Markets and operations

This article reviews developments since the Spring Quarterly Bulletin *in sterling and global financial markets, in UK market structure and in the Bank's official operations.*(1)

- *Markets brought forward expectations of the timing of increases in US official rates, as the global economic upswing continued. International short-term rates rose, and in the United States longer-term forward rates also increased.*
- *The dollar appreciated in effective terms and after March there was no evidence of further intervention by the Bank of Japan. The sterling ERI was broadly unchanged and remained higher than during 2003.*
- *Equity markets fell slightly in the United States, the United Kingdom and the euro area, but rose in Japan.*
- *Revisions to views about the path of US official rates were associated with a sharp widening of credit spreads in emerging market economies and the high-yield corporate sector, leading some high-yield issues to be postponed. But, overall, the adjustment has been reasonably orderly, so far.*
- *The Bank of England issued a consultative paper on reform of its operations in the sterling money markets. The paper set out the Bank's objectives.*

The global economic upswing continued and, in consequence, the main development in global financial markets was that expectations of the timing of increases in US official rates were brought forward. This has affected the expected paths of short rates in other countries, credit spreads, equity markets and exchange rates. This article reviews each in turn.

International short-term interest rates rose by between around 15 and 50 basis points (Table A). At longer maturities, US dollar forward rates rose by about 50 basis points, with a small increase in sterling rates, but little change in euro rates. The dollar appreciated against the euro by just over 2% and the sterling ERI was broadly unchanged. Equity markets fell in the United States, the United Kingdom and the euro area, but rose in Japan.

Changes in expectations for the path of official interest rates contributed to a widening of credit spreads on high-yield bonds. Overall the adjustment was orderly,

Table A
Summary of changes in market prices

	27 Feb.	28 May	*Change*
September 2004 three-month interbank interest rate (per cent)			
United Kingdom	4.57	5.08	*51 bp*
Euro area	2.03	2.19	*16 bp*
United States	1.43	1.93	*50 bp*
Ten-year nominal forward rate (per cent) (a)			
United Kingdom	4.83	4.95	*12 bp*
Euro area	5.45	5.47	*2 bp*
United States	6.21	6.72	*51 bp*
Equity indices (domestic currency)			
FTSE 100 index	4492	4431	*-1.4%*
Euro Stoxx 50 index	2893	2737	*-5.4%*
S&P 500 index	1145	1121	*-2.1%*
Effective exchange rates			
Sterling effective exchange rate	105.7	105.8	*0.1%*
$/€ exchange rate	1.25	1.22	*-2.2%*

Columns may not correspond exactly due to rounding.

Sources: Bank of England and Bloomberg.

(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 web site at www.bankofengland.co.uk/statistics/yieldcurve/main.htm.

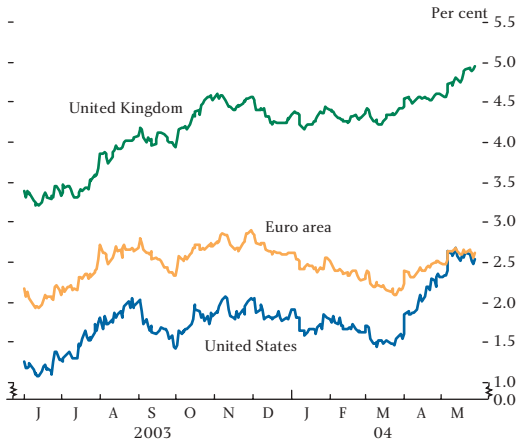
but with brief strains—manifested in sharp price changes—in some less liquid markets, including emerging market economies. Increased volatility in credit markets and the widening of credit spreads led to several companies postponing or scaling back issuance.

(1) The period under review is 27 February (the data cut-off for the previous *Quarterly Bulletin*) to 28 May.

Short-term interest rates

Market perceptions of the likely path of monetary policies were revised against a background of synchronised recovery in the world economy. In some countries, for example New Zealand, Canada and the United Kingdom, official rates were increased. The United Kingdom's Monetary Policy Committee (MPC) raised the official repo rate by 25 basis points to 4.25% at its meeting on 6 May. US dollar, euro and yen official interest rates, meanwhile, remained unchanged over the review period, but market interest rates rose. The increases in two-year nominal spot rates were most pronounced in the dollar market (Chart 1), with positive news about the outlook for the US economy; for example the April non-farm payrolls published on 7 May and associated revisions to previous months' data.

Chart 1
Two-year nominal spot rates(a)

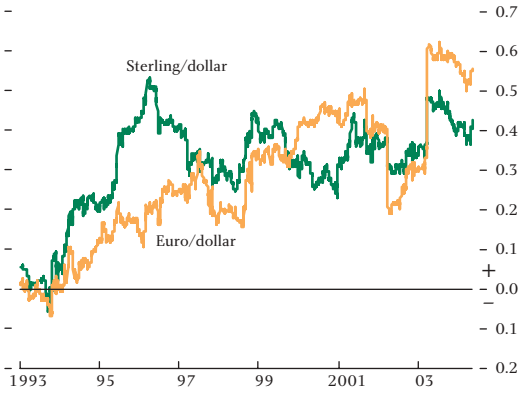


(a) Derived from the Bank's government liability curves.

Casual observation of Chart 1 suggests that international short-term rates have been highly sensitive to moves in dollar rates. Closer examination confirms this (Chart 2). While sterling/dollar rate sensitivity was higher in the mid-1990s, euro/dollar sensitivity, compared with the previous decade, has been high since 2003.

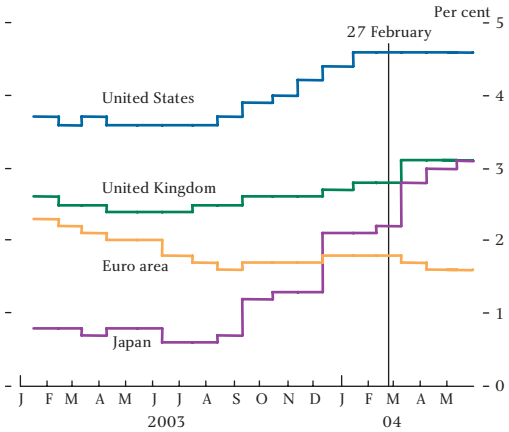
In principle, positive correlation could be accounted for by synchronisation of business cycles, or by global developments that affect different economies in similar ways. The first of these explanations seems unlikely; while growth forecasts for the US and UK economies have been revised upwards or have been unchanged over recent months, forecasts for GDP growth in the euro area have become slightly more pessimistic (Chart 3). A more likely explanation is that, because of the integrated nature of financial markets, and the size of the US economy, the US data have had a global impact; real

Chart 2
Comovement of UK and euro-area short rates with US short rates (two-year nominal spot rates)(a)



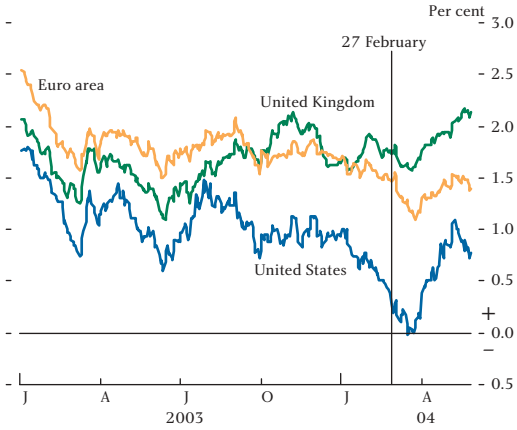
(a) Two-year nominal spot rates derived from the Bank's government liability curve. The statistics are the one-year rolling regression coefficients of changes in sterling and euro rates on contemporaneous changes in dollar rates. Prior to 1999, the euro measure is based on German government interest rates.

Chart 3
Expected 2004 real GDP growth



Source: Consensus Economics.

Chart 4
Five-year real yields(a)



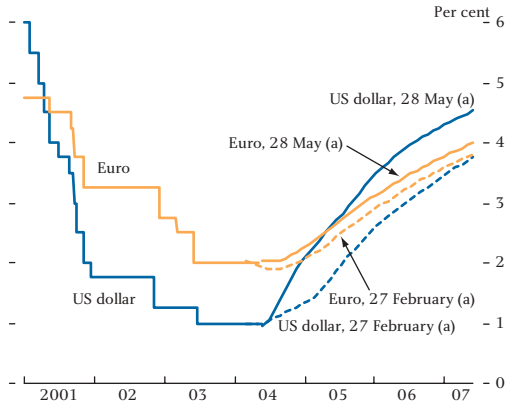
Sources: Bank of England and Bloomberg.

(a) US and euro rates calculated from index-linked yields, maturities of which may vary.

yields in all three currencies rose following the US data releases, suggesting less loose monetary conditions ahead (Chart 4).

The dollar forward curve was already steeper than the euro curve at the time of the Spring *Quarterly Bulletin*, and it has since steepened further while the euro curve has flattened slightly (Chart 5). Information from options prices suggests that the probability attributed by the market to an imminent reduction in euro official interest rates fell following the ECB's April meeting and on various US data releases (Chart 6).

