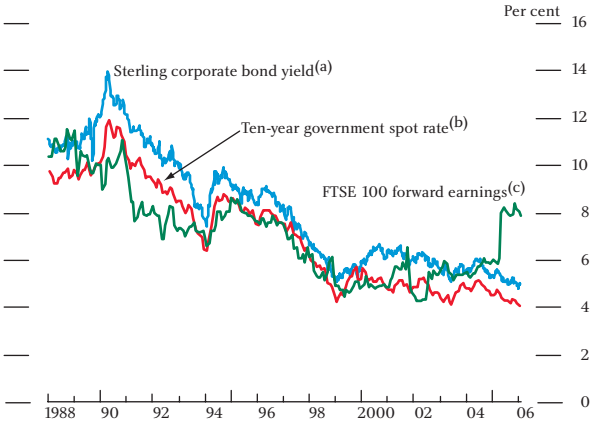
Source: Bloomberg.

Some crude measures suggest the cost of debt finance has been fairly low relative to the cost of equity finance. For example, over the past year or so, expected earnings relative to equity prices (the so-called 'forward earnings

(1) This analysis uses a simple 'Gordon growth model' (see Gordon (1962), *The investment, financing and valuation of the corporation*) assuming an (arbitrary) equity risk premium of 4% and a long-term real dividend growth rate of 3%. For more details on dividend discount models, see Vila Wetherilt, A and Weeken, O (2002), 'Equity valuation measures: what can they tell us?', *Bank of England Quarterly Bulletin*, Winter, pages 391–403.

yield')[1] for the FTSE 100 has risen sharply and has been high relative to yields on sterling-denominated corporate debt (Chart 16). This could help to explain the recent high level of private equity and leveraged buyout (LBO) activity.

Chart 16
FTSE 100 forward earnings yield and sterling bond yields

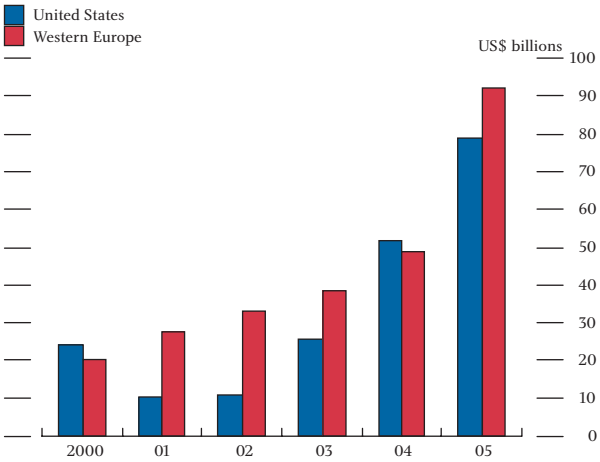


Sources: GlobalFinancialData.com, IBES, Merrill Lynch and Bank calculations.

(a) Corporate bond yields before 2001 from GlobalFinancialData.com, after 2001 from Merrill Lynch.
(b) Ten-year spot rate from the Bank's government liability curve.
(c) Changes in accounting standards have changed the way companies report earnings per share, which could affect the series.

In the United States, LBO lending reached $79 billion, (Chart 17), which is the highest level since the late 1980s. In Western Europe, LBO lending was a record $92 billion in 2005 and total syndicated lending remained strong.

Chart 17
Leveraged buyout volume(a)



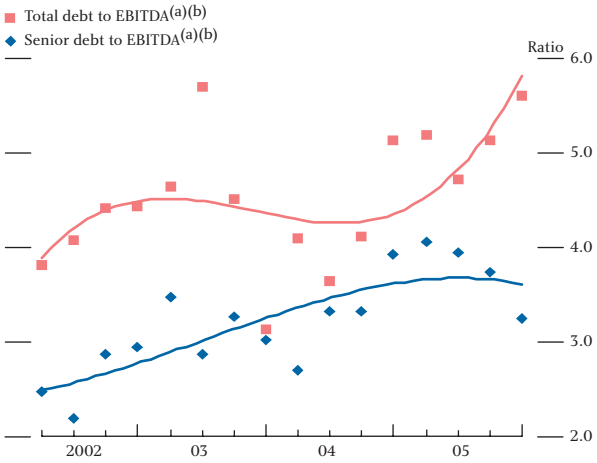
Source: Loan Pricing Corporation.

(a) Excludes recapitalisations.

There were also indications that loan pricing may have become more favourable for borrowers recently. The Federal Reserve's Senior Loan Officer survey and the ECB's Bank Lending survey, both conducted in January, showed a slight loosening in credit standards.

Leverage in the European LBO market also appears to have increased over recent months, with the average total debt to EBITDA[2] ratio rising from 5.1 in 2004 to 5.6 at the end of 2005 (Chart 18). Deal structures have reportedly been re-engineered so that the additional leverage has typically been in the form of second-tier and mezzanine loans ranking above the bondholders but below the senior debt. In part, this development appears to reflect demand for higher yielding loans from institutional investors, including via collateralised loan obligations (CLOs). Hedge funds have also become more involved in the LBO market, at all levels of the debt capital structure.[3]

Chart 18
Leverage in Western European leveraged buyouts



Source: Loan Pricing Corporation.

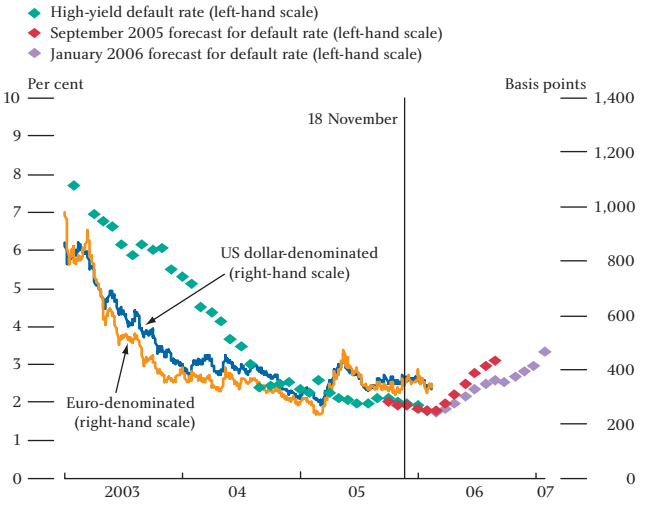
(a) EBITDA refers to earnings before interest, taxes, depreciation and amortisation have been deducted.
(b) Individual data points refer to debt to EBITDA ratios averaged across LBO deals in each quarter (weighted by deal size). Solid lines represent fitted lines through the data points based on a polynominal regression of order three.

In high-yield bond markets, credit spreads narrowed further over the period (Chart 19). And despite a few isolated cases of default (discussed on page 18), default rates remained low. Going forward, market commentators expect forecast default rates to pick up, albeit only modestly. But compared with rating agency forecasts made in September 2005, default rates are expected to rise more gradually.

