
Markets and operations

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

- *Volatility picked up in a number of asset markets towards the end of the period. In particular, emerging market asset prices and some commodity prices fell sharply. This seemed to reflect an adjustment in investors' perceptions of risk, at least in these markets.*
- *There was a more moderate pickup in volatility in sterling interest rate markets. Short-term nominal sterling interest rates rose over the period as a whole.*
- *Long-term nominal sterling rates also increased, on account of higher real rates and a pickup in inflation expectations and/or inflation risk premia. The rise in real rates was common across currencies.*
- *Despite higher interest rates and lower equity prices, corporate bond spreads did not widen much.*
- *The Bank implemented fundamental reforms to modernise its operations in the sterling money markets.*

During May, sterling markets were caught up in a global increase in asset price volatility. Commodities, equities and emerging market asset prices fell sharply.

These developments might have reflected a reappraisal of the global macroeconomic outlook. But consensus projections for economic growth in the major industrialised countries remained firm and there were few signs of slowing in corporate profit growth.

Some market commentators have highlighted a possible rise in global inflationary pressures as a reason for the asset price adjustment. Others have attributed it to changes in investors' perceptions of risk. According to contacts, some speculative investors have reduced their positions. Higher asset price volatility may have added to perceptions of somewhat greater risk, for example, through increased Value-at-Risk measures of traders' positions.

Equity markets

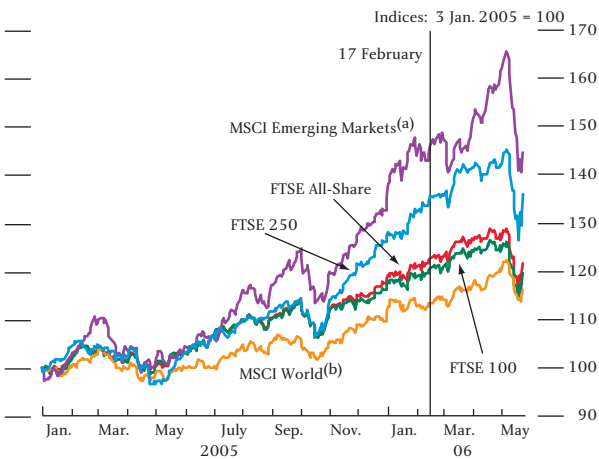
In the United Kingdom, the rise in financial market volatility was manifested in a sharp fall in equity indices. The FTSE All-Share declined 5.4% from its recent peak on 21 April, and around 1% over the period as a whole (Chart 1). Mid-cap stocks fell by more in mid-May, although the FTSE 250 ended the period more than 8% higher than at the start of 2006. At the same time, expected future volatility implied by option prices increased, especially at short horizons (Chart 2).

Long-term sterling real interest rates rose, which other things being equal might have been expected to reduce equity prices via higher discount rates. But whereas long-term real interest rates increased fairly steadily over the period, the equity price falls were sudden and concentrated toward the end of the period.

The equity price falls could have been amplified by hedging of some over-the-counter equity derivatives.

(1) This article focuses on sterling markets. The period under review in this article is 17 February (the data cut-off for the previous *Quarterly Bulletin*) to 26 May.

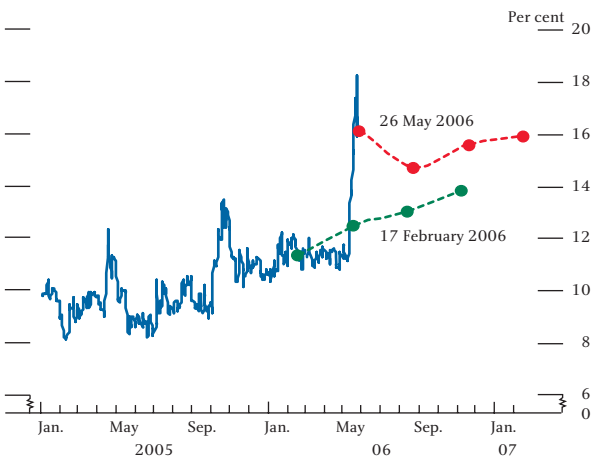
Chart 1
UK and international equity indices



Sources: Bloomberg, Morgan Stanley Capital International Inc. (MSCI) and Bank calculations.

- (a) The MSCI Emerging Markets index is a capitalisation-weighted index that monitors the performance of stocks in emerging markets.
- (b) The MSCI World index is a capitalisation-weighted index that monitors the performance of stocks from around the world.

Chart 2
FTSE 100 equity index implied volatility^(a)



Sources: Bank of England and Euronext.liffe.

- (a) The solid line shows three-month (constant maturity) implied volatility. The dots indicate three-month volatility, three, six and nine months ahead respectively.

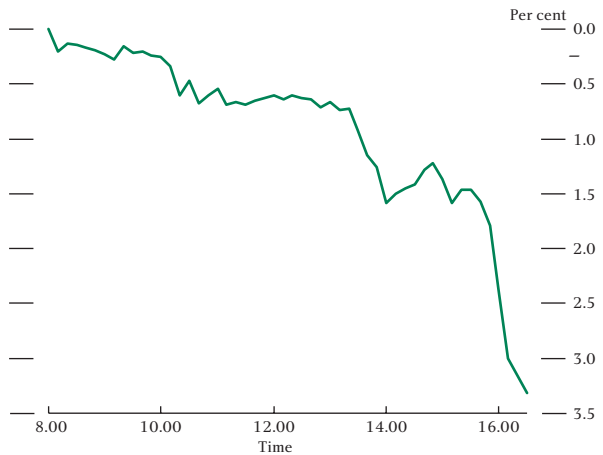
For example, as explained in the box on page 127, hedging of equity variance swaps might have added to volatility. The pay-off from a variance swap is typically computed using closing prices, so a trader's overall position may not be known until late in the day. As a result, hedging may be delayed until just before the market closes. This may have been the case on 17 May when the FTSE 100 index fell sharply in late trading (Chart 3). However, some market contacts believe this amplification effect was modest.