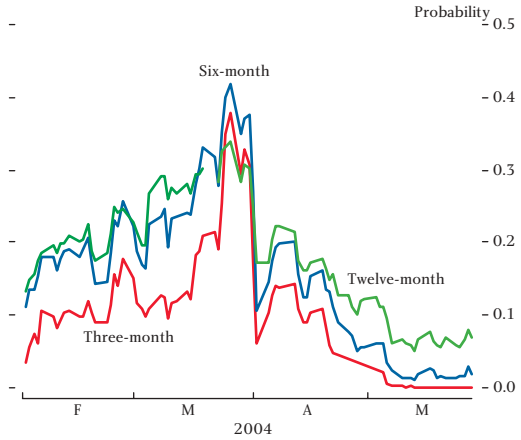
Chart 5
Short-term international nominal forward rates



Sources: Bank of England and Bloomberg.

(a) Three-month nominal forward rates implied by futures contracts.

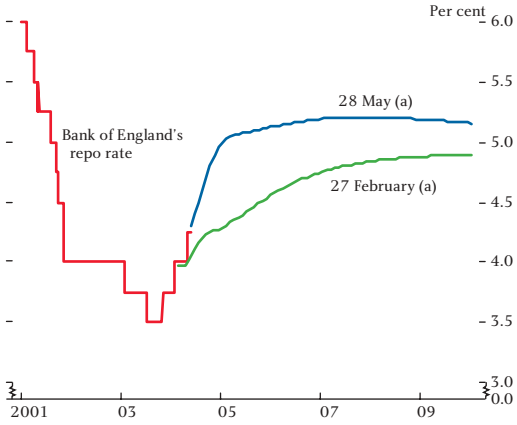
Chart 6
Probability that three-month Euribor will lie at or below 1.75% at different horizons



Sources: Bank of England and Bloomberg.

The profile for short-term sterling forward rates has shifted up by up to around 60 basis points (Chart 7). In the period prior to the April MPC meeting, market participants' views had hardened around a 25 basis point rise in either April or May. The April decision to leave the sterling official rate unchanged meant that a rise in May became widely anticipated. Following May's increase, there was a modest rise in short-term sterling interest rates of just under 10 basis points.

Chart 7
Sterling official and forward market interest rates

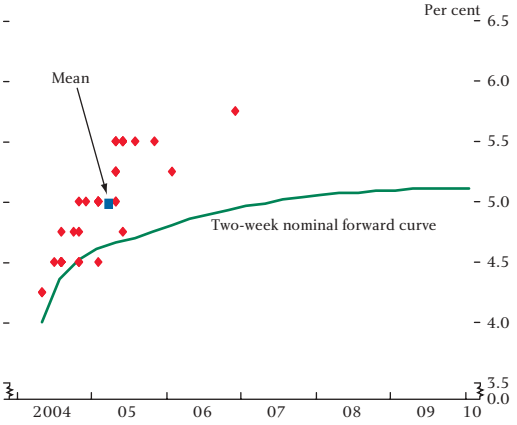


Sources: Bank of England and Bloomberg.

(a) Two-week nominal forward rates implied by GC repo/gilt curve.

Reuters polls City UK economists for their views on the timing and the level of the next peak in UK official interest rates. Chart 8 shows the results of the May poll, taken on 27 and 28 April. The mean result put the peak at around 5.0% in May 2005, some time before the peak of the forward curve which, at the time of the Reuters survey, was around 5.2% in 2008. The forward rate implied by market rates for May 2005 also lies below economists' rate expectations, unusually implying a negative term premium or risk premium.(1) Alternatively it could reflect differing views of economists and traders.

Chart 8
Reuters poll of timing and level of next peak in UK official rates, and two-week nominal forward rate(a)



Sources: Bank of England and Reuters.

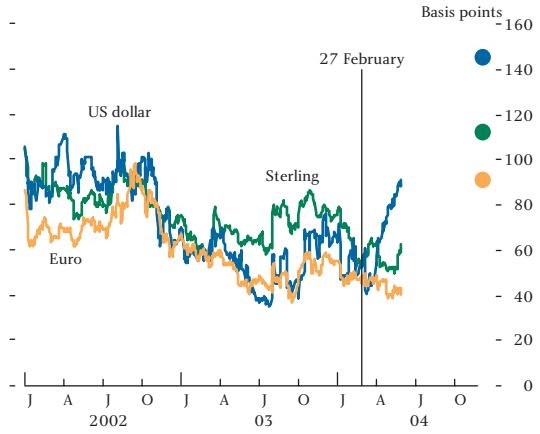
(a) Forward curve corresponds to an average of the survey dates (27 and 28 April).

(1) For more on term premia, see 'Deriving a market-based measure of interest rate expectations', by Christopher Peacock, published in this *Quarterly Bulletin*.

Uncertainty about interest rates

Measures of uncertainty about dollar interest rates, derived from option prices, have risen. By contrast, uncertainty about sterling and euro short-term interest rates remained markedly lower (Chart 9). Six-month forward implied volatility six months ahead remains especially high for the United States.

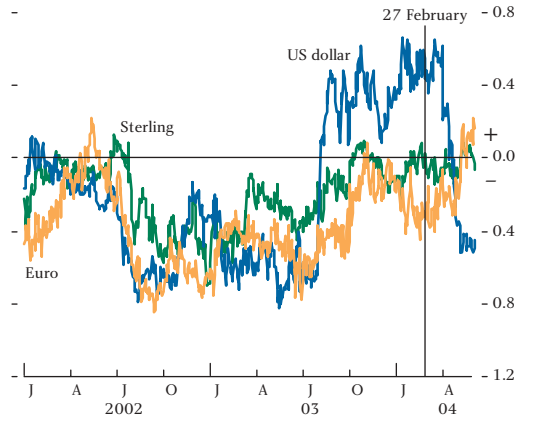
Chart 9
Six-month implied volatility from interest rate options(a)



(a) The lines show historical six-month implied volatility in basis points. The dots indicate the six-month forward implied volatility six months ahead.

By looking at the prices of short-term interest rate options over a range of strike prices, it is possible to derive measures of skew, which describe the perceived balance of risks to short-term interest rates (Chart 10). While official dollar rates were declining, the balance of risks around the dollar forward curve remained on the downside until around mid-2003. Around the Autumn of 2003, although it was perceived that official dollar rates would remain low for some time, the skew indicated that the balance of risks was that the Federal Open Market Committee (FOMC) would begin to raise rates sooner than indicated by the dollar forward curve. This balance of risks around the dollar forward curve has now returned to slightly negative as the dollar curve has shifted up. The balance of risks around both the sterling and euro forward curves was broadly neutral.

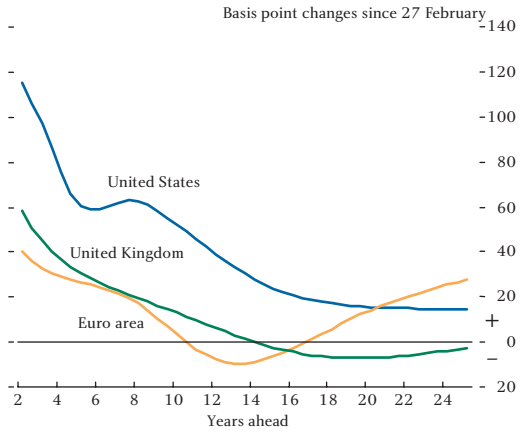
Chart 10
Six-month implied skew from interest rate options



Long-term interest rates

Movements at the short end of the US dollar interest rate curve have contributed to increases in yields at longer maturities. This would happen even if longer maturity forward rates were unchanged. But long-term nominal forward interest rates also rose—by around 60 and 50 basis points at maturities of five and ten years respectively (Chart 11). Sterling and euro forward rates increased at medium maturities, but by less, and both fell at some longer maturities.

Chart 11
Changes in implied nominal forward rates(a)



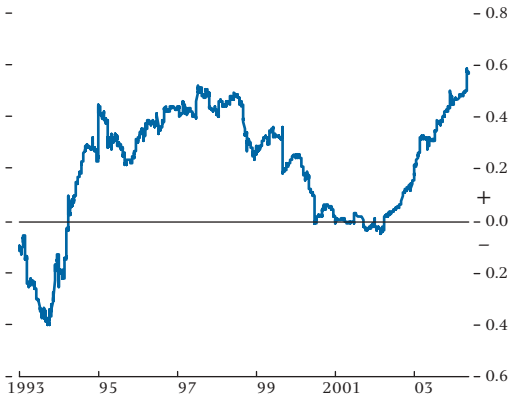
(a) Instantaneous forward rates derived from the Bank's government liability curves.

By historical standards, this rise in US dollar nominal forward rates at longer maturities was relatively large.(1) A pronounced rise over a three-month period also occurred between June and August 2003, when market contacts suggested that movements were being exaggerated by activity related to hedging of mortgage-backed securities (MBS).(2) In contrast, over the current review period, contacts indicated that MBS hedging was more muted, suggesting the forward rate rises might be more likely to persist.

Over the period, the largest rises in longer-term forward rates coincided with the macroeconomic data releases that contributed to rises at the short end of the curve. Statistically, this can be captured by an estimate of the

(1) Since 1991, absolute changes in the ten-year US dollar forward rate over a three-month period have tended to be less than 50 basis points, on average.
(2) See 'Markets and operations' (2003), *Bank of England Quarterly Bulletin*, Autumn, pages 258–59.