The projected pickup in default rates appears to reflect idiosyncratic factors rather than a more broad-based

(1) The forward earnings yield is often used by market participants as a crude measure of equity valuation. It is the expected level of earnings in twelve months' time (from survey data) divided by the current price level.
(2) Earnings before interest, taxes, depreciation and amortisation have been deducted.
(3) For more information see the box entitled 'Hedge funds and leveraged loans' on pages 33–34 of the December 2005 *Financial Stability Review*.

Chart 19
High-yield option-adjusted corporate bond spreads and global default rates

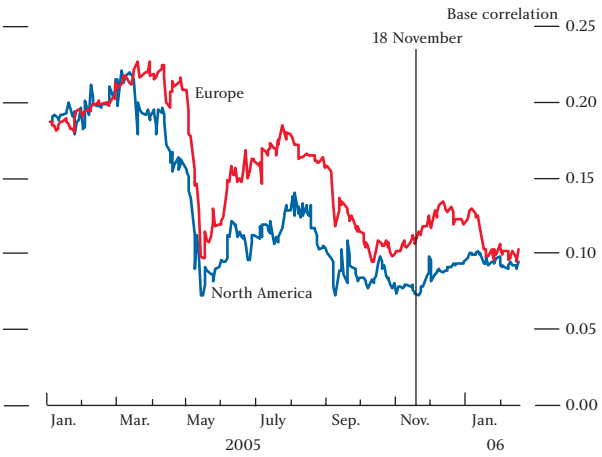


Sources: Merrill Lynch and Moody's Investor Service.

deterioration in credit quality. Market contacts suggest that idiosyncratic risk is currently one of the most important factors affecting credit traders and portfolio managers, as credit spreads react quickly to firm-specific news such as rumours of LBOs.

Consistent with this, implied default correlation, as inferred from the first-loss tranches on European CDS indices, declined over the period (Chart 20). In the United States, implied correlation picked up a little but from a low base. Taken together, this suggests the perceived likelihood of systematic defaults and/or the general level of credit risk premia remained low.(1)

Chart 20
Default correlation implied by equity tranches of credit default swap indices(a)



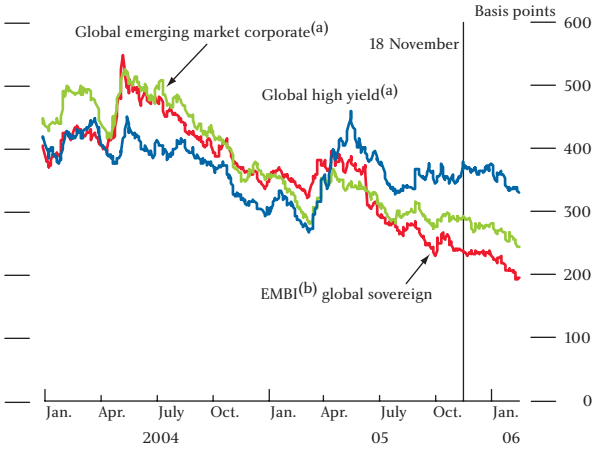
Source: JPMorgan Chase and Co.

(a) Five-year on-the-run Dow Jones North American Investment Grade (CDX.NA.IG) index and five-year on-the-run iTraxx Europe investment grade index.

Emerging markets

Spreads on emerging market economy (EME) corporate and sovereign bonds narrowed further, and by more than corporate spreads on industrial country bonds (Chart 21). Indeed, at the beginning of 2006, sovereign and corporate EME credit spreads touched all-time lows. The narrowing of spreads has been broadly based across EMEs but was most pronounced for bonds with the highest yields.

Chart 21
Emerging market and high-yield bond spreads



Sources: JPMorgan Chase and Co. and Merrill Lynch.

(a) Option-adjusted spreads.
(b) Emerging Markets Bond Index.

The box on pages 14–15 examines some possible explanations behind the continued falls in emerging market economy (EME) bond spreads. Specifically, using simple regression analysis, it evaluates how far the recent sustained narrowing in EME spreads reflects changes in perceptions of default risk and external financing conditions. It concludes that some of the change in spreads might be associated with improvements in EMEs' underlying credit quality, reflecting stronger macroeconomic performance. But improved fundamentals appear to account for only a part of the decline in emerging market spreads.

Accompanying the narrowing in EME credit spreads, emerging market equity indices rose sharply in 2005 and by more than developed economy equity indices (Chart 22).

Both corporates and governments in emerging markets have taken advantage of narrower credit spreads and buoyant equity markets by increasing issuance. Gross

(1) For details on CDS index tranches and interpreting measures of implied correlation, see Belsham, T, Vause, N and Wells, S (2005), 'Credit correlation: interpretation and risks', *Bank of England Financial Stability Review*, December, pages 103–15.

A simple model for emerging market bond spreads

Net bond issuance by emerging market economies (EMEs) increased sharply during 2005. At the same time, credit spreads on EME sovereign bonds tightened, and have continued to do so in early 2006 to reach record lows.

This box uses a simple regression model to analyse how much of the recent compression in EME credit spreads is due to an improvement in EMEs' economic performance rather than benign external market conditions.

An empirical framework for analysing EME spreads

The framework used is a parsimonious regression model that relates the aggregate emerging market bond spread(1) to three explanatory variables:

- (Country-weighted) sovereign credit ratings (*RAT*). This captures changes in EMEs' economic fundamentals — the higher the rating, the lower the expected spread.
- Short-term US dollar nominal interest rates (*TBY*). This is included as a measure of global liquidity.(2) Greater liquidity would be expected to reduce the cost of financing investments in emerging market debt and, in turn, lead to narrower spreads.
- A forward-looking measure of equity price volatility (*VIX*) to proxy for investors' risk appetite:(3) greater uncertainty would tend to widen spreads as investors require higher compensation for bearing the additional uncertainty.

More formally, the regression model on the (log of the) EME spread (*LSP*) can be written as:

$$LSP_t = \alpha + \underset{(-)}{\beta_1} RAT_t + \underset{(+)}{\beta_2} TBY_t + \underset{(+)}{\beta_3} VIX_t + \xi_t$$

where the terms in brackets represent the expected signs of the coefficients and ξ captures random disturbances that cannot be accounted for by the model.

The regression equation can be thought of as representing the long-run or 'equilibrium' relationship between the variables. In reality, it may take time for EME spreads to respond to changes in underlying credit quality or external financing conditions. But over the medium to long term, if the model adequately captures the long-run relationships, it suggests spreads should tend to move together with credit ratings, global liquidity conditions and investors' risk appetite.

Of course, this does not mean that the right-hand side variables necessarily 'cause' changes in EME bond spreads. Without a structural model of the underlying demand for and supply of emerging market bonds it is not possible to identify the exact mechanism by which spreads on emerging market bonds over the risk-free rate are determined.