Commodities

Realised and implied volatility also rose sharply in some commodity markets, especially industrial and precious

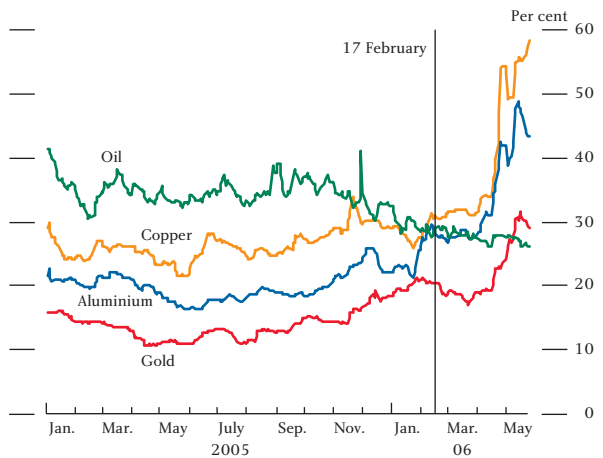
metals (Chart 4). At the same time, the prices of some commodities fell sharply, following a period of rapid rises.

Chart 3
Change in FTSE 100 on 17 May



Source: Bloomberg.

Chart 4
Three-month implied volatilities on selected commodity indices



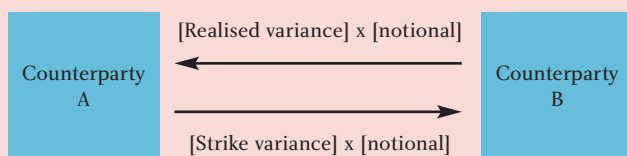
Sources: Bloomberg, COMEX, NYMEX and Bank calculations.

These earlier rises might have reflected pension funds increasing their exposure to commodities with the aim of increasing asset diversification and/or boosting overall returns. This has been facilitated by new investment vehicles such as exchange-traded funds (ETFs), commodity indices, and more sophisticated bespoke structured products. For example, the first silver ETF, launched in April 2006, accumulated an amount equivalent to more than 5% of total global inventories of silver in its first week of trading. Greater involvement of speculative investors might also have contributed to recent volatility.

Equity variance swaps

Variance swaps are instruments that allow investors to trade and hedge the volatility of asset prices. At maturity, the pay-off of the swap is equal to the difference between the realised variance in the underlying asset price over the life of the swap and the pre-agreed 'strike' variance (Chart A).

Chart A
Illustrative variance swap



Variance swaps provide a straightforward exposure to asset price volatility. To obtain a similar exposure using a 'vanilla' option would be more complicated because it is exposed to both the volatility and the level of the underlying asset price. Moreover, the sensitivity of the price of a vanilla option to changes in volatility depends upon the level of the underlying asset price. By contrast, a variance swap can provide a more stable exposure to volatility as its value does not depend directly on the price of the underlying asset.

Pricing and hedging

In principle, a variance swap is straightforward to price because its pay-off can be replicated with an appropriately weighted portfolio of vanilla options across a range of strike prices. Such a portfolio also provides a good hedge for a position in a variance swap. But to ensure that this portfolio remains a good hedge over time, it needs to be adjusted dynamically to neutralise the effect on its value of any changes in the underlying asset price. This is typically achieved by buying or selling an appropriate amount of the underlying asset, and is known as 'delta-hedging'; the so-called delta measures the sensitivity of an option price to changes in the price of the underlying asset.

In practice, even a delta-hedged portfolio of vanilla options is not a perfect hedge for a position in a

variance swap. First, an investor seeking to hedge a position in a variance swap may be restricted if options across a wide range of strike prices are not actively traded and/or if the cost of constructing the ideal hedge is prohibitive.

Second, the investor is exposed to so-called 'jump risk', ie the risk of sharp discontinuous jumps in the underlying asset price. The theoretical hedge assumes the underlying asset price evolves according to a continuous process. In the presence of jumps, there may be a mismatch between the impact on the variance swap and the hedge. For example, a jump downward in the underlying asset price would cause an investor hedging a long position in a variance swap with a short position in a portfolio of options to realise an overall loss — the gain on the swap would be less than the loss on the hedge.

Variance swaps and recent moves in equity indices

Some contacts have suggested that delta-hedging could have amplified recent falls in equity indices. More specifically, it has been reported that some traders, including hedge funds, sold a large amount of equity index variance swaps over the past year or so, as a way of maintaining returns in an environment of generally low financial market volatility. The counterpart was that equity derivative dealers bought volatility, which they may have hedged by selling vanilla equity options.

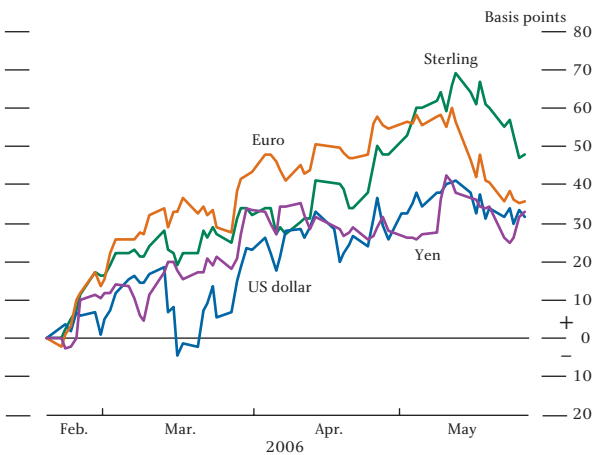
Selling vanilla options leaves a dealer 'short gamma'. Gamma measures the sensitivity of the delta to changes in the price of the underlying asset. Being 'short gamma' means that to delta-hedge a position, an investor should sell the underlying asset as its price declines.⁽¹⁾ For small price falls, only small adjustments are required for the position to remain delta-neutral. But when price moves are large, as was the case on some days during the review period, more material changes may be required. In turn, the additional selling pressure exerted by the hedges may amplify the initial price falls.

(1) For more information on 'short-gamma' option positions see the box entitled 'Market dynamics and options selling', *Bank of England Financial Stability Review*, June 2005, pages 60–61.

Short-term interest rates

Alongside the sharp rise in financial market volatility, short-term market interest rates in most developed economies declined towards the end of the period (Chart 5). Nonetheless, over the period as a whole, forward rates implied by short sterling futures contracts had increased. That occurred against a background of rising short-term market interest rates in the other major currencies and reflected further evidence of the continuing strength of global macroeconomic conditions and some signs of a slight pickup in inflationary pressure.

Chart 5
Cumulative changes in June 2007 interest rate futures contracts since 17 February



Sources: Bloomberg and Euronext.liffe.