Chart 12
Comovement between changes in dollar forward rates at two-year and ten-year maturities(a)



(a) Analogous to Chart 2, this chart plots the coefficient from a regression of daily changes in ten-year nominal forward rates on daily changes in two-year nominal forward rates over a one-year rolling window.

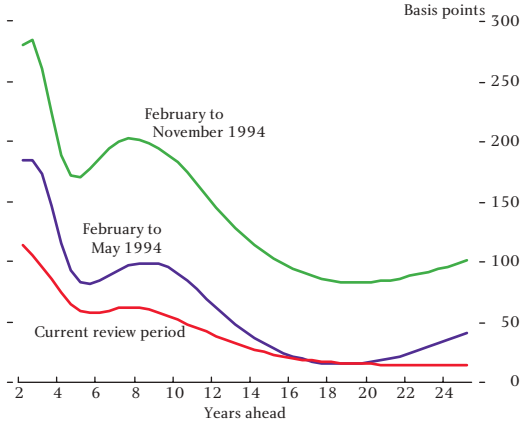
comovement between changes in long-term US dollar nominal forward rates and changes at the short end of the curve. This measure was unusually high over the review period (Chart 12).

That long forward rates should be so strongly correlated with changes at the short end is puzzling. While the increase in dollar rates at shorter maturities is consistent with investors bringing forward expectations of a US monetary policy tightening, medium-term policy expectations would not usually be expected to affect greatly longer-term forward rates, given that the monetary authority is perceived to be credible.(1) Rather, these should reflect long-term expectations of inflation and risk-free real interest rates, as well as associated risk premia.

A previous episode where changes in short-term dollar rates coincided with large movements in longer-term forward rates was during the policy tightening cycle that began in early 1994. In the nine months between February and November 1994, the federal funds target rate was raised from 3.0% to 4.75%.(2) Over the same period, two-year and ten-year forward rates increased by around 280 and 170 basis points respectively (Chart 13), with the latter reaching a peak of around 9.0% in mid-November.

Chart 13 shows that in the three months following the start of the 1994 tightening cycle, the rise in US dollar nominal forward rates was only slightly higher than the

Chart 13
Cumulative changes in US dollar forward rates(a)



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

rise observed recently. Should longer-term dollar interest rates increase further, repeating the 1994 experience, there could be an adverse effect on the global recovery, given the important role of long yields in the US economy and, in turn, the importance of the United States in the global economy. But the objectives of policymakers and their reaction to macroeconomic news may have been less well understood by investors in 1994 than now.

One explanation for the current increase in long-term US dollar forward rates could be that inflation expectations and risk premia have risen as well. This would be consistent with renewed focus on inflation risk, given that fears of deflation in the United States have receded. But this is unlikely to be the only factor that contributed to rises in long-term US dollar nominal forward rates; indeed, Chart 14 suggests that at least

Chart 14
US implied real forward rates(a)

Sources: Bank of England and Bloomberg.

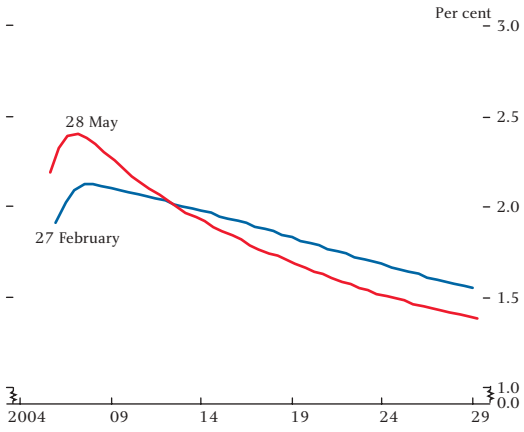
(a) US real rates calculated from TIPS, maturities of which may vary.

(1) See Haldane, A and Read, V (1999), 'Monetary policy and the yield curve', *Bank of England Quarterly Bulletin*, May, pages 171–76.
(2) By end-November 1994, the federal funds target rate was 5.5% and eventually peaked at 6.0% in February 1995.

some of the rise could be accounted for by the real component of the nominal curve.

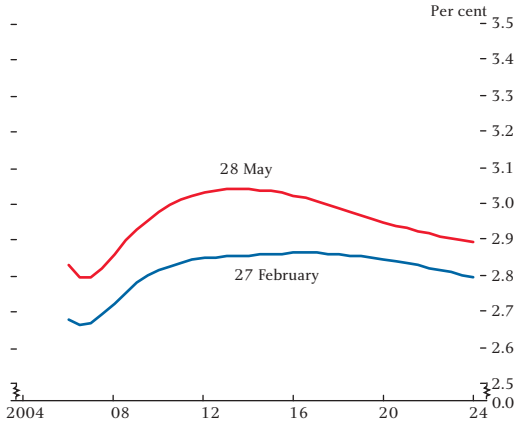
By contrast, the sterling real forward curve (derived from RPI-indexed gilts) has become more inverted, with real rates at shorter maturities rising over the period, while those at maturities beyond eight years fell (Chart 15). At the short end, this could be interpreted as reflecting changed expectations of the path of official interest rates. At the longer end the movements were smaller and, as mentioned in previous *Quarterly Bulletins*, strong demand for longer-maturity index-linked gilts by UK pension funds and life insurers can make it more difficult to relate movements in real yields to economic fundamentals. More specifically, since the real interest rate reflects agents' intertemporal consumption and investment decisions, there should be a link between the long-term (or equilibrium) real interest rate and the trend growth rate of the economy. But even ignoring risk premia, it is difficult to reconcile a long-term real forward rate of around 1.5% with plausible estimates of trend productivity growth.

Chart 15
UK real forward rates



To the extent that the index-linked gilt curve is distorted away from fundamentals, there may be an effect on the derivation of forward measures of RPI inflation from the difference between nominal and real sterling forward rates (Chart 16). Over the period, the forward inflation curve shifted upwards, with the largest moves for maturities around 2013. While this could reflect a rise in inflation expectations, it could also reflect a change in the inflation risk premium or simply inefficiencies in the relative pricing of conventional and index-linked gilts.

Chart 16
UK break-even RPI inflation curve



Sources: Bank of England and Bloomberg.

Corporate credit conditions

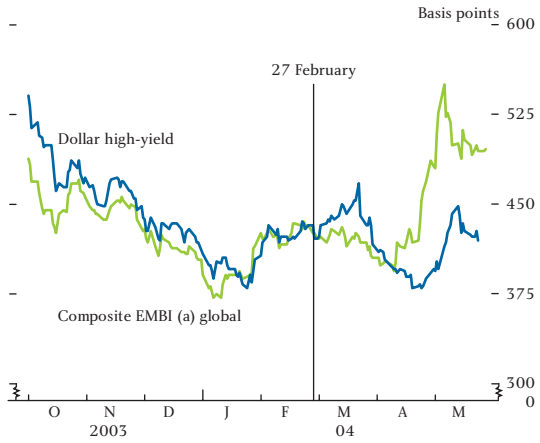
Another possible explanation for the recent rise in dollar nominal forward rates is that, reflecting changed expectations about the path of US monetary policy, there may have been some partial unwinding of the dollar yield curve carry trade that contacts suggest became widespread during 2003 and into this year.(1) Similar explanations have been offered by contacts for the compression of and, more recently, the widening of credit spreads.

Over the first half of the review period, credit spreads on emerging market bonds fell slightly, continuing the downward trend that began in early 2003. Market contacts reported that some investors had been investing in emerging market bonds to exploit yield differentials. Since mid-April, however, expectations that interest rates are set to rise, particularly in the United States, have contributed to a sharp rise in the spreads on emerging market debt—in the final week of April and the first week of May, emerging market spreads increased by more than 100 basis points (Chart 17). The sudden and sharp manner of the rise may suggest that the market was at times disorderly. Spreads subsequently fell back, however, consistent with a return to more normal market conditions.

Spreads on high-yield sterling, dollar and euro corporate bonds followed a similar pattern, rising sharply after mid-April, but falling back towards the end of the period (Chart 18). High-yield issuance was generally strong over the period, though this in large part reflected capital restructuring (eg leveraged buy-outs) rather than new investment. Towards the end of the period the

(1) A yield curve carry trade exploits a positive slope in the yield curve by borrowing at the short end, where yields are relatively low, and investing at the long end.

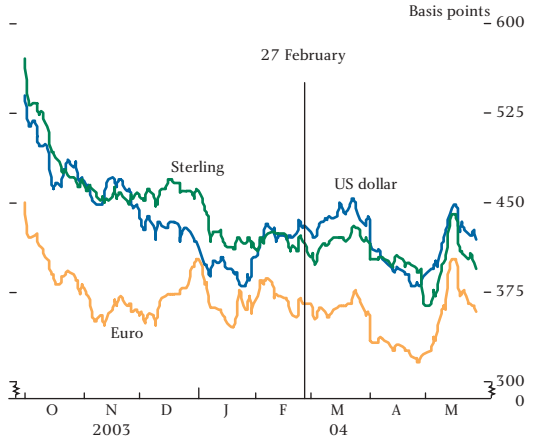
Chart 17
Emerging market and high-yield bond spreads



Sources: JPMorgan Chase and Merrill Lynch.

(a) Emerging Markets Bond Index.