Estimation results

Table 1 summarises the results of regressions using different sample periods. The signs of the coefficients are in line with expectations and all are statistically significant. In terms of economic significance, based on the estimation results for the full sample period (January 1998–January 2006), a one-notch improvement in the average credit rating would imply an 18% tightening of the EME spread; a 100 basis points increase in US dollar short-term interest rates is associated with 1.4% widening; and a one unit decrease in the implied volatility index suggests a 1.7% compression in spreads.

Table 1
Estimated model coefficients

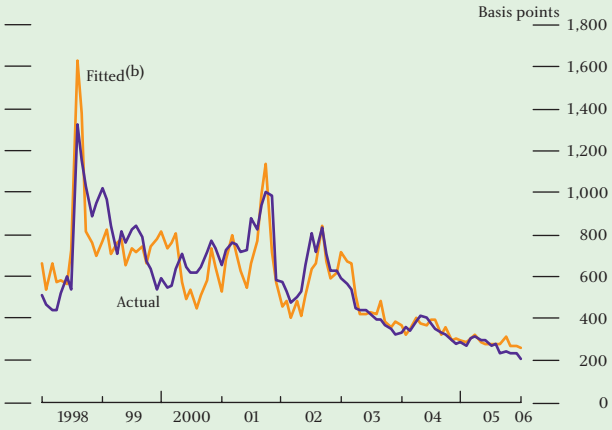
	Dependent variable: *LSP* Estimation period		
	(1) Jan. 1998–Feb. 2003	(2) Jan. 1998–Feb. 2004	(3) Jan. 1998–Jan. 2006
RAT	-0.11	-0.12	-0.18
	(-3.44)	(-3.80)	(-6.91)
TBY	1.68	2.00	1.40
	(3.30)	(4.25)	(2.83)
VIX	0.01	0.02	0.02
	(12.80)	(15.06)	(14.75)
α	3.48	3.54	4.11
	(10.46)	(10.69)	(14.67)
R^2	0.60	0.74	0.84

Note: Figures in brackets show t-statistics for the estimated coefficients.

(1) The index used in the estimations is JPMorgan's Emerging Markets Bond Index Global excluding defaulted bonds.
(2) There are a number of ways to measure global liquidity conditions although none are ideal. Alternative regressions including US *long-term* interest rates produced qualitatively similar results.
(3) VIX is the implied volatility from option prices of the S&P 500 stock index and is an imperfect measure of investors' risk appetite. A number of alternative measures for risk appetite were also considered. Although most of these were statistically significant, the regression including the VIX measure had the highest explanatory power.

The full sample estimation indicates that the three explanatory variables can account for 84% of the variation in spreads and suggests that the EME spread is currently around 50 basis points below the long-run level suggested by the model (Chart A).

Chart A
EME sovereign bond spreads[a] — actual versus fitted



Sources: JPMorgan Chase and Co., IMF, Bloomberg and Bank calculations.

(a) Refers to the composite JPMorgan EMBI (Emerging Markets Bond Index) Global excluding defaulted bonds.
(b) The fitted values are based on a regression of log values of EME sovereign bond spreads on ratings, US dollar three-month market interest rates and the VIX index over the January 1998 to January 2006 period.

Decomposing the movements in the spread over the past two years that can be explained by the model suggests that improvements in credit quality have been the most important influence. Specifically, as shown in Table 2, the model suggests that the improvement in country credit ratings has contributed around two thirds of the total explained compression in spreads since January 2004.(4)

Table 2
Accounting for the change in EME spreads
January 2004– January 2006

Percentage contribution of:	
Credit rating (*RAT*)	65
US interest rates (*TBY*)	-25
Risk appetite (*VIX*)	30
Unexplained (ξ)	30

However, there is some evidence that the sensitivity of spreads to changes in the explanatory variables may have altered over the recent past (Table 1). In particular, spreads appear to have become more sensitive to changes in credit ratings and less sensitive to changes in US interest rates over the full sample than in the earlier period. On the face of it, this indicates that the estimated impact of credit ratings on percentage changes in spreads may have increased over time, while the effect of US short-term interest rates has fallen.

However, these changes in model parameters over time could be symptomatic of model misspecification. Specifically, the equation may be missing one or more variables which have asserted a stronger influence on spreads in recent years than in the past. For example, there is anecdotal evidence that pension funds and insurance companies from the major economies have progressively allocated more funds to EME assets, attracted by the recent higher returns and perceived diversification benefits. Pension funds' allocations are likely to be particularly sensitive to improved credit ratings, since they are more likely to be given a mandate to invest in EME assets once EME sovereign bonds attain investment grade status. Alternatively, since the model uses proxy variables to capture particular influences on EME spreads, measurement error problems could be important. In turn, this may have led to some biases in the estimated model coefficients. For example, an increase in the sensitivity to credit ratings might be associated with investor exuberance, which may not be fully captured by the proxy for risk appetite.

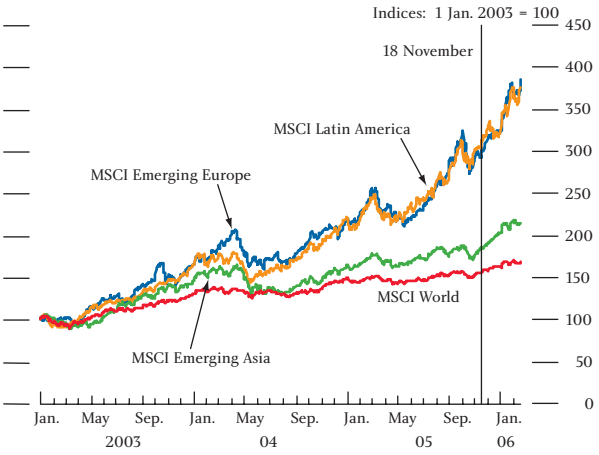
Summary

Given the parsimonious nature of the model for EME spreads and importantly the potential for misspecification, it is important not to draw too definitive conclusions about the size of any departure from long-run equilibrium. But to the extent that spreads are currently below levels implied by the model, then going forward one might expect spreads to widen.

Nonetheless, the estimated model is silent over both the mechanism and the speed with which any adjustment might occur. It may be that one of the external drivers will change, thereby pushing spreads wider. For example, there is much debate about the causes and sustainability of the current level of risk appetite. Alternatively, an exogenous shock to one or more emerging bond markets may push EME spreads back towards (or beyond) their long-run sustainable levels.

(4) See also the article 'Capital flows to emerging markets' in the December 2005 *Financial Stability Review*.