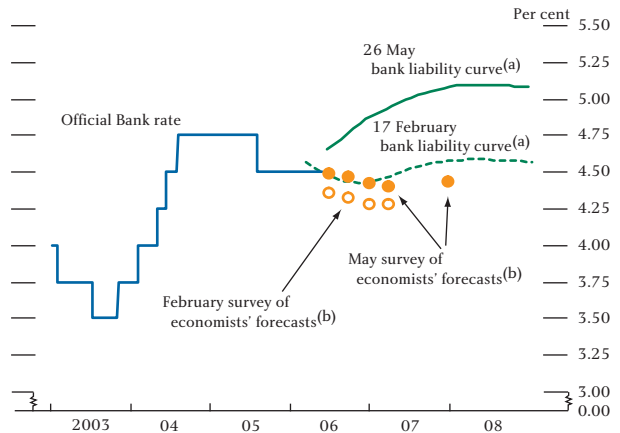
On 26 May, the profile for forward sterling interest rates (derived from instruments that settle on Libor) implied that, broadly, the market expected two 25 basis point increases in the official Bank rate over the next two years (Chart 6).

In contrast to information from financial markets, the May Reuters survey of UK economists' expectations suggested that the majority of economists expected the official Bank rate to remain at 4.5% until at least the end of 2007. As explained in the box on page 129, there are several possible reasons for the divergence between economists' expectations and market-based forward rates.

Measures of uncertainty surrounding short-term sterling interest rates increased over the period, and the skew of the implied distribution of future sterling interest rates became less negative (Chart 7). Early in the review period, market participants had assigned a higher probability to a large downward move in short-term

interest rates than a comparable upward move. By the end of May, option prices suggested a roughly balanced probability that sterling forward rates would rise or fall.

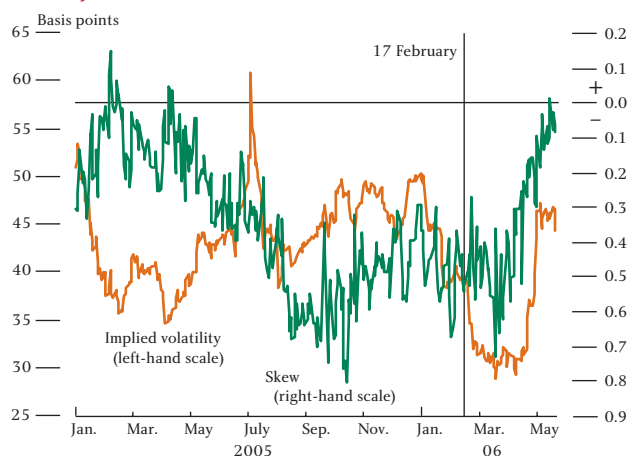
Chart 6
Sterling official and forward market interest rates plus survey expectations



Sources: Bank of England, Bloomberg, Euronext.liffe and Reuters.

- (a) One-day nominal forward rates implied by a curve fitted to a combination of instruments that settle on Libor.
- (b) Survey expectations based on mean of end-of-quarter forecasts.

Chart 7
Six-month implied volatility and skew from interest rate options



Sources: Bank of England and Euronext.liffe.

Exchange rates

Accompanying higher short-term sterling market interest rates, the sterling effective exchange rate index (ERI) rose by around 2% over the period, with most of the appreciation occurring towards the end of the review period (Chart 8). This largely reflected an increase in the value of sterling against the dollar of around 6½%.

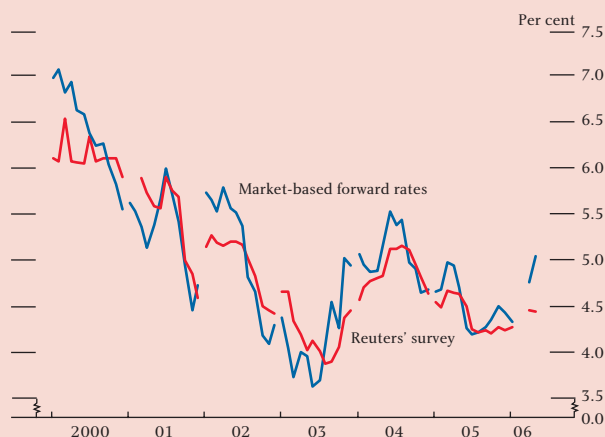
The dollar also depreciated against other currencies — its ERI fell by around 5%. Most of the fall occurred in the final month of the review period and, in particular, following the publication of a G7 communiqué in late

Forward rates and economists' expectations

In general, market-based sterling forward rates tend to track closely the mean expectation for the future official Bank rate from surveys of economists (Chart A). Since 2000, the average gap between the series has been only 6 basis points. In early May, the gap was 60 basis points, equivalent to nearly two standard deviations from the mean.

There are several possible reasons for the unusually large divergence observed recently, although their relative importance is unclear. First, economists may have had different views from financial market participants about the economic outlook and hence the path for future interest rates.

Chart A
Survey expectations and sterling forward interest rates^(a)



Sources: Bank of England, Bloomberg, Euronext.liffe and Reuters.

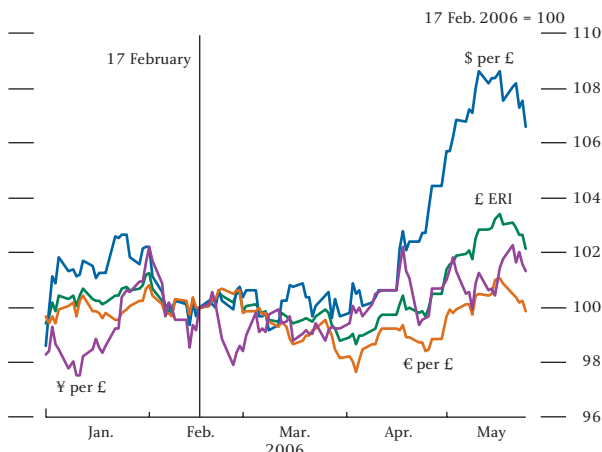
(a) Breaks in each series occur where the data refer to a different calendar year. The chart shows mean interest rate expectations for the end of the full calendar year following the survey date. Forward interest rates are taken from the Bank's interbank liability curve, with rates adjusted downwards by a moving average of the spread between six-month Libor rates and six-month GC repo rates to account crudely for the credit risk implicit in Libor rates.