Chart 18
High-yield option-adjusted corporate bond spreads



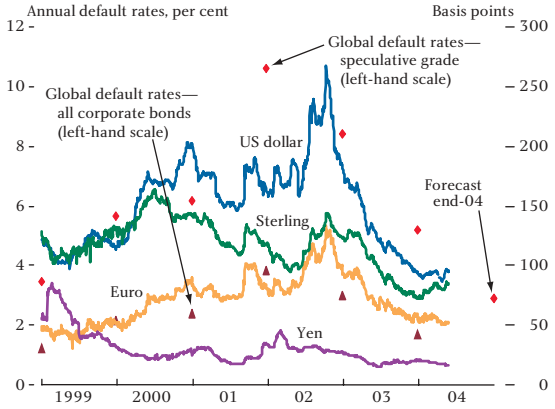
Source: Merrill Lynch.

volatility in markets and the widening of credit spreads led several companies to scale back or postpone issuance.

In the investment-grade sector, spreads were little changed over the period, and credit conditions for highly rated issuers appeared to remain favourable. Fundamentally, actual default rates were low by historical standards and risk has probably been reduced by the synchronised recovery (Chart 19).

In the sterling market, there was a marked increase in issuance volumes during March, due largely to overseas issuers exploiting an apparent funding arbitrage opportunity arising from movements in basis swap rates (see the box on page 120). Globally, issuance in the investment-grade sector has been fairly low, while funds allocated to invest in credit are said to be plentiful.

Chart 19
Investment-grade option-adjusted corporate bond spreads(a) and global default rates

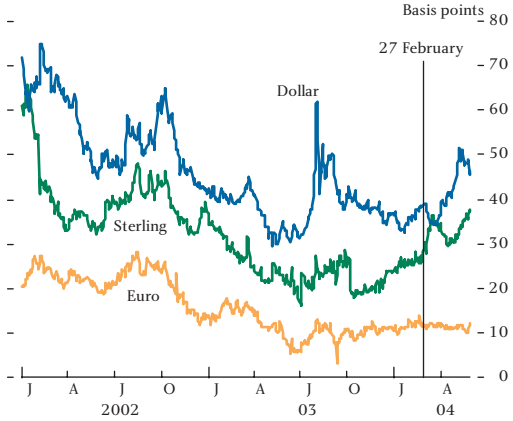


Sources: Merrill Lynch and Moody's.

(a) Shown on right-hand scale.

Sterling and US dollar swap spreads both widened by around 9 basis points. In theory, if markets were perfectly efficient, this could be interpreted as a slight deterioration in the outlook for the banking sector. But consistent with credit conditions in the investment-grade sector remaining largely unchanged, contacts reported that these rises in part reflected strong demand to swap floating-rate liabilities for fixed rates, thereby locking in lower rates ahead of an expected policy tightening in the United States.

Chart 20
Ten-year swap spreads



Source: JPMorgan Chase.

Equity markets

With market interest rates rising, most equity markets fell; the FTSE All-Share and S&P 500 fell slightly between February and May and, in local-currency terms, the Euro Stoxx by rather more (Chart 21). Long-term real interest rates should be a key determinant of equity prices since they affect the rate at which claims on expected earnings streams are discounted. Equity prices

Basis swaps

Cross-currency basis swaps are exchanges of interest rate payments in two different currencies where the underlying reference rates are floating interbank interest rate indices such as the London interbank rate (Libor) and Euribor.

Such transactions can be illustrated by the following cross-currency basis swap example, based on a notional value of $100 million, a tenor of two years, quarterly floating-rate payments, a basis swap rate of +3 basis points and an exchange rate of 1.20 dollars per euro, where one party:

- pays $100 million and receives €83.3 million at initiation;
- pays three-month Euribor +3 basis points on €83.3 million and receives three-month USD Libor on $100 million for two years; and
- receives $100 million and pays €83.3 million at expiry.

In principle, the price (or 'basis') in cross-currency swaps should be zero, unless there are differences in credit risk embedded in the underlying reference rates of one currency relative to another. But such differences seem unlikely given the similarity of the various Libor and Euribor panels. Market contacts suggest that, in practice, movements in the basis away from zero are predominantly driven by flows of funds, in particular primary issuance flows. In the absence of market frictions, funding arbitrage should ensure that the cost of issuing debt domestically is the same as the cost of issuing debt in a foreign currency. In practice, however, issuers sometimes can borrow at a lower cost by issuing in a particular currency and swapping the liabilities to another.(1)

In addition to primary issuance flows, other activities that can affect basis swaps are asset/liability management (ALM), mergers and acquisitions activity, foreign-currency assets purchased by fund managers benchmarked to swaps(2) and cross-currency arbitrage trading by hedge funds. All of these involve the change in the foreign-currency component of an asset or liability, and hence have to float through the basis swap market.

The volatility of cross-currency basis swap markets has increased. This has been most pronounced in the sterling/dollar basis swap, which widened to a peak of 6.25 basis points (at the five-year tenor) in early March, having traded in a narrow -3 to +1.25 basis point range for much of the previous year.

The widening seems to have reflected an increase in demand to pay sterling and receive dollars which, until very recently, was not matched by offsetting flows. The source of this increased demand seems to have been primarily UK banks issuing US dollar mortgage-backed and other securities and swapping them back to sterling.(3)

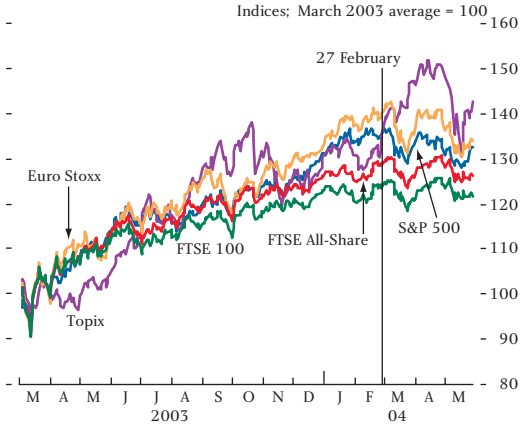
Chart A
Five-year sterling/dollar and euro/dollar basis swaps

Source: Bloomberg.

By late March, the rise in the sterling basis swap had attracted increased sterling issuance from non-UK issuers, particularly supranationals, agencies and non-UK financials. This increased demand to receive sterling (pay dollars) in swaps temporarily depressed the sterling dollar basis from +4 to +2 basis points before it rose again in April.

(1) Issuers are sometimes better known in one market than another and investors may have a preference for assets denominated in a particular currency. See for further detail the box 'International funding arbitrage' (2000), *Bank of England Quarterly Bulletin*, May, pages 130–31.
(2) These fund managers are commonly known as asset swappers because they swap the income stream from their foreign-currency asset holdings into short-term floating interest rate payments.
(3) For more on UK banks' foreign-currency funding activity, see Speight, G and Parkinson, S (2003), 'Large UK-owned banks' funding patterns: recent changes and implications', *Bank of England Financial Stability Review*, December, pages 135–42.

Chart 21
Selected equity indices (local currency)

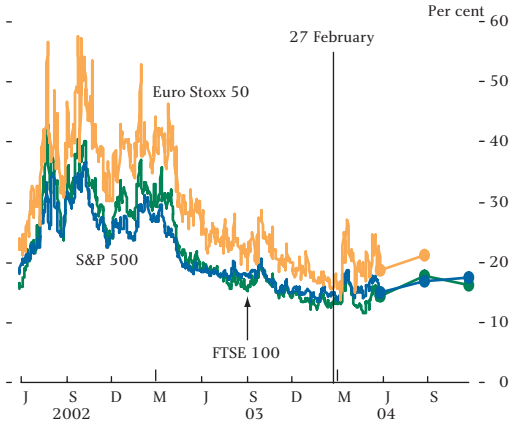


Source: Thomson Financial Datastream.

should also reflect the expected growth rate of future corporate earnings. The S&P 500 fell despite many US companies announcing higher-than-expected earnings and a slight rise in expected earnings growth, consistent with the decline being driven by higher expected real interest rates as monetary accommodation is withdrawn.

Three-month implied volatilities of equity indices, a measure of equity market uncertainty, increased over the period. Following the Madrid attacks, there was a short-lived spike in uncertainty, most notably for the Euro Stoxx (Chart 22). Longer-maturity equity option prices suggest uncertainty was somewhat greater at six and twelve-month horizons—as illustrated by the dots in Chart 22—though by historical standards it remained low.

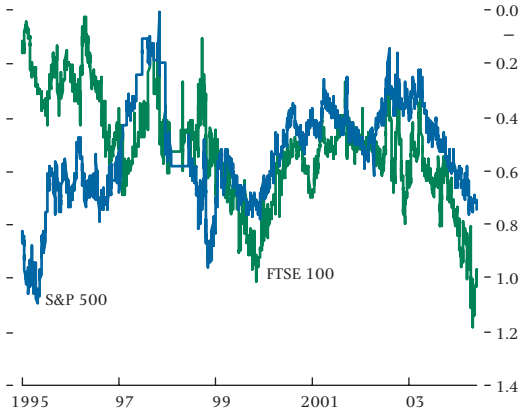
Chart 22
Three-month implied volatilities of selected equity indices(a)



(a) The solid lines show three-month implied volatility in per cent. The dots indicate the three-month volatility three, six and nine months ahead respectively.