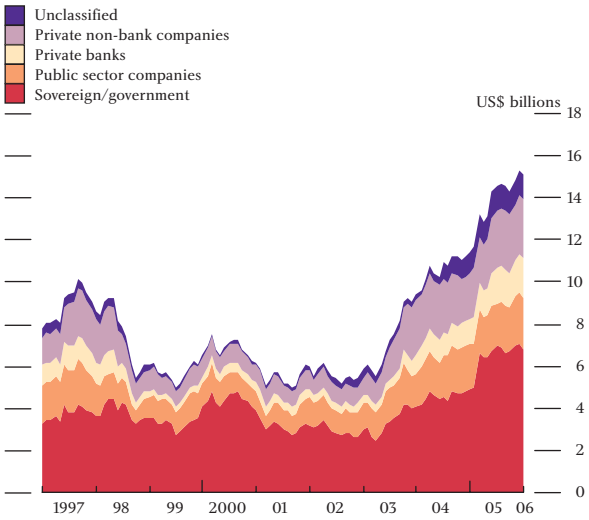
Chart 22
Global and emerging market equity indices



Sources: Bank of England and Bloomberg.

external debt issuance in January was higher than in the period prior to the late-1990s Asian crisis (Chart 23). And equity issuance was strong, reaching $53 billion in 2005 compared with $33 billion in 2004.

Chart 23
Emerging market gross monthly external debt issuance by sector(a)



Source: Dealogic.

(a) Twelve-month moving average.

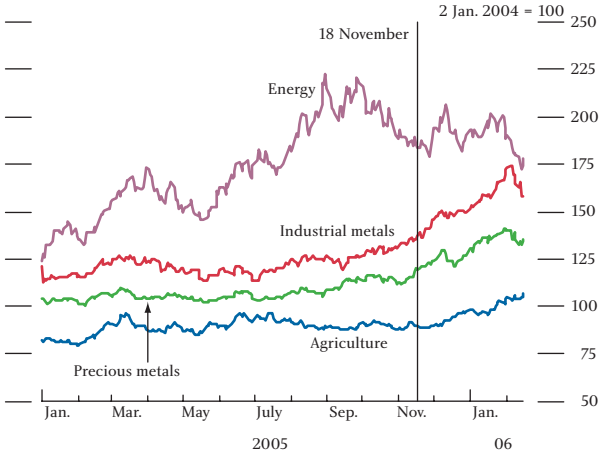
Pension funds and insurance companies in the major economies have reportedly allocated an increasing proportion of their assets to emerging markets over the past year, attracted by the recent higher returns and the perceived diversification benefits. Similarly, the latest CSFB-Tremont survey showed that net asset flows into emerging market hedge funds were $8.1 billion in 2005 up from $6.6 billion in 2004. The survey also suggested that hedge funds investing in emerging markets posted the highest returns in 2005, up by 17% on average, compared with an average return of around 7% for the overall CSFB-Tremont hedge fund index.

Other assets and commodities

Oil and commodities markets provide another example of investors looking to a wider class of assets to augment overall returns and/or diversify their portfolios. According to market contacts, established investors in commodity markets, such as hedge funds and commodity trading advisors (CTAs), have increasingly been joined by longer-term investors (for example, mutual funds and pension funds) which have been shifting their asset allocations away from more traditional sectors.

The growth in investment in commodities by long-term institutional and speculative investors has been facilitated by new instruments, principally the development of new commodity investment vehicles and, in particular, exchange-traded funds (ETFs). For example, the implicit holdings of gold through ETFs has risen sharply over recent months. The increase in investment demand for commodities could be one reason behind the increase in some commodity prices since last autumn (Chart 24).

Chart 24
Goldman Sachs commodity indices



Sources: Bloomberg and Bank calculations.

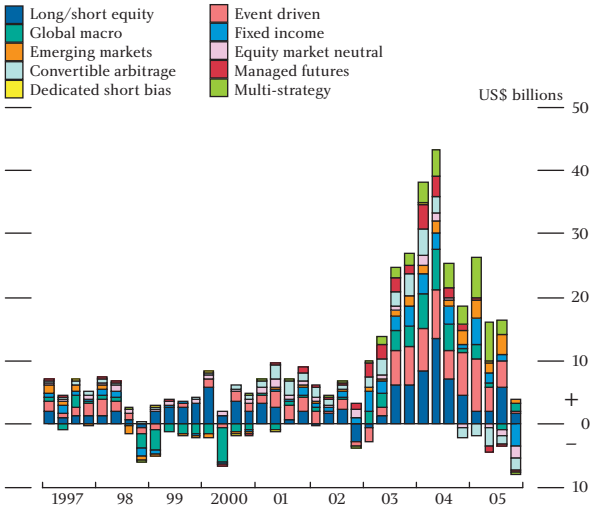
Risk appetite and the search for yield

Over the review period, developments across asset markets do not suggest any broad-based decline in investors' willingness to take risk. Credit spreads remained narrow by recent historical standards, equity prices rose and there was evidence of investors continuing to switch into alternative asset classes and leveraged investment strategies. At the same time, average trading book Value-at-Risk (VaR) measures for

large complex financial institutions (LCFIs) that have reported 2005 Q4 results, have not changed significantly since the previous quarter.

One contrary indicator could be investment flows into hedge funds, which continued to slow during the review period. Indeed, Tremont Capital Management reported an overall net outflow of around $4 billion from hedge funds in 2005 Q4, the first for three years (Chart 25). But according to market contacts, withdrawals appear to have been from high-net-worth individuals, perhaps seeking higher expected returns in other asset classes, rather than reversals of investment mandates from institutional investors. Moreover, there was a further increase in the number of new funds launched in Europe during 2005 H2.

Chart 25
Net capital flows into hedge funds

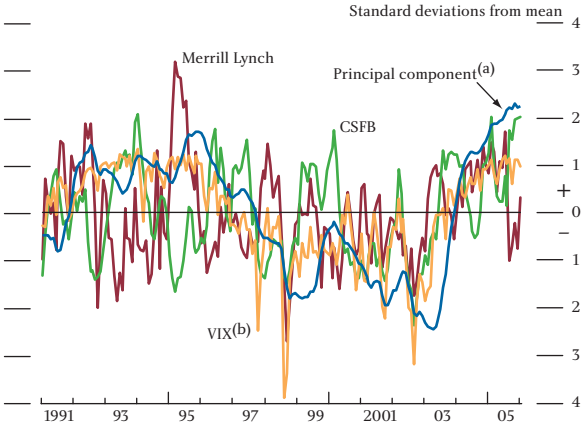


Source: Tremont Capital Management, Inc.

Assessing the direction of any change in the general level of risk appetite is difficult, not least because, *ex ante*, risk premia are unobservable and depend crucially on the preferences of investors. Put another way, it is difficult to know if recent asset price rises mean that risk premia are currently abnormally low (and will therefore revert to more normal levels at some point following a downward asset price adjustment) or whether there has been a structural decline in the compensation investors require for bearing risk.