Second, the two groups may update expectations at different times. Financial market prices typically adjust quickly in response to new information, whereas the economists surveyed may update their forecasts less regularly. This might imply a tendency for the market-based measure to lead mean survey expectations, for which there is some evidence, particularly during 2003 and 2004 H1.

Third, unlike survey expectations, market rates are likely to incorporate term premia that compensate investors for the uncertainty surrounding the path of future short-term interest rates.

April, which called for greater exchange rate flexibility in emerging economies, and especially China, to help reduce global imbalances.

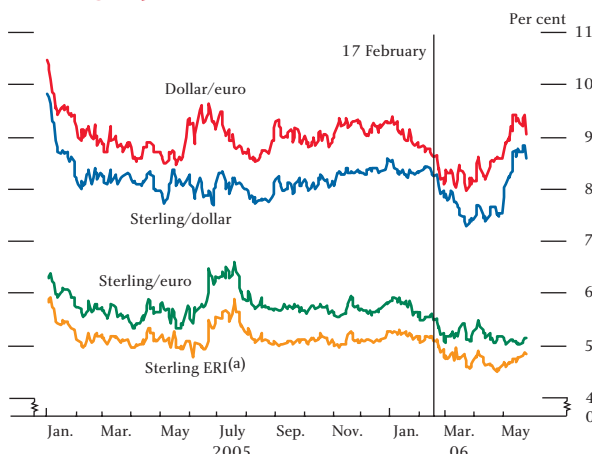
Chart 8
Cumulative change in sterling exchange rates



Source: Bloomberg.

Information from option prices suggests that uncertainty about the future level of the major dollar bilateral exchange rates increased slightly, particularly from early May onwards (Chart 9). But despite a rise in implied dollar-sterling volatility, based on techniques explained in the box on pages 130–31, the derived implied volatility for the sterling ERI fell slightly over recent months.

Chart 9
Three-month implied volatility from foreign exchange options



Sources: Bank of England and British Bankers' Association.

(a) Based on a simplified sterling ERI as discussed in the box on pages 130–31.

Moreover, the same information from option prices suggested that even if the dollar were to fall by a further 10% against the euro, the mean expectation was for a relatively small change in the sterling ERI. This reflects

Using option prices to derive a probability distribution for the sterling exchange rate index

Foreign currency option prices contain information about market participants' expectations of future movements in exchange rates. This box outlines a technique that uses option prices to gauge expectations about the future path of the sterling exchange rate index (ERI).⁽¹⁾

A 'simplified' sterling ERI probability distribution

As there is no actively traded market in options on the sterling ERI, the risks to the future value of the index cannot be inferred directly. An indirect approach is to model the probability distribution of a 'simplified' sterling ERI based solely on the prices of options on euro-sterling and dollar-sterling, which are the key bilateral exchange rates in the sterling ERI.⁽²⁾

A statistical tool (known as a copula function) can be used to map the euro-sterling and dollar-sterling implied distributions onto a joint distribution. The process by which this is done can be explained in the following steps:

Step one — Use option prices to estimate (risk-neutral) probability distributions for euro-sterling and dollar-sterling.⁽³⁾ Then construct a joint distribution using (arbitrary) initial values for the copula function parameters.

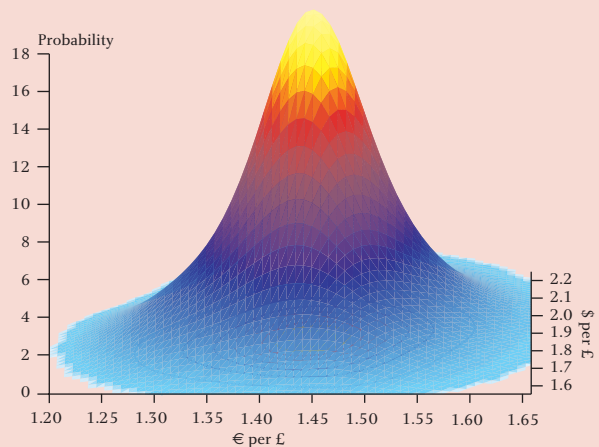
Step two — From this joint distribution, back out the implied marginal distribution for the euro-dollar exchange rate and compare it with a distribution estimated directly from euro-dollar option prices.

Step three — Update the parameters of the copula function so that they reduce the difference between the directly and indirectly inferred distributions for euro-dollar.

Step four — Repeat steps two and three until the difference between the two euro-dollar distributions is negligible.

An example of the resulting joint distribution for the euro-sterling and dollar-sterling exchange rates is shown in Chart A.

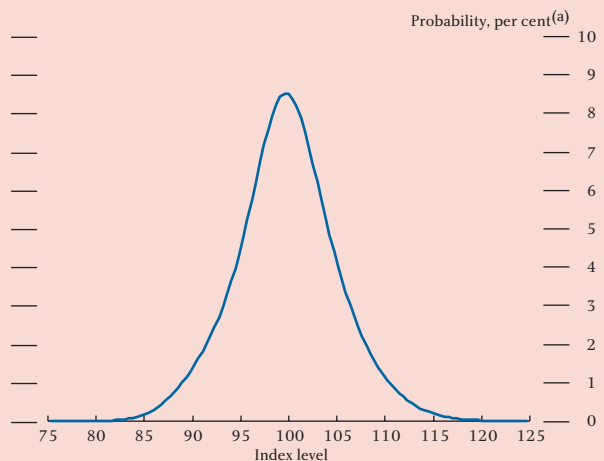
Chart A
Joint probability distribution



Source: Bank calculations.

From the joint distribution, an estimate of the implied probability distribution for the simplified sterling ERI can be constructed. More specifically, using weights of 0.7 for euro-sterling and 0.3 for dollar-sterling, it is possible to back out an implied probability distribution for the sterling ERI.⁽⁴⁾ Chart B shows the

Chart B
Twelve-month sterling ERI probability distribution



Source: Bank calculations.