Information from options prices might suggest that the downside risk to equities has increased, particularly for the FTSE 100—the downside skew to the FTSE 100 is large by historical standards and greater than that to the S&P 500. Market contacts suggest that this may reflect not the probabilities attached to a fall, but rather moves by UK insurance companies to buy protection against large equity price falls which, were they to occur, could potentially raise solvency concerns.

Chart 23
Six-month skew of FTSE 100 and S&P 500 derived from options prices

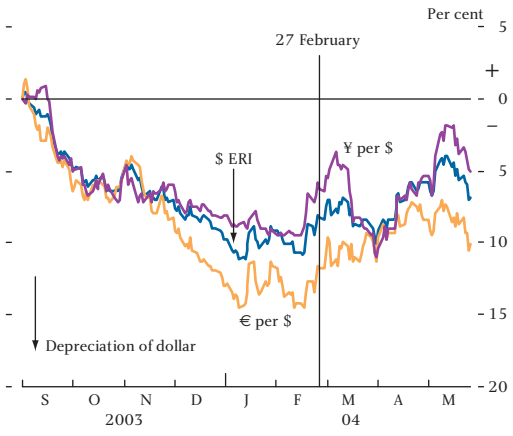


Exchange rates

Just as the changed macroeconomic outlook and yield curve have affected emerging market and high-yield credit spreads, so have they affected foreign exchange markets.

Both the dollar ERI and the Federal Reserve's broad index rose by about 1.5% between 27 February and 28 May (Chart 24). The direction of this move was consistent with the upward revision to dollar interest rates relative to sterling, euro and yen rates across the curve. In particular, the dollar rose significantly in April

Chart 24
Cumulative changes in US dollar exchange rates since 1 September 2003

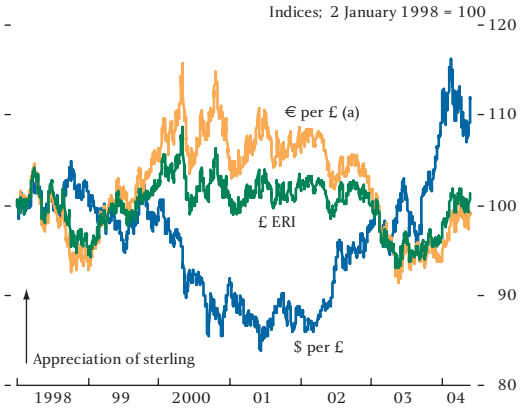


Sources: Bank of England and Bloomberg.

and May, following the strong US employment data in both months (Chart 24).

The sterling ERI was broadly unchanged between 27 February and 28 May. Sterling depreciated by just over 1% against the US dollar and rose slightly against the euro, having reached a 14-month high against the euro on 13 April. Between January 2004 and the end of May, the sterling ERI remained between 102 and 109. It previously traded in this range between 2000 and the start of February 2003. Compared with then, however, bilateral rates were different, with sterling being stronger against the dollar and weaker against the euro than during 2001–02 (Chart 25).

Chart 25
Sterling exchange rates



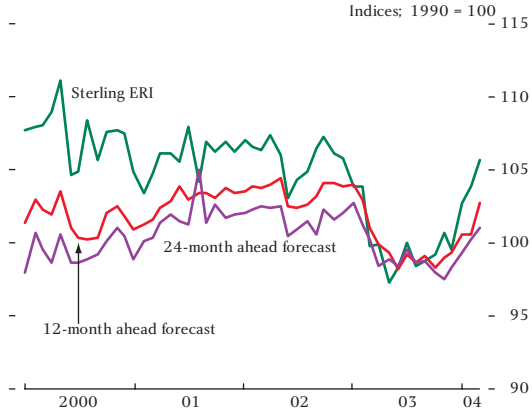
Sources: Bank of England and Bloomberg.

(a) Deutsche marks per pound before 1999.

Consensus surveys during the period suggested that not all the sterling ERI appreciation since January 2004 was expected to persist over the following year or two, though these surveys have underpredicted sterling strength in the past (Chart 26).

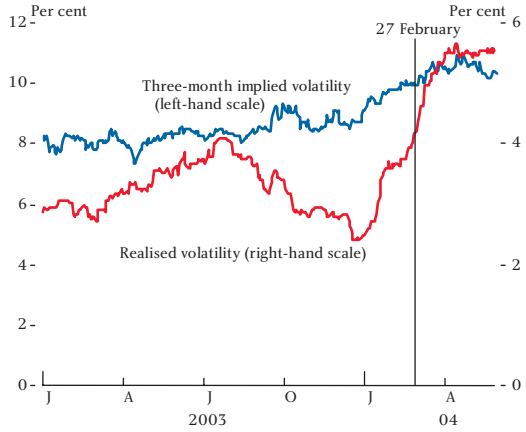
Realised volatility in the sterling/dollar exchange rate, measured by the annualised three-month standard deviations, increased sharply during the review period, reaching its highest level since the early 1990s. Realised volatility increased by about 3 percentage points between 27 February and 28 May, compared with an increase of around 0.5 percentage points in implied volatility from foreign exchange options. Market contacts suggest that this might reflect both demand for sterling as a high-yielding currency, and recent unwinding of these carry trades as the US rate outlook improved.

Chart 26
Sterling ERI, spot and Consensus Forecast



Sources: Bank of England and Consensus Economics.

Chart 27
Implied and realised sterling/dollar volatility since 2 January 2003



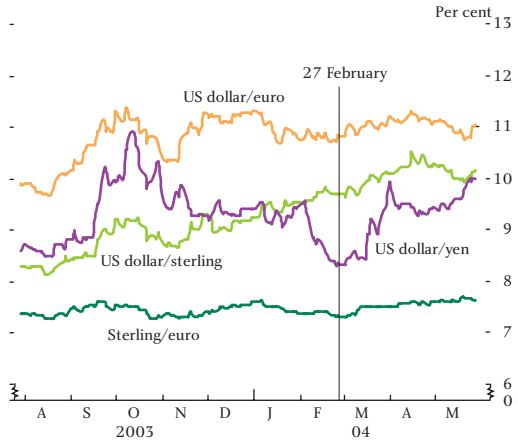
Sources: Bank of England and Bloomberg.

Intervention by the Bank of Japan supported the dollar relative to the yen during the first half of March, but during the week beginning 15 March there was market and press speculation that the intervention policy was changing. Dollar/yen implied volatility (Chart 28) rose. Following the September G7 meeting the Bank of Japan's intervention policy was cited as accounting for the divergence between three-month and twelve-month dollar/yen risk reversals.(1) Twelve-month risk reversals had suggested that the balance of risks was weighted towards a further dollar depreciation against the yen, but intervention had reduced the risks of this happening in the short term, driving down the three-month risk reversal (Chart 29). The speculation about a change in intervention policy was associated with a brief spike up in three-month dollar/yen risk reversals.

Market contacts had reported that at longer maturities the magnitude of the dollar/yen risk reversal reflected

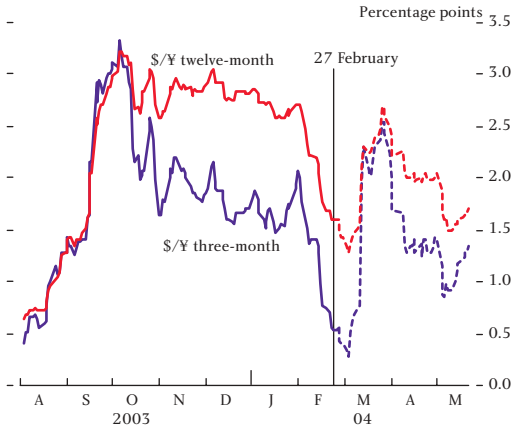
(1) A risk reversal is a financial instrument for which the pay-off depends on the sign and magnitude of exchange rate moves. Its price, therefore, provides information about the perceived balance of risks around the forward exchange rate.

Chart 28
Twelve-month implied foreign exchange volatilities



Source: British Bankers' Association.

Chart 29
Foreign exchange risk reversals(a)



Sources: Bank of England and British Bankers' Association.

(a) A positive number indicates the balance of risk is towards a yen appreciation versus dollar.

purchases of insurance against large spot moves associated with hedging of another type of foreign exchange derivative called a power reverse dual-currency note.(1) These notes, which offer yield enhancement in exchange for exposure to dollar/yen currency risk, became popular during the period of low nominal interest rates and may be another manifestation of the search for yield. Going forward, as nominal yields rise, such yield-enhancing trades may become less popular and a key question is whether the unwinding of positions in such trades will be orderly.

Developments in market structure

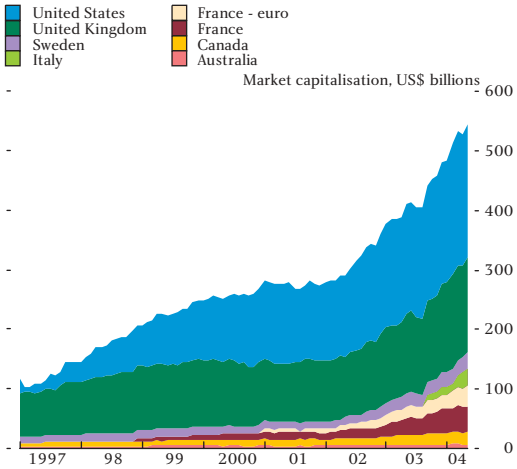
This section provides an update on some significant structural developments in domestic and overseas markets, as well as noting a new publication on the securities lending market.