A number of financial institutions calculate proxy measures for overall investor risk appetite — that is the willingness of investors to bear risks — based on surveys of investors or derived from movements in asset prices themselves.(1) These measures are typically quite volatile and often do not give consistent information. But attempting to extract the common signal in some of these series using principal component analysis indicates that risk appetite may currently be unusually strong (Chart 26).

Chart 26
Proxy measures of risk appetite



Sources: Chicago Board Options Exchange, CSFB, Merrill Lynch and Bank calculations.

(a) Principal component analysis was applied to twelve-month rolling moving averages of the three individual measures of risk appetite. The blue line shows the first principal component. Qualitatively similar results were found when a wider set of risk appetite proxy measures was used, but these series were only available for shorter time periods.
(b) The VIX is an index of volatility in the S&P 500 implied from option prices. On the chart it is inverted.

Overall, recent developments would seem to be consistent with continued high risk appetite, low risk premia across financial markets and little, if any, unwinding of the so-called 'search for yield' (a topic which has been discussed in recent *Quarterly Bulletins* and issues of the Bank's *Financial Stability Review* since June 2003).

How long can risk premia stay low? The answer is likely to depend on the underlying factors driving the falls. As discussed in the December 2005 *Financial Stability Review*, there are two broad sets of influences that might have contributed to the reduction in required risk premia. First, it may reflect some combination of a perceived decline in uncertainty in the macroeconomic environment, together with financial innovations that have brought about greater dispersion and diversification of risk. Second, other, less fundamental, factors may have led to risk being mispriced, perhaps because investors have underestimated the financial risk taken on or because they have overestimated the ability of policymakers to offset shocks to the macroeconomy.

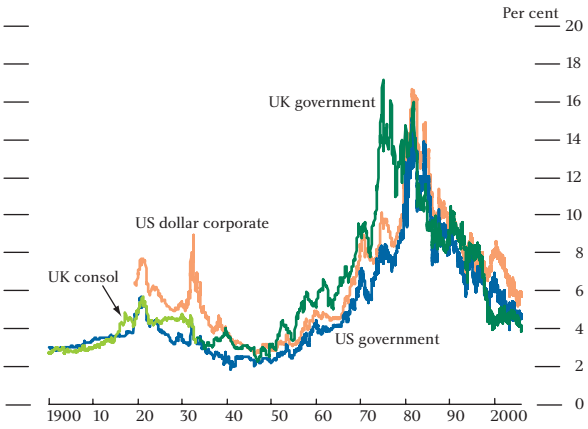
(1) For a discussion of the theory behind risk appetite measures see Gai, P and Vause, N (2004), 'Risk appetite: concept and measurement', *Financial Stability Review*, December, pages 127–36.

At the same time, some firms may have been reluctant to scale back risk taking, despite the possibility of risk being underpriced, owing to the potential for missed trading opportunities if any market correction does not occur for some time. Put another way, they face a potential trade-off between business and financial risk.

To the extent that the reduction in risk premia has been based more on fundamentals — the fact that financial markets have seemingly coped well with the withdrawal of monetary accommodation in the United States and a number of idiosyncratic credit events over the past year might provide some support for this view — then arguably the falls may be more persistent.

Indeed, current levels of risk premia may not be unprecedented. Despite recent rises in asset prices, nominal yields on government and corporate bonds have remained above the low levels experienced in the early 20th century (Chart 27). Moreover, the current spread between the yield on the Dow Jones US corporate bond index and an index of US government bonds, of around 109 basis points, is only a little below the long-run average value of around 130 points.

Chart 27
Indicative sterling and dollar bond yields(a)



Source: GlobalFinancialData.com.

(a) UK government bond is a 20-year gilt. US government bond is a spliced series of the yields on several long-term bonds. US dollar corporate is a composite series of yields on long-term corporate securities rated 'A' by Moody's. UK consol is a government bond with no fixed redemption date.

However, if risk has been mispriced, a sufficiently large disturbance could cause asset prices to correct sharply as investors reassess the outlook for returns. For example, a number of market contacts considered leverage levels in loan markets to be high and credit spreads to be very tight. And a recent survey by Mercer Investment Consulting of 17 funds of hedge funds, albeit only accounting for around 15% of global assets managed by this type of fund, found that most managers expected credit spreads and market volatility to increase in 2006. So the possibility of a correction in risk premia on asset prices cannot be ruled out.

Such an adjustment could have widespread and potentially destabilising effects across asset markets, particularly if a generalised reduction in risk appetite limited the ability of certain investors, such as hedge funds and the proprietary trading desks of LCFIs, to perform a stabilising role. This might be the case if the search for yield had led investors to build up leverage and move into increasingly illiquid assets particularly in markets for more risky or complex instruments where liquidity may prove ephemeral. In volatile market conditions, these investors could switch from being marginal liquidity suppliers in a wide range of markets, to being liquidity demanders.

It is impossible to know the mechanism through which any widespread adjustment in the price of risk could occur. In light of this uncertainty, investors and policymakers alike need to be alert to potential vulnerabilities in financial markets. Drawing on market intelligence from its contacts, the Bank will continue to assess these risks and report its views through future editions of the *Quarterly Bulletin* and *Financial Stability Review*.

Developments in market structure

Developments in credit derivative markets

There were a number of high-profile defaults in the United States at the end of last year, such as auto-part maker Delphi and the utility company Calpine. These defaults were significant because of the amount of credit derivative protection that had been bought and sold on these names (both single-name credit default swaps (CDS) and through trades in CDS indices that included the defaulted firms, eg the Dow Jones CDX indices). In the event of default, CDS agreements usually specify settlement by physical delivery of the debt of the defaulted company in exchange for its par value.

Given the large notional value of CDS contracts outstanding relative to the amount of cash debt, there was the potential for a disorderly settlement process, which could have dented confidence in the wider credit derivatives market. In the event, CDS dealers and trade associations organised auctions to obtain an agreed value for cash settlement of the CDS index trades, and there was little disruption to credit markets.

Table B
Simplified version of Bank of England consolidated[a] balance sheet[b]

£ billions

Liabilities	17 Feb. 2006	18 Nov. 2005	Assets	17 Feb. 2006	18 Nov. 2005
Banknote issue	40	40	Short-term and long-term repos	29	29
Settlement bank balances	<0.1	<0.1	Ways and Means advance to HMG	13	13
Other sterling deposits, cash ratio deposits and the Bank of England's capital and reserves	10	10	Other sterling-denominated assets	4	4
Foreign currency denominated liabilities	14	15	Foreign currency denominated assets	18	19
Total[c]	**64**	**65**	**Total**[c]	**64**	**65**

(a) For accounting purposes the Bank of England's balance sheet is divided into two accounting entities: Issue Department and Banking Department. See 'Components of the Bank of England's balance sheet' (2003), *Bank of England Quarterly Bulletin*, Spring, page 18.
(b) Based on published weekly Bank Returns. The Bank also uses currency, foreign exchange and interest rate swaps to hedge and manage currency and non-sterling interest rate exposures — see the Bank's 2005 *Annual Report*, pages 38 and 61–65 for a description.
(c) Figures may not sum to totals due to rounding.