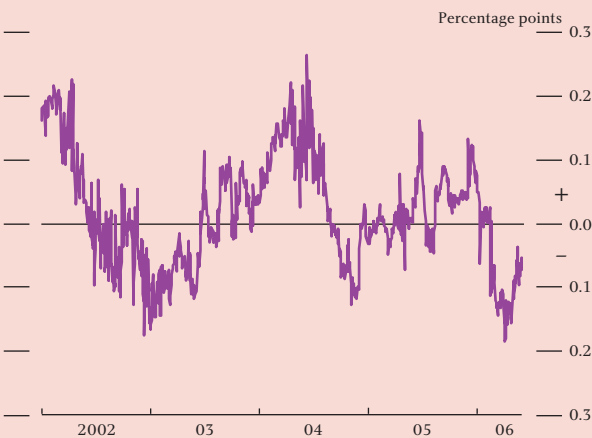
(a) Probability of the sterling ERI being within ± 0.5 index points of any given level. For example, the probability of the ERI being at 100 (between 99.50 and 100.50) in a year's time was around 9%.

(1) For a more in-depth discussion of this topic see Hurd, M, Salmon, M and Schleicher, C (2005), 'Using copulas to construct bivariate foreign exchange distributions with an application to the sterling exchange rate index', *CEPR Discussion Paper no. 5114*.
 (2) The euro-sterling exchange rate has a weight of around 55% and the dollar-sterling exchange rate a weight of around 20% in the sterling ERI.
 (3) For more details on risk-neutral distributions see Clews, R, Panigirtzoglou, N and Proudman, J (2000), 'Recent developments in extracting information from options markets', *Bank of England Quarterly Bulletin*, February, pages 50–60.
 (4) These weights were found by regressing euro-sterling and dollar-sterling against the overall ERI index.

distribution of the twelve-month ahead sterling ERI on 26 May 2006.

Given the probability distribution for the sterling ERI, it is possible to construct synthetic measures of implied volatility and risk-reversal statistics. Chart 9 in the main text shows that the implied volatility of the sterling ERI has declined a little over recent months. And, as shown in Chart C, the probability distribution has recently become less negatively skewed — on 26 May the perceived risks to the sterling ERI were broadly balanced.

Chart C
Twelve-month 'synthetic' risk reversal for the sterling ERI



Sources: Bank of England and British Bankers' Association.

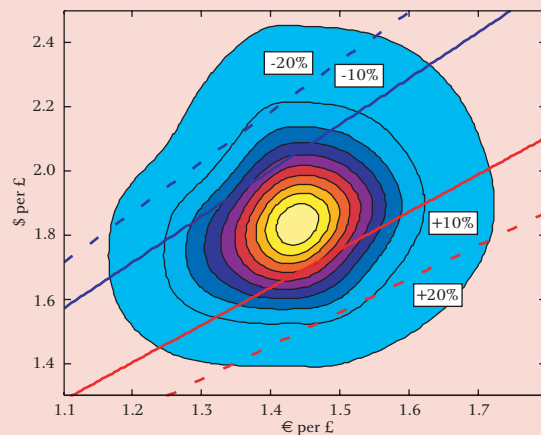
Estimating conditional probabilities

Another use of the joint distribution is to calculate conditional probabilities. For example, it is possible to construct an implied distribution for the sterling ERI over the next twelve months given an assumed change in the euro-dollar exchange rate.

Chart D shows an aerial view of the joint probability distribution for the simplified sterling ERI shown in Chart A. Essentially, a conditional distribution takes a vertical 'slice' of the joint distribution.⁽⁵⁾ The location of the 'slice' is determined by the combination of dollar-sterling and euro-sterling exchange rates that are consistent with the assumed fall in the euro-dollar exchange rate. The diagonal lines in Chart D correspond to the locations of the conditional distributions (or 'slices') for a 10% or

20% appreciation (+) or depreciation (-) of the dollar versus the euro.

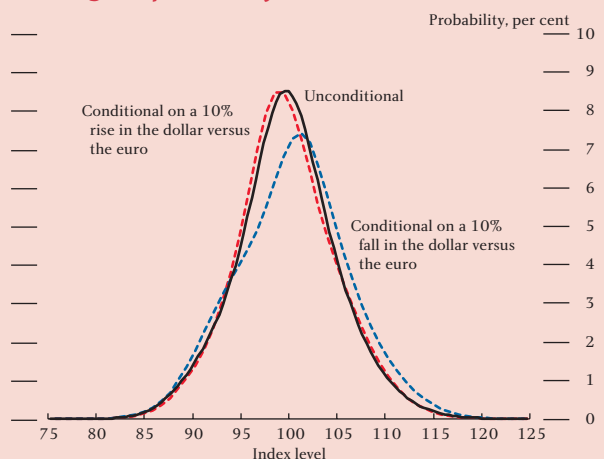
Chart D
Contour 'map' of joint probability distribution



Source: Bank calculations.

Chart E shows the conditional distributions for the sterling ERI in the event of a 10% fall/rise in the value of the dollar against the euro at the twelve-month horizon, as well as the unconditional distribution. At face value, the distributions indicate that option market participants perceived that even relatively large bilateral movements in the value of the dollar against the euro would tend have a relatively modest impact on the probability distribution of the ('simplified') sterling ERI.

Chart E
Twelve-month unconditional and conditional sterling ERI probability distributions^(a)



Source: Bank calculations.

(a) Probability of the sterling ERI being within ±0.5 index points of any given level.

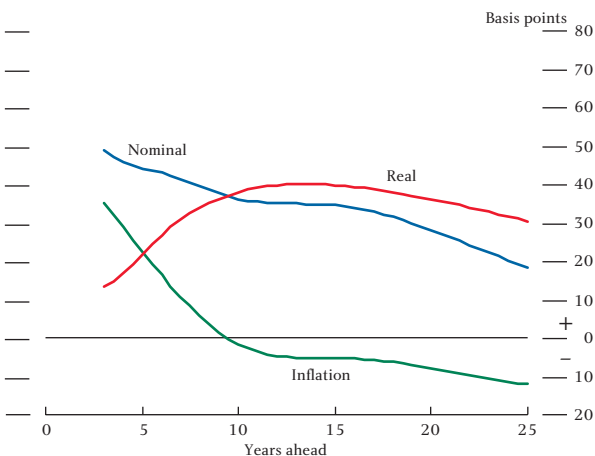
(5) More precisely, the conditional probabilities are calculated by applying Bayes' Law. See Hurd, Salmon and Schleicher (2005) for more details.

an expected appreciation of sterling against the dollar roughly offsetting an anticipated depreciation in sterling against the euro. And the risks around that conditional projection appeared to be broadly balanced (Chart E in the box on pages 130–31).

Long-term interest rates

Looking along the yield curve, sterling nominal forward rates rose (Chart 10). Out to around a five-year horizon, that predominantly reflected an increase in inflation expectations and/or inflation risk premia. Some market contacts reported that the move was consistent with the possibility of higher energy and commodity prices feeding through into consumer price inflation.