International 'real' bond markets

In March 2004, Japan became the latest country to issue inflation-protected government debt, with a ¥100 billion 'real' bond. The bond had a maturity of ten years, with an indexation lag of two to three months. The Bank of Japan has since announced plans to issue a ¥300 billion 'real' bond on 3 June, with a further ¥300 billion of issuance expected in December.

The issuance of Japan's first such bond comes against a background in which the market for inflation-protected debt (both government and non-government) has been growing significantly. The market capitalisation of major government real bond markets has now reached over US$500 billion (Chart 30). The box on pages 124–25 discusses the development of government real bond markets in greater detail, and discusses similarities and differences between the bonds of different issuers.

Chart 30
Market capitalisation of major government real bond markets



Sources: Barclays Capital inflation-linked bond indices and Bloomberg.

For central banks, the existence of real as well as nominal government bonds of different maturities is invaluable, as it makes it possible to derive term structures of real interest rates and implied measures of future inflation. Forward inflation can be a measure of whether inflation expectations are well anchored and therefore of the credibility of the monetary policy regime. Real interest rates can help policymakers to gauge the perceived stance of monetary policy.

(1) For more on these notes, see Rule, D, Garratt, A and Rummel, O, 'Structured note markets: products, participants and links to wholesale derivatives markets', (forthcoming in June *Bank of England Financial Stability Review*).

Inflation-protected bonds and swaps

In recent years, there has been significant growth in the market for inflation-linked bonds and derivatives. Growth has been particularly strong in the issuance of government bonds and the market for inflation swaps, both of which are discussed in further detail below. Non-government issuers have also issued an increasing amount of inflation-protected bonds—in the United Kingdom, for example, these have included utilities and private finance initiative (PFI) projects, where, in both cases, revenues are closely linked to consumer price inflation. And in the United States, in February 2004, the Chicago Mercantile Exchange launched its new CPI futures contracts out to three years, although open interest in this instrument is currently low at around 1,000 contracts.

Issuance of government inflation-protected bonds

The UK government issued its first index-linked gilt in 1981, becoming the first G7 country to issue inflation-protected or 'real' bonds. Since then, the governments of several other G7 and non-G7 countries have begun to issue real bonds, including: New Zealand (1983), Australia (1985), Canada (1991), Sweden (1994), the United States (1997), Greece (1997), France (1998), Italy (2003) and Japan (2004).

At end-2003, the amount outstanding of index-linked gilts was £78 billion, 27% of the total gilt market, in nominal terms (Table 1). The largest real government bond market in terms of the nominal amount outstanding is in the United States ($176 billion at end-2003). However, as a percentage of all Treasury bonds, Treasury Inflation Protected Securities (TIPS) account for only 7% of the market. In the euro area, real bonds currently account for an even smaller proportion of the total market, as only three countries issue them.

Table 1
Size of major government inflation-linked (IL) bond markets at end-2003

Country	Size (billions)	Size (£ billions)	Per cent of govt. bonds	No. of IL bonds
United Kingdom	£78	78.0	27	10
United States	$176	98.7	7	11
France	51	35.9	6	5
Sweden	SEK171	13.3	25	6
Italy	10	7.0	1	1
Greece	1.3	0.9	1	1
Canada	C$20	8.6	7	4
Australia	A$6.6	2.8	15	4
New Zealand	NZ$1.5	0.6	5	1

Sources: Barclays Capital, Deutsche Bank Research, and various government and central bank web sites.

Table 2
Indexation conventions of different government inflation-linked bonds

Country	Index used	Indexation lag	Floor
United Kingdom	RPI	8 months	No
United States	US CPI-Urban NSA	2–3 months	Par
France (OATi)	French CPI excl. tobacco	2–3 months	Par
France (OATei)	Euro-area HICP excl. tobacco	2–3 months	Par
Sweden	CPI	2–3 months	Par (new issues)
Italy	Euro-area HICP excl. tobacco	2–3 months	Par
Greece	Euro-area HICP excl. tobacco	2–3 months	Par
Canada	CPI all groups, NSA	2–3 months	No
Australia	ACIF (CPI all groups)	6 months	Par (coupon and principal)
New Zealand	CPI all groups	6 months	No
Japan	CPI (excl. perishables)	2–3 months	No

Sources: Barclays Capital, Deutsche Bank Research, and various government and central bank web sites.

For most government inflation-protected bonds, the reference price index is a domestic measure of consumer prices (Table 2). But in France, while some bonds (OATi) are linked to a domestic measure (French CPI excluding tobacco), others (OATei) are linked to a euro area wide measure (euro-area HICP excluding tobacco). The latter has become the most common reference price index in the euro area, with the current Italian and Greek government inflation-protected bonds referenced to the same measure.

The calculation of the inflation element can also vary, with the markets established in the 1980s generally having a longer indexation lag than markets established more recently. In the United Kingdom, interest payments and the principal repayment depend on the level of RPI around eight months before the payment is made. Australian and New Zealand index-linked bonds have a six-month lag, while other major markets generally have a two to three-month indexation lag.

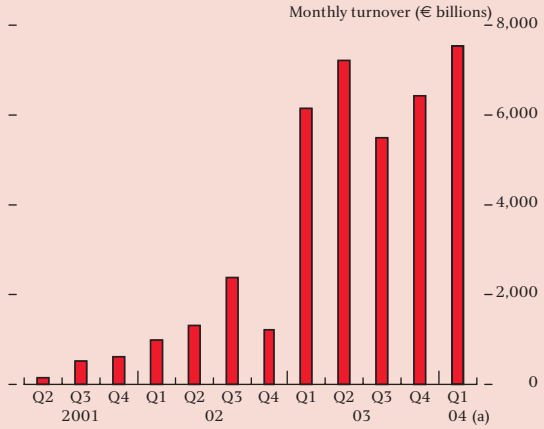
Another important design difference concerns whether, in the event of deflation over the life of the bond, investors receive nominal principal back in full (a par floor), or whether the nominal principal is reduced in line with the fall in the index (preserving its real value). There is no floor for any real bonds issued in the United Kingdom, Canada and New Zealand, for the first four bonds issued in Sweden and for the new Japanese government real bond. Meanwhile, Swedish bonds issued after the first four issues, as well as all bonds issued in France, the United States and Australia, do pay the nominal principal back in full when its real value has been eroded by deflation. Australian real bonds also provide a nominal par floor on coupons.

Inflation-linked bonds have proved popular with institutional investors, and more recently this popularity has led non-government institutions to expand the range of instruments that provide inflation protection.

Inflation swaps

Turnover in inflation swap markets has grown rapidly, particularly in euros (Chart A). One driver for the growth of this market has been demand to hedge structured notes.

Chart A
Growth of inflation swap turnover

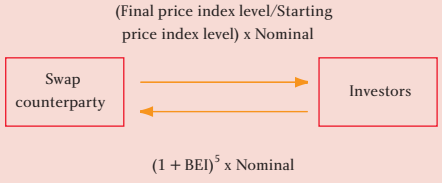


Source: ICAP.

(a) March 2004 data unavailable; 2004 Q1 data show January and February only.

A major benefit of inflation derivatives is that the pay-off structure can be matched to the exact needs of the counterparty, and hence their importance for dealers of tailor-made structured notes. They allow flexibility in terms of floors, caps or swaptions, as well as allowing for a wider variety of reference price indices than available in government bond markets. One of the more common uses of inflation swaps in relation to principal-protected structured notes is to exchange at maturity a payment linked to actual inflation over the life of the note for one linked to expected inflation at the outset, as derived from market prices (Diagram A).

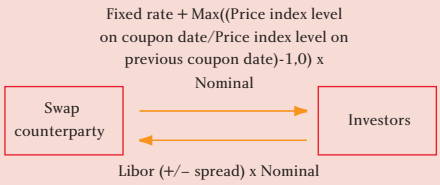
Diagram A
Break-even/zero-coupon inflation swap cash-flow structure



Expected inflation, the so-called break-even inflation rate (BEI) over the maturity of the swap can be derived from the difference between the rate implied by the nominal yield curve and the rate implied by an equivalent real yield curve, at the same point as the maturity of the swap. Hence, if inflation was higher than initially expected, the investor is compensated. A floor is sometimes added to the structure if investors want to protect themselves against a prolonged period of deflation.

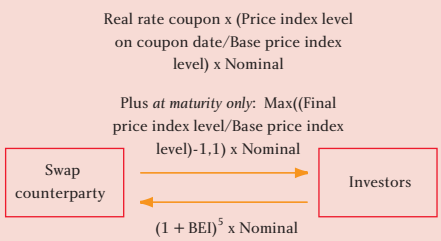
With the pay-as-you-go swap (Diagram B), unlike for a typical inflation-linked bond, there is no inflation uplift added to the nominal amount repaid at maturity. Instead, the investor receives a guaranteed minimum fixed-rate coupon, plus an additional amount, typically floored at zero, dependent on the inflation over each coupon period.