Credit derivative indices

The market for credit derivatives referenced to asset-backed securities (ABS) has grown significantly since the launch of the standardised International Swaps and Derivatives Association terms in mid-2005. A further innovation in January 2006 was the launch of a tradable CDS index, known as ABX, referencing US sub-prime residential mortgage-backed securities (RMBS). The index is a family of five sub-indices tracking tranches of different credit quality bonds, each of which references a pool of 20 sub-prime RMBS. Contacts expect one consequence of the index to be further issuance of collateralised debt obligations (CDOs) of ABS, which have been popular recently.

London foreign exchange markets

Thirty banks participated in the most recent semi-annual survey of foreign exchange turnover in London undertaken by the Foreign Exchange Joint Standing Committee (JSC). Average daily turnover reported in October 2005 was $863 billion, an increase of 31% on the previous year. The share of turnover accounted for by major currency pairs fell slightly from 85% to 82% over the same period.(1)

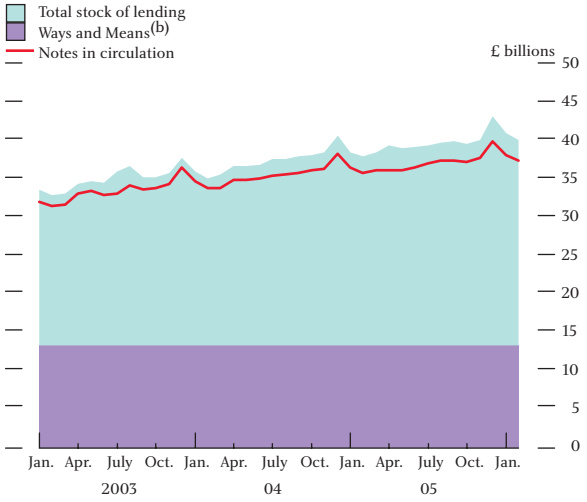
Similar surveys were also conducted for the New York market in October 2005 by the New York Foreign Exchange Committee, and for the Singapore market by the Singapore Foreign Exchange Market Committee.(2)

Bank of England official operations

Changes in the Bank of England balance sheet

The size of the Bank's balance sheet decreased slightly over the review period, owing to a small fall in the foreign-currency components (Table B). Notes in circulation, the largest liability on the Bank's balance sheet, changed little over the review period as a whole, although it rose as normal over the Christmas period (Chart 28).

Chart 28
Banknotes in circulation, the stock of lending through OMOs and 'Ways and Means'[a]



(a) Monthly averages.
(b) An advance to HM Government. This fluctuated prior to the transfer of responsibility for UK central government cash management to the UK Debt Management Office in April 2000. The Ways and Means is now usually constant, varying only very occasionally.

On 27 January 2006, one of the Bank's outstanding euro-denominated notes matured. The maturing note, which had a maturity of three years at issue, is being replaced by a new €3 billion three-year euro note maturing on 27 January 2009. The first €2 billion tranche of the new euro note was sold by auction on 24 January 2006. The auction attracted bids totalling 2.6 times the amount of notes on offer. The weighted average yield across all accepted bids was 3.048%, corresponding to an indicative spread of 11.5 basis points below the euro swaps curve at the time of the auction. The expected date for the €1 billion auction of the second tranche of the new euro note is 28 March

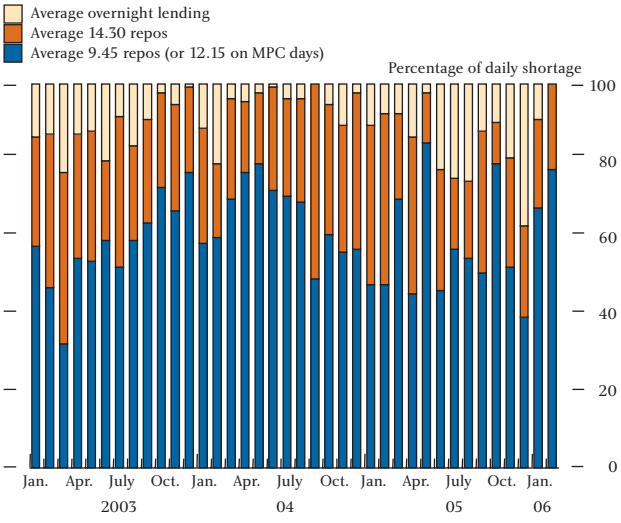
(1) The detailed results were published on 23 January 2006 and can be found at www.bankofengland.co.uk/markets/forex/fxjsc/index.htm.
(2) The results of these surveys can be found at www.newyorkfed.org/fxc/ and www.sfemc.org respectively.

2006. The proceeds of all euro note (and bill) issues will be added to the Bank's foreign currency bond holdings, of which around €3 billion is used to facilitate the UK commercial banks' participation in TARGET, the trans-European payment system.

As set out in previous *Bulletins*, the Bank holds an investment portfolio of gilts (currently around £2 billion) and other high-quality sterling-denominated debt securities (currently around £1.2 billion). These investments are generally held until maturity. Over the current review period, gilt purchases were made in accordance with the published screen announcements; £32.0 million of 4.75% 2010 in November, £48.0 million of 5% 2012 in January and £47.0 million of 5% 2014 in February. A screen announcement on 1 March 2006 detailed the purchases to be made over the following three months.

Over the period, the majority of lending in the Bank's open market operations (OMOs) in the sterling money market continued to be carried out at a two-week maturity, at the MPC's official rate (Chart 29). However, counterparties' use of overnight borrowing, at 25 basis points above the official rate, increased in December. End-year balance sheet constraints may have deterred counterparties from taking on two-week borrowing that crossed the year-end. In January and February, most shortages were cleared in the two-week rounds.

Chart 29
Lending via the Bank's short-term open market operations(a)



(a) Monthly averages.

In January, as a further step towards the planned introduction of fundamental reforms to the Bank's operations in the sterling money market, the Bank began lending via longer-term repos alongside its existing short-term repos. The box on page 22 sets out the motivation for these long-term repo operations. Table C shows the results of the tenders on 17 January and 14 February. Cover was substantial and yield 'tails' (the difference between the weighted average rate and the lowest accepted rate) were small, particularly in the nine and twelve-month repos. The February tender was similarly well covered.