Chart 10
Changes in sterling forward curves since 17 February^(a)



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

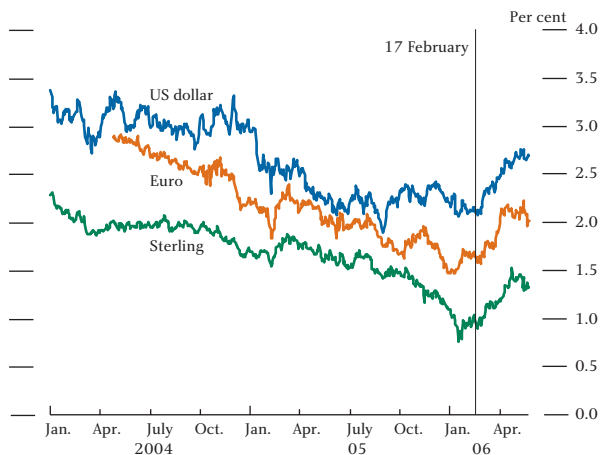
Sterling real forward rates rose across the curve. Much of the rise was in line with international long-term real rates, which increased steadily from mid-January until mid-May (Chart 11). However, towards the end of the review period long real forward rates fell slightly, perhaps reflecting some 'flight to quality' as financial market volatility rose and equity indices fell.

The increase in real forward rates over the period partly reversed the steady falls observed during the previous two years.⁽¹⁾ But just as it was difficult to be categorical about what had pushed them lower, so it is hard to be certain about the reasons for the recent rise.

It is possible that a change in sentiment among bond investors may have pushed up term premia on long-dated bonds over the review period. However,

implied volatilities derived from long-dated swaptions prices provided little evidence of a sharp pickup in uncertainty surrounding long-term interest rates.

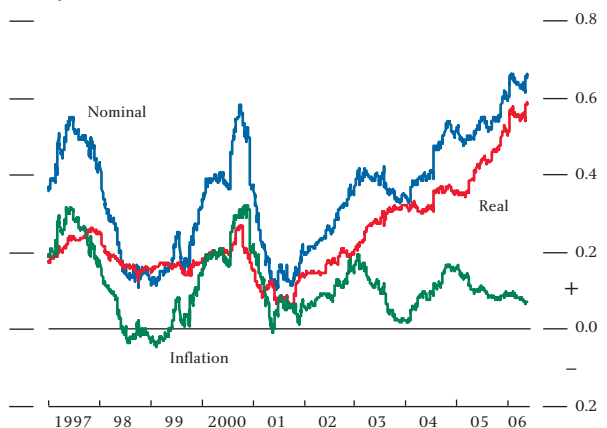
Chart 11
International nine-year real forward rates^(a)



(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.

Alternatively, sterling long real forward rates may have been influenced by the rise in short-term market interest rates. In principle, long real forward rates should be related to the equilibrium real interest rate, which is likely to be fairly stable over time. But over the past few years, movements in long-term real and short-term nominal interest rates have been highly correlated (Chart 12). One possible explanation is that market participants might have been updating their beliefs about the long-run equilibrium real rate based on observed moves in short-term rates.

Chart 12
Comovement of one-year nominal forward rates with ten-year nominal, real and inflation forward rates^{(a)(b)}



(a) Instantaneous forward rates derived from the Bank's government liability curve. (b) Coefficient from 260-day rolling regression of changes in ten-year nominal, real and inflation forwards on one-year nominal forward rates.

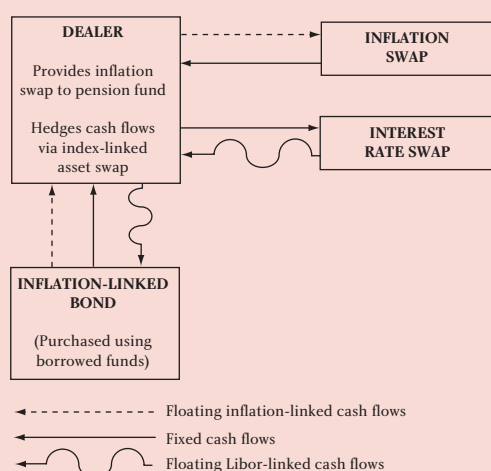
(1) Previous *Bulletins* have identified several possible explanations for the gradual drift down in long real forward rates, which began in late 2005. For example, see page 6 of the Spring 2006 *Quarterly Bulletin*.

Hedging inflation exposures by swap dealers

Dealers providing inflation swaps can hedge their exposure by isolating the inflation-linked cash flows on index-linked bonds using so-called asset swaps.

More specifically, having entered an inflation swap transaction, a dealer can convert fixed payments into floating (Libor-linked) payments using an interest rate swap (Chart A). The dealer can then borrow cash, on which it pays floating (Libor-linked) payments, which it invests in an index-linked bond to provide inflation-linked cash flows. Dealers may enter into asset swaps themselves or receive inflation-linked cash flows from hedge funds that undertake the asset swap. To the extent that these hedge funds are located overseas, this highlights the need for care in interpreting statistics on the location of gilt holdings, as the interest rate and inflation risk exposures on the gilts may have been transferred to a different location through the swap market.

Chart A
Hedging using an inflation-linked bond asset swap



Dealers can sometimes find hedges for their inflation-linked exposures in other parts of their business, such as making inflation-linked loans to companies, private finance initiative (PFI) projects or commercial property leases, although they may still need to retain exposures until they can find a suitable hedge. Alternatively, they can use non-government sterling-denominated inflation-linked bonds, issuance of which picked up recently. Over the review period, more than £1 billion of bonds linked to PFI projects were issued. There has also been a steady stream of index-linked bond issuance from utilities companies and other corporates, for example retailers.

Despite the rise in long real forward rates, the sterling curve remained inverted. As discussed in previous *Bulletins*, the inversion may indicate continued robust demand, relative to available supply, for long-maturity index-linked bonds from defined-benefit pension funds.

Over the review period, there were announcements by the UK Debt Management Office and by the UK Pensions Regulator (summarised on pages 135), which had the potential to affect the balance of anticipated supply of, and demand for, long-dated gilts. However, there were no obvious significant reactions in implied forward rates around the time of the announcements.