Diagram B
Pay-as-you-go inflation swap cash-flow structure



Finally, as the name suggests, a synthetic inflation-linked bond has a coupon and redemption pay-off structure similar to that of government inflation-linked bonds, and as such is sometimes known as a TIPS-style swap (Diagram C). As for many government inflation-linked bonds, there is usually a par floor on the nominal amount repaid at maturity.

Diagram C
Synthetic inflation-linked bond with par floor cash-flow structure



Such inflation derivatives provide policymakers with another useful measure of market-implied inflation rates.

Review of European collateral framework

On 10 May, the ECB announced the results of its review of the Eurosystem's collateral framework. In a press release, the ECB noted that the Governing Council had approved the gradual replacement of the current two-tier system of eligible collateral with a single list, in order to 'enhance the level playing field in the euro area, to further promote equal treatment for counterparties and issuers, and increase the overall transparency of the collateral framework'.(1)

At present, the ECB maintains two lists of eligible collateral for Eurosystem operations, known as Tier 1 and Tier 2.(2) Eligibility criteria for securities on the Tier 1 list are specified by the ECB whereas, subject to approval by the ECB, eligibility criteria for assets on the Tier 2 list are specified by the relevant national central banks.(3) Tier 1 securities are euro-denominated marketable debt instruments of high credit quality. Tier 2 securities include equities and non-marketable assets such as bank loans.

The transition to the single list is scheduled for completion in May 2007. As well as all securities currently on the Tier 1 list, the single list will include euro-denominated securities issued by entities established in the G10 countries that are not part of the EEA (currently the United States, Canada, Japan and Switzerland), provided they are issued into a European settlement system. A final list of eligible assets, including the newly eligible G10 securities, will be published in May 2005. All the securities listed will be subject to a requirement that they are quoted on a regulated market, or specific non-regulated markets approved by the ECB; the ECB has altered the list of approved non-regulated markets to exclude some over-the-counter (OTC) markets. Assets traded on newly ineligible markets will be phased out before May 2007.

The Bank of England currently accepts ECB Tier 1 securities as collateral for intraday liquidity in CHAPS Euro (and in CHAPS Sterling). In the new framework, as now, national central banks that are not part of the euro area, including the Bank of England, will not be obliged to accept all collateral from the single list in their euro payments systems (such as CHAPS Euro in the United Kingdom) and, also as now, will be able to accept alternative collateral having at least the same quality as the single list.

Changes to the London gold fixing

The London Gold Fix is widely known as an international pricing benchmark. On 29 April 2004, the members of the Fix announced changes to its operation. Since 5 May, a telephone conference call has replaced the twice-daily physical meetings. A web-based application to allow viewing of the fixing process is to be introduced later in 2004.

ScotiaMocatta has taken over the chair of the Fix, following the withdrawal of NM Rothschild London, which had chaired the Fix since 1919. In future, the chairmanship will rotate annually. The other members are Deutsche, HSBC, Société Générale, and Barclays, which replaces Rothschild.

Securities lending publication

In March, the Securities Lending and Repo Committee (SLRC), chaired by the Bank of England, cosponsored the publication of 'An introduction to securities lending' with the Association of Corporate Treasurers, the British Bankers' Association, the International Securities Lending Association, the London Investment Banking Association and the London Stock Exchange. The publication was welcomed by the National Association of Pension Funds and the Association of British Insurers.

Securities lending provides liquidity to the equity, bond and money markets, making it central to the functioning of the financial system. The ability to borrow and lend securities supports many of the activities of dealers and asset managers. 'An introduction to securities lending' is available on the web sites of the sponsoring organisations, including www.bankofengland.co.uk/slrc.

Bank of England official operations

Changes in the Bank of England balance sheet

Table B summarises changes in the components of the Bank's balance sheet between 25 February 2004 and 26 May 2004.

(1) ECB press release, 10 May 2004.
(2) Both Tier 1 and Tier 2 securities are accepted as collateral in the Eurosystem's payments systems, open market operations and standing facilities, although Tier 2 securities are not normally used for outright transactions.
(3) For the specific eligibility criteria of Tier 1 and Tier 2 assets, refer to Chapter 6 of the ECB manual 'The implementation of monetary policy in the euro area: general documentation on Eurosystem monetary policy instruments and procedures', February 2004, available at www.ecb.int/pub/pdf/gendoc2004en.pdf.

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

£ billions

Liabilities	26 May	25 Feb.	Assets	26 May	25 Feb.
Bank note issue	35	33	Stock of refinancing	23	21
Settlement bank balances	<0.1	<0.1	Ways and Means advance	13	13
Other sterling deposits, cash ratio deposits and the Bank of England's capital and reserves	7	6	Other sterling-denominated assets	4	4
Foreign currency denominated liabilities	10	9	Foreign currency denominated assets	12	10
Total (c)	**52**	**48**	**Total** (c)	**52**	**48**

(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.
(c) Figures may not sum to totals due to rounding.

There was an increase in the both the sterling and foreign-currency components of the Bank's balance sheet over the period. On 16 March 2004, the Bank auctioned a further €1 billion of the 2007 note as part of its euro-denominated notes programme. The auction was covered 2.2 times and the average accepted yield was 2.509%, 11.5 basis points below the prevailing three-year swap rate. This increased the total nominal value of the 2007 note outstanding in the market to €2 billion, and the total nominal value of Bank euro notes outstanding in the market to €6 billion.

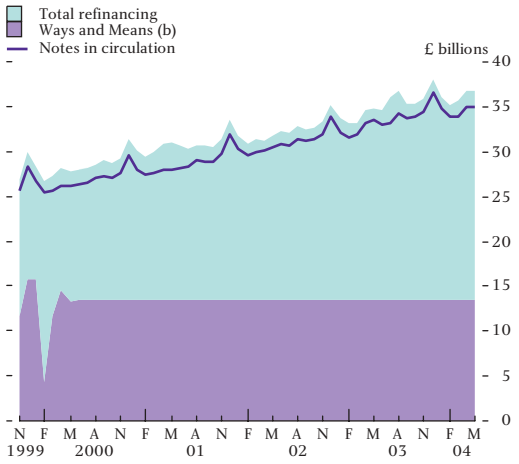
The Bank maintained the nominal value of its three-month and six-month euro-denominated bills outstanding at €3.6 billion, by rolling over maturing bills at auctions held monthly during the period. Average three-month issuance spreads narrowed slightly and were 8.2 basis points below Euribor, compared with 9.7 basis points in the previous period (November-February); average six-month bills spreads were 10.5 basis points below Euribor, compared with 11.7 basis points previously.

Notes in circulation, by far the largest sterling liability on the Bank's balance sheet, increased over the period, driven by increased demand over the Easter and May Day Bank Holidays. Notes in circulation reached a peak of £38 billion prior to Good Friday.

The stock of refinancing, which comprises assets taken by the Bank in its open market operations (OMOs), moved broadly in line with the level of notes in circulation (Chart 31).

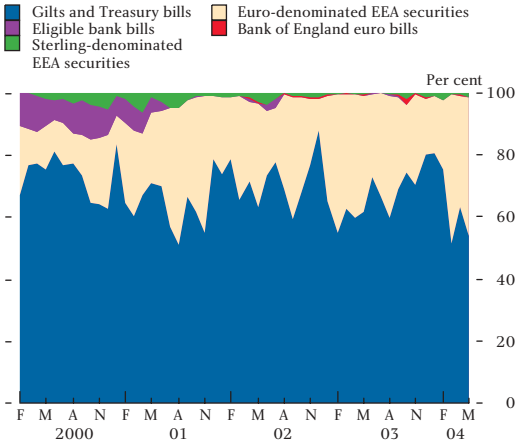
The Bank's counterparties made increased use of euro-denominated European Economic Area (EEA) government debt as collateral against the Bank's lending in OMOs during the latest quarter (Chart 32).

Chart 31
Bank notes in circulation, the stock of refinancing, and 'Ways and Means'[a]



(a) Monthly averages.
(b) An illiquid 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.

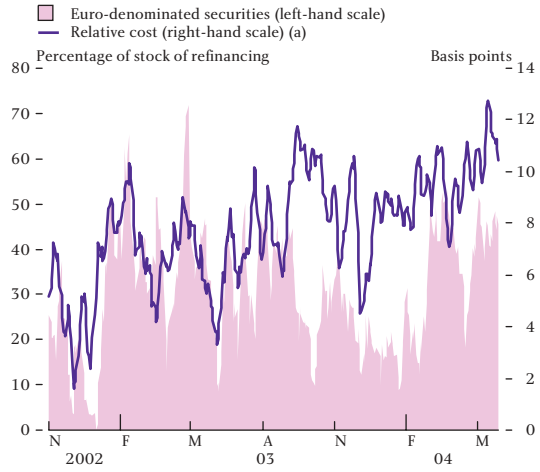
Chart 32
Instruments used as OMO collateral[a]



(a) Monthly averages.