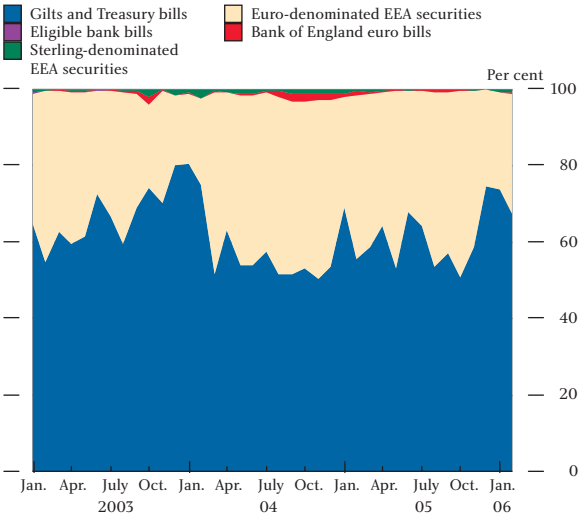
Table C
Long-term repo operations

	Three-month	Six-month	Nine-month	Twelve-month
17 Jan. 2006				
On offer (£ millions)	1,800	750	300	150
Cover	3.15	4.25	5.67	8.23
Weighted average rate(a)	4.407	4.416	4.425	4.435
Highest accepted rate(a)	4.471	4.451	4.425	4.453
Lowest accepted rate(a)	4.385	4.390	4.425	4.425
Tail(b) (basis points)	2.2	2.6	0.0	1.0
14 Feb. 2006				
On offer (£ millions)	1,800	750	300	150
Cover	2.61	3.32	3.25	3.93
Weighted average rate(a)	4.400	4.386	4.386	4.405
Highest accepted rate(a)	4.420	4.400	4.400	4.405
Lowest accepted rate(a)	4.390	4.385	4.385	4.405
Tail(b) (basis points)	1.0	0.1	0.1	0.0

(a) Per cent.
(b) The yield tail measures the difference between the weighted average bid rate and the lowest accepted rate.

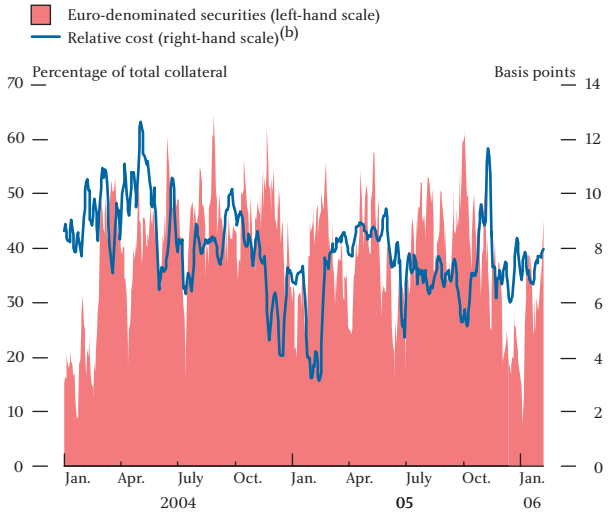
There was a rise in the use of gilts and Treasury bills and a corresponding fall in the use of euro-denominated European Economic Area (EEA) government debt as OMO collateral (Chart 30), despite the cost of euro-denominated EEA debt falling relative to gilts (Chart 31). In part, this was reflected in greater recourse to the overnight lending facilities in December. EEA securities cannot be delivered in the late lending

Chart 30
Instruments used as OMO collateral in short-term operations(a)



(a) Monthly averages.

Chart 31
Relative cost and use in OMOs of euro-denominated EEA government securities(a)



(a) Includes collateral used in short-term and long-term OMOs.
(b) Relative cost calculated as the difference between one-month BBA repo and Libor fixing spread and one-month European Banking Federation repo and Euribor spread. A larger spread indicates a lower cost of repoing euro-denominated debt relative to repoing gilts.

facilities, due to settlement constraints, unless prepositioned by counterparties.

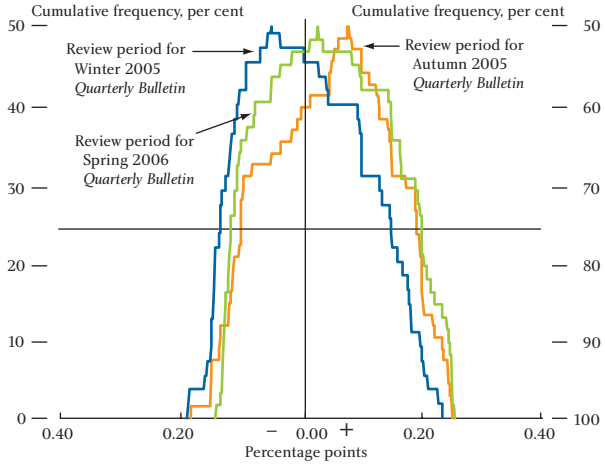
So far, counterparties have used a somewhat greater proportion of euro-denominated EEA debt collateral in the Bank's long-term repo operations compared with the short-term operations.

Short-dated interest rates

The distribution of the spread between the sterling secured (gilt GC repo) overnight rate and the Bank's official rate moved up during the current review period (Chart 32), indicating an increase in the number of days on which the overnight rate traded above the official rate. In part, this reflected greater use of overnight borrowing from the Bank in December.

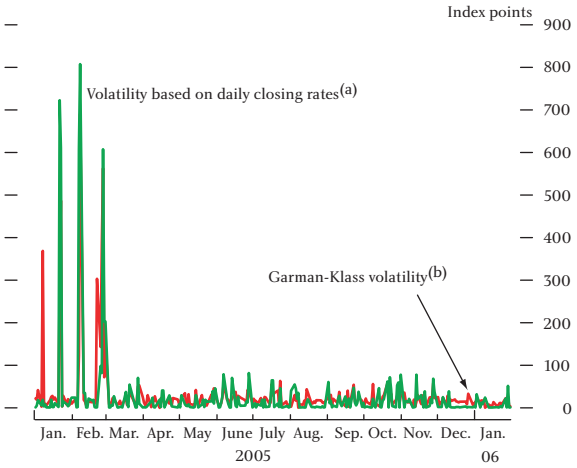
Volatility in sterling overnight rates has remained at the lower levels experienced since the narrowing of the 'corridor' between the rates available on the late lending and deposit facilities to +/- 25 basis points on 14 March 2005 (Chart 33). But, despite relatively low volatility based on daily closing rates, periodic spikes in the intraday volatility of sterling overnight rates have remained. Chart 33 also shows an alternative volatility measure that takes account of daily highs and lows (known as the Garman-Klass measure of volatility). At times this has been higher than the volatility measure based only on daily closing rates. Measures of volatility should fall further after the Bank's money market reforms are introduced.

Chart 32
Cumulative folded distribution of sterling secured overnight rates(a)



(a) Distribution of the spread between the GC dmo rate and the official rate. A negative spread indicates that the market rate is less than the official rate; if more than 50% of the spread distribution is below zero, it has a negative bias.