In addition to demand for long-dated gilts from defined-benefit pension funds, defined-contribution pension schemes may add to demand for long-dated gilts if scheme members purchase annuities on retirement and the annuity-provider then hedges its exposure in the bond market. The relationship between annuity prices and long-term interest rates is described in the box on this page.

Previous *Bulletins* have also noted that a large part of the demand for ultra-long dated sterling assets has been in the form of interest rate or inflation swaps tailored to match the future liabilities of pension funds. The providers of such swaps subsequently have exposure to inflation risk. Some ways in which they might seek to hedge this risk are outlined in the box on this page.

Credit markets and the search for yield

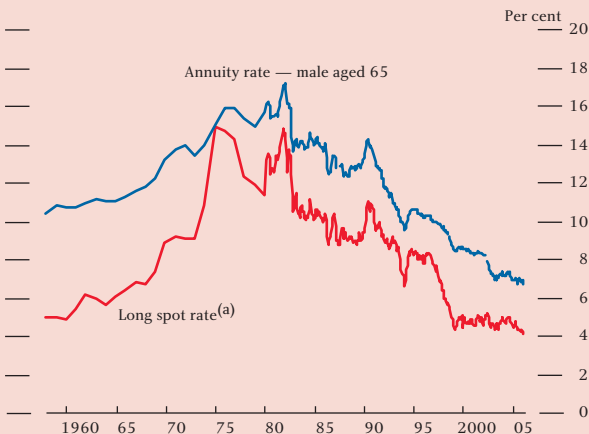
Despite the rise in long-term interest rates and falls in equity and other prices, spreads on sterling-denominated corporate bonds ended the period narrower, although they did widen a little around the middle of May (Chart 13).

Elsewhere, there was some evidence of a slight repricing of risk. For example, spreads on emerging market corporate debt widened by around 50 basis points during May, although they still remained quite close to historical lows recorded earlier in the year. Primary issuance also slowed in some corporate credit markets, and a few initial public offerings (IPOs) were postponed. But more generally, credit conditions did not appear to have changed significantly in the wake of the recent pickup in financial market volatility.

Decomposing changes in annuity rates

On retirement, an individual with a defined-contribution (DC) pension scheme will usually purchase an annuity, to provide a future income stream.⁽¹⁾ Providers of annuities typically purchase bonds in order to hedge this exposure, implying a link between bond yields and annuity rates.

Chart A
Sterling annuity and long-term interest rates since 1957



Sources: Bank of England, Edmond Cannon (Bristol University), GlobalFinancialData.com, William Burrows Annuities.

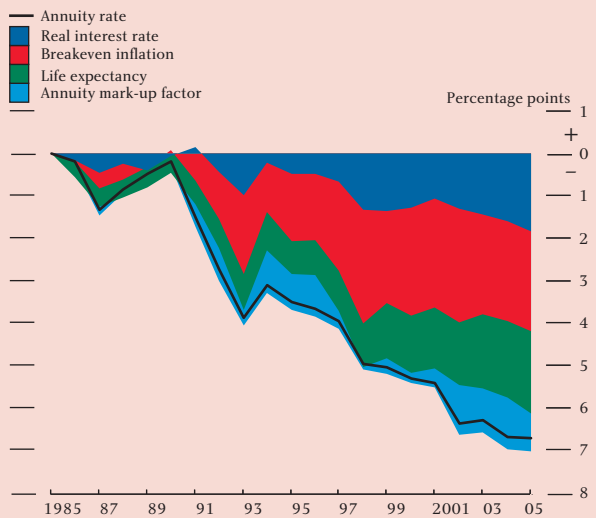
(a) 2½% consol yield until 1980 then 15-year spot rate. Spot rates derived from the Bank's government liability curve.

In recent years, annuity rates have fallen steadily, and at the end of 2005 had reached the lowest levels observed in several decades (around 7%). In part, these falls reflected declines in long-term interest rates (Chart A). However, annuity prices are determined by a number of factors. Annuity rates fall as discount rates fall; as life expectancy increases; and as the 'mark-up factor' (ie the expected compensation to the annuity provider) rises.

To see how these factors can affect annuity rates, it is informative to consider a simple model of fixed annuities with the price of an annuity equal to the present value of the expected future cash flows paid to the pensioner (adjusted to provide some expected profit to the annuity provider). Using the Bank's government liability yield curves, together with mortality data from the ONS,⁽²⁾ it is possible to decompose changes in annuity rates into changes in these underlying components (Chart B).

Approximately 35% of the decline in annuity rates since 1985 can be attributed to a fall in breakeven inflation, with

Chart B
Contributions to cumulative changes in annuity rates (1985–05)^(a)



Sources: Bank of England, Edmond Cannon (Bristol University), GlobalFinancialData.com, ONS, William Burrows Annuities and Bank calculations.

(a) Decomposition is a linear approximation of a non-linear relationship. As a result, the components of the chart do not sum exactly to the observed annuity rate.

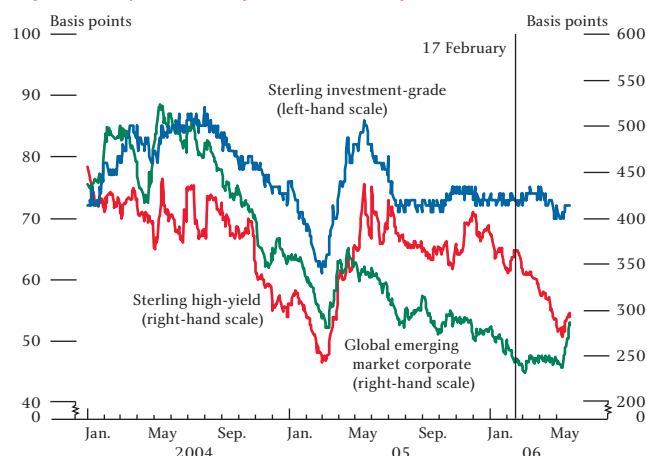
the largest falls following Bank operational independence in 1997. A further 27% of the decline is attributed to lower real interest rates. Twenty nine per cent of the decline reflects increased life expectancy, while the remainder appears to be attributable to an increase in the mark-up factor, estimated here as a residual.

One explanation for the rise in the mark-up is that annuity providers may have become more risk-averse as a result of unanticipated upward revisions to life expectancy. Increased life expectancy and a higher mark-up factor are likely to reduce pensioners' expected retirement income. In response, DC scheme members may choose to increase their age of retirement and/or increase their pension saving.