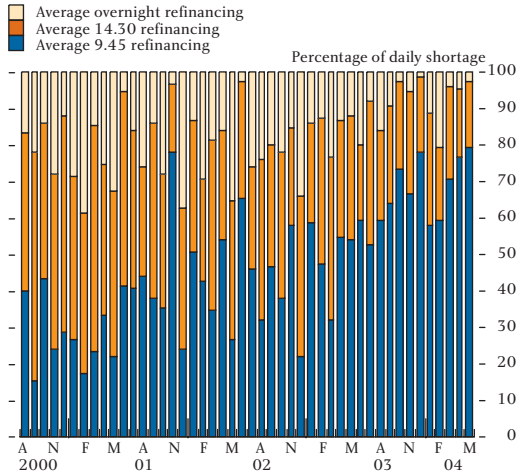
In part, this reflected a fall in the cost of using euro-denominated collateral over the quarter relative to gilts (Chart 33). Another factor may have been less use of the Bank's overnight lending facilities (Chart 34). Due to settlement timetable constraints, EEA government debt securities cannot be delivered as

Chart 33
Relative cost and use in OMOs of euro-denominated EEA government securities



(a) Relative cost calculated as 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.

Chart 34
Refinancing provided in the Bank's open market operations(a)



(a) Monthly averages.

collateral in the Bank's overnight dealing rounds unless pre-positioned by counterparties with the Bank as intraday collateral within the RTGS payments system.

From 4 May 2004, the Bank of England introduced a requirement that, in order to be eligible for use as collateral in OMOs, sterling and euro-denominated bonds issued by EEA sovereigns or international organisations should be rated Aa3 (on the Moody's scale) or higher by two or more of the major ratings agencies. This was to ensure that the Bank's collateral is always of high credit quality.

Short-dated interest rates

Volatility of sterling overnight interest rates fell sharply (Chart 35) following the publication by the Bank of

Chart 35
The sterling overnight interest rate and official repo rate

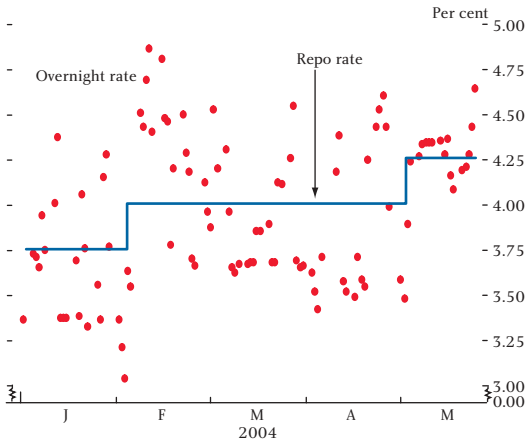
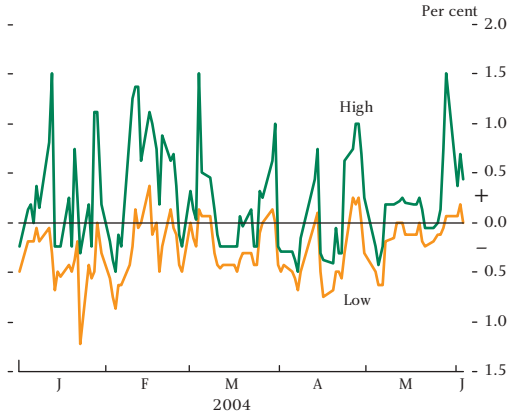


Chart 36
Volatility of the sterling overnight interest rate(a)



(a) High and low of the day observed by the Bank's dealing desk as a spread to the policy rate.

England of a consultative paper on its operations in the sterling money market (see the box opposite). The spread between the daily fixing for the overnight rate and the MPC's repo rate has also narrowed somewhat (Chart 36); since the publication of the consultative paper on 7 May, the average overnight rate has been 4.28%.

In the week leading up to the MPC's 5–6 May meeting, many market participants were expecting an increase in the Bank's repo rate to 4.25%, and demand to borrow in the Bank's two-week operations increased. The bid/cover ratio (the amount of bids divided by the size of the funds available) averaged 4.5. Expectations of a rate rise also led to a fall in overnight market interest rates. On 5 May, the intraday overnight interbank rate fell to a low of 3.375%, some 62.5 basis points below the then current policy rate.

Reform of the Bank of England's operations in the sterling money markets

In October 2003, the Governor announced a review of the Bank's operations in the sterling money markets.(1) Since then, the Bank has held discussions with more than 60 market participants and has studied the operational frameworks of many overseas central banks.

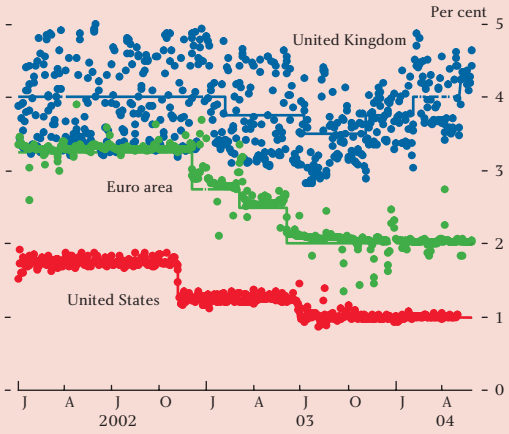
On 7 May 2004, the Bank published a consultative paper.(2) The paper set out the objectives of the Bank's operational framework, its reasons for reform and described various options for the architecture of a new framework. Comments were invited from any interested parties by 11 June.

The purpose of the Bank's operations in the sterling money markets is to implement the Monetary Policy Committee's (MPC's) interest rate decisions while meeting the liquidity needs, and so contributing to the stability, of the banking system. Under the terms of the review, this will not change. But in seeking to implement the MPC's interest rate decisions through its operations, the Bank will aim to control overnight interest rates much more closely, while improving the framework for banking system liquidity management. In particular, the Bank will have the following four objectives:

- Overnight market interest rates to be in line with the MPC's repo rate up to the next MPC decision date, with very limited day-to-day or intraday volatility.
- An efficient, safe and flexible framework for banking system liquidity management, both in normal and stressed conditions.
- A simple, straightforward and transparent operational framework.
- Competitive and fair sterling money markets.

The primary reason for change is that the current operational framework leaves sterling overnight interest rates considerably more volatile than is desirable, as illustrated by comparison with those of other major currencies (see Chart A).

Chart A
International overnight interest rates and policy rates



The paper has already formed the basis of further discussions with market participants; the Bank has also received a number of written comments. In due course, the Bank will issue a further paper setting out its conclusions, and will consult, as necessary, on questions of detail and implementation.

(1) See www.bankofengland.co.uk/pressreleases/2003/110.htm, and the box in the Winter 2003 *Quarterly Bulletin*.
(2) For the entire consultative paper, see pages 217–27 of this *Quarterly Bulletin*.

Such developments are referred to as 'pivoting' and reflect a process of normal market arbitrage, by which market rates ahead of the meeting adjust to equalise the cost of borrowing from the Bank at two weeks (so spanning the MPC meeting on 5–6 May) with the expected cost of rolling borrowing in the overnight market over the same period. In its recent consultative paper the Bank announced that it intends to cease lending at a fixed rate for maturities beyond the next MPC decision date as part of the planned reforms of its operations in the sterling money markets. This should eliminate such pivoting, and the associated distortion to overnight rates.

Table C
Intraday forecasts versus actual shortages

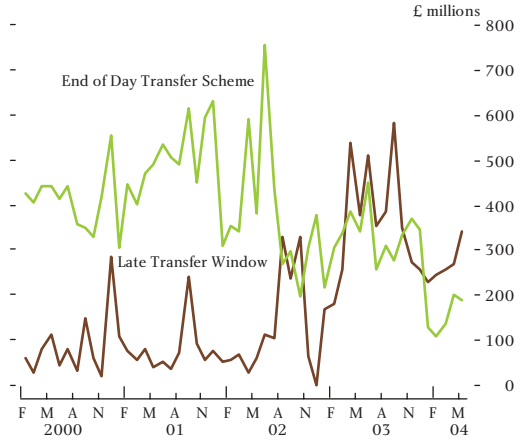
Mean absolute difference (standard deviation), £ millions

	9.45 forecast	14.30 forecast	16.20 forecast
2002	83 (107)	43 (79)	30 (73)
2003	101 (123)	61 (96)	51 (85)
2003 Q1	80 (74)	45 (54)	33 (31)
2003 Q2	119 (131)	54 (76)	38 (43)
2003 Q3	118 (170)	92 (154)	85 (150)
2003 Q4	87 (91)	52 (57)	46 (36)
2004 Q1	120 (108)	79 (77)	55 (43)
April-May 2004	134 (137)	68 (96)	71 (91)

Forecasting the liquidity shortage

There was a small deterioration in the accuracy of the Bank's daily liquidity forecast during the latest period

Chart 37
Use of the Late Transfer Window and EoDTS(a)



(a) Monthly averages.

(Table C). In part, this reflected greater uncertainty over demand for bank notes around the Easter and May Day Bank Holidays.

There was some increase in use of both the End of Day Transfer Scheme (EoDTS) and the Late Transfer Window (LTW) by the settlement banks (Chart 37),[1] perhaps suggesting that they also saw some deterioration in the accuracy of their liquidity forecasting over the period. However, use remained lower than in 2003.

(1) For a description of the EoDTS, see page 163 of the Summer 2003 *Quarterly Bulletin*, or the APACS web site: www.apacs.org.uk/downloads/EoDT.pdf, and of the LTW, see page 406 of the Winter 2003 *Quarterly Bulletin*.