Chart 33
Volatility of overnight interest rates



(a) This measure is derived by taking the squared difference of the log of the daily closing overnight rate, C_t, and the previous day's closing overnight rate, C_{t-1}. Algebraically, it is simply a time series of $(1n\ C_t - 1n\ C_{t-1})^2$.
(b) The Garman-Klass measure includes additional terms to account for the intraday highs and lows of the overnight rate, as well as the opening and closing values. It is calculated using $(1n\ O_t - 1n\ C_{t-1})^2 + 0.5(1n\ H_t - 1n\ L_t)^2 - 0.3862(1n\ C_t - 1n\ O_t)^2$, where O_t, H_t, L_t are, respectively, daily opening level, high and low of the overnight rate.

Forecasting the liquidity shortage

The accuracy of the Bank's liquidity forecast improved slightly over the review period (Table D). During the final quarter of 2005, accuracy was greater than in

Table D
Intraday forecasts versus actual liquidity shortages

Mean absolute difference, £ millions

	9.45 forecast	14.30 forecast	16.20 forecast
2002	83	43	30
2003	99	58	41
2004	105	60	36
2005 Q1	117	79	44
2005 Q2	119	67	50
2005 Q3	195	72	32
2005 Q4	121	64	31
3 Jan.–17 Feb.	103	56	43

The Bank's long-term repo operations

The Bank has recently introduced longer-term repo lending as part of its open market operations (OMOs). The new long-term repo operations are conducted monthly at maturities of three, six, nine and twelve months. Because these maturities extend beyond the next MPC interest rate decision, the Bank operates as a price taker rather than lending at the MPC's official rate, as it does in its short-term repo operations. The long-term repos are at fixed market rates, determined in discriminatory (bid-price) tenders.

The Bank introduced long-term repos in order to help manage its balance sheet ahead of the launch of the fully reformed framework for its operations in the sterling money market, currently expected in May or June. The new framework will be based on averaging of voluntary reserves alongside widely available standing lending and deposit facilities.(1) The structure of the Bank's short-term OMOs will change as a result, moving from daily to weekly operations, of one-week maturity, so that the entire stock of short-term repo lending will roll over once each week. In addition, the introduction of reserves will increase significantly the amount of funds that the Bank needs to provide via OMOs. Effective implementation of monetary policy does not require the Bank to roll over its entire stock of financing each week. Indeed, that would be inefficient. Following consultation with market participants last year,(2) the Bank announced on 14 December that it intended to introduce long-term repo lending in order to limit the size of its short-term repo lending.(3) The Bank also said that it would build up the portfolio of long-term repo lending gradually, over a number of months ahead of launch.

The first long-term repo tender took place on 17 January (see Table C, on page 20 for the results of the January and February tenders). The amounts offered at each maturity have been skewed towards the shorter maturities, reflecting the greater liquidity of the repo market at those maturities. The Bank has initially planned to build up a portfolio of around £15 billion by the time reserve-averaging is launched. The Bank is also considering over time providing longer-term financing through outright purchases of bonds.

Long-term repo tenders are conducted for next-day settlement and usually take place at 10 am on a Tuesday, for settlement on the third Wednesday of each month. All four maturities are normally offered at each tender. The tenders are open to counterparties in the Bank's OMOs, and each counterparty is allowed to submit a maximum of ten bids at each maturity (with a maximum of five in the final ten minutes of the half-hour bidding window). No counterparty is allowed to bid for more than 40% of the total amount on offer in a tender. Funds are then allocated in descending order of the rate offered until the amount on offer has been allocated in full. The eligible collateral that can be used in the long-term repos is the same as that for the Bank's short-term repo operations.

(1) For more information on the new framework, see *Reform of the Bank of England's Operations in the Sterling Money Markets — A paper on the new framework by the Bank of England*, April 2005, available at www.bankofengland.co.uk/markets/money/smmreform050404.pdf.
(2) The consultative paper *Reform of the Bank of England's Operations in the Sterling Money Markets: Transitional Arrangements — A consultative paper by the Bank of England*, August 2005, is available at www.bankofengland.co.uk/markets/moneymarketreform/transarrang050823.pdf.
(3) Available at www.bankofengland.co.uk/markets/moneymarketreform/long_term_repos051214.pdf.

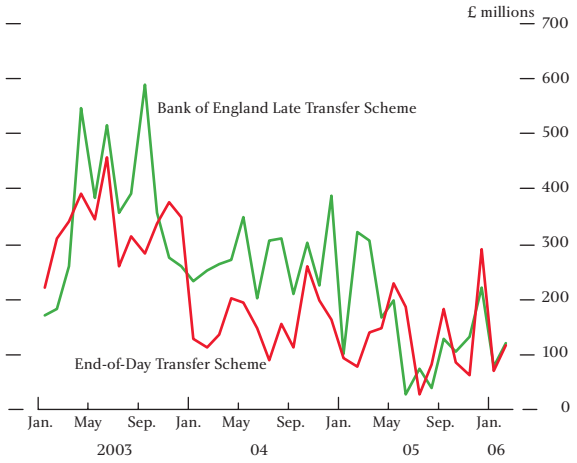
2005 Q3, even though the period included potential additional volatility in the Bank's forecast as a result of seasonal demand for notes around the Christmas period.

A welcome development has been the low level of flows in the end-of-day settlement bank schemes in recent quarters. Average daily payments in both the Bank of England Late Transfer Scheme (BELTS) and End-of-Day Transfer Scheme (EoDTS) have tended to be below £200 million, suggesting the CHAPS-Sterling settlement banks have continued to make accurate forecasts of their end-of-day positions (Chart 34). Flows can be lumpy with many days on which only negligible payments occur in the facilities. The Bank monitors use of these facilities to ensure that, where possible, settlement banks make payments ahead of the CHAPS deadline at 4.20 pm so as to minimise flows in these end-of-day facilities.

Progress on money market reform

The Bank currently expects to launch the reformed system in May or June 2006. A notice was published on

Chart 34
Bank of England Late Transfer Scheme and End-of-Day Transfer Scheme(a)



(a) Monthly averages.

22 December 2005 setting out the key milestones for both the Bank and external participants. These include the Bank undertaking exercises to help ensure that all participants in the reserve scheme, OMOs and standing facilities are familiar with the associated processes. Following these familiarisation exercises, the Bank will invite participants to take part in a 'dress rehearsal' in order to demonstrate to all parties that IT systems and processes, both internal to the Bank and involving external participants, work together effectively. The application period for all institutions wishing to take part in the new system began on 3 January and closed on 17 February. The Bank is currently expecting around 40 reserve scheme banks and building societies, more than 30 OMO counterparties and over 50 standing facility banks and building societies at the launch of the new framework.