Lower inflation expectations do not necessarily reduce the expected *real* retirement income of DC scheme members. At the same time, lower real interest rates should only reduce expected real retirement income if they are perceived to be permanent. And to some extent this effect may be offset by a rise in the value of these members' pension funds. For example, a simple dividend discount model of equity prices would predict a rise in the value of equities when *real* interest rates fall.

(1) Although there are a variety of annuity products on the market, this box focuses on a simple annuity that provides a fixed nominal payment each period until death, with a five-year guarantee, purchased by a male who retires aged 65.
(2) These data provide estimated survival probabilities for the *general population*. The analysis also assumes that changes in general population life expectancy proxy changes in the life expectancy of the annuity holder.

Chart 13
Option-adjusted corporate bond spreads



Source: Merrill Lynch.

Against a generally benign global macroeconomic backdrop, it is perhaps too early to tell whether the recent increase in financial market volatility and the gradual withdrawal of monetary accommodation is prompting a widespread repricing of risk.

Anecdotal evidence suggests that some market participants, especially hedge funds and others in the speculative community, have either reappraised the amount of financial risk associated with particular asset classes or reassessed their overall attitude towards risk. However, there are as yet few signs that other investors with longer investment horizons (for example pension funds and insurance companies) have significantly increased their required compensation for taking on risk.

Moreover, a number of the key elements of the ‘search for yield’ — described in previous *Bulletins* and in the Bank’s recent *Financial Stability Reviews* — would appear to have remained largely intact over recent months. In particular, the repackaging of credit risk through collateralised debt obligations backed by assets such as leveraged loans, commercial real estate loans, home equity loans and investment-grade bonds continued apace. And credit conditions for leveraged buyouts of companies remained favourable.

Developments in market structure

Over the review period, there were two significant developments affecting the supply of and demand for long-dated sterling-denominated bonds. In addition, the Bank launched fundamental reforms to modernise the way in which the MPC’s interest rate decisions are implemented in the sterling money markets. The box on

pages 136–37 describes the work of the Securities Lending and Repo Committee over the past year.

DMO funding remit

On 22 March, HM Treasury announced the UK Debt Management Office (DMO) financing remit for the 2006–07 financial year. It stated that, of a total planned £63 billion of gilt issuance, there would be a minimum core programme of £53 billion comprising at least £10 billion in short conventional gilts (up to seven years’ maturity), £10 billion in medium conventional gilts (7 to 15 years), £17 billion in long conventional gilts (over 15 years) and £16 billion in index-linked gilts. As well as the core programme, a £10 billion programme of supplementary issuance was introduced to allow the DMO to respond to changes in market conditions and the pattern of demand for gilts within the financial year. The supplementary issuance will be allocated on a quarterly basis, with the first quarter’s £2.5 billion share allocated to long conventional gilts. The second quarter’s share, announced on 31 May, will be split by the DMO between £1.25 billion of long conventional gilts and £1.25 billion of index-linked gilts.

The pensions regulator’s approach to funding of defined-benefit pension schemes

On 4 May, the Pensions Regulator announced how it would regulate the funding of defined-benefit (DB) pension schemes, following a consultation exercise that began in October 2005. The main points noted by market commentators were: the increased emphasis on Section 179 and FRS17/IAS19 valuations for deficit measurements (which discount liabilities using market interest rates), rather than valuations on a buyout basis (which is the payment required by an insurer to take on the liabilities); that triggers should not be seen as standards or targets against which DB schemes would be measured; and that there would be no requirement for schemes sponsored by companies in good financial health to change their investment strategy.

Money market reform

The new framework for the implementation of UK monetary policy launched by the Bank on 18 May has four objectives:

- Overnight market interest rates to be in line with the official Bank rate, so that there is a flat money market yield curve, consistent with the official

The work of the Securities Lending and Repo Committee

The Securities Lending and Repo Committee (SLRC), chaired by the Bank, was formed in 1990. It provides a forum for discussion of market, infrastructure and legal developments in securities lending and repo markets and, where appropriate, makes recommendations to market participants and relevant authorities. It typically meets quarterly and comprises representatives from repo and securities lending practitioners, trade associations, infrastructure providers and UK authorities (the FSA, DMO and HM Revenue and Customs). SLRC membership has recently been widened to ensure a broader representation of market practitioners and trade associations. The minutes of SLRC meetings are available on the Bank's website.⁽¹⁾

Over the past year, the SLRC has discussed proposed changes to the infrastructure supporting the UK securities lending and repo markets, including:

- *Euroclear's consultation on securities financing on its future Single Platform*, to which it is planned that the current national central securities depositories in the Euroclear group (including CREST in the United Kingdom) will migrate. SLRC members emphasised that the Single Platform should include the best features of the current national systems, including CREST. In particular, delivery-by-value (DBV), or something analogous, should be available on the new platform to enable bundles of securities to be financed overnight, or for a longer period, in a straightforward way. Relatedly, the Bank has been pressing for any DBV facility to be not just overnight, as at present in CREST, but also to include provision for term transactions to remain 'intact' during the day in order to reduce the intraday liquidity required to unwind DBVs at the start of each day.
- *LCH.Clearent gilt DBV repo clearing project*, scheduled to be introduced in 2006, which aims to introduce the benefits of a central counterparty, including netting, for repos against bundles of gilts selected using the DBV service offered in CREST. In particular, SLRC

members have discussed the proposed standard size (shape) for trades sent to LCH for clearing, favouring no compulsory size on the basis that failed trades were rare in the gilt DBV market.

The SLRC's market participant members have also discussed the impact of proposed regulatory changes affecting securities lending and repo markets, in particular two new EU directives:

- *The Transparency Directive*, due for implementation in January 2007, and in particular its requirements regarding notification of interests in shares in securities lending transactions. SLRC practitioner members had raised concerns about the limited value of this information and the potential reporting burden on securities lending market participants. SLRC has discussed further how these requirements might be implemented in a way that meets the requirements of the Directive while being workable and cost-effective for market participants.
- *The Market in Financial Instruments Directive (MiFID)*, due for implementation in November 2007. It seems that MiFID's implications for repo and securities lending will be limited; for example, the best execution requirement will not apply to repo and security lending transactions conducted between Eligible Counterparties (over 90% of the total securities lending market). The Committee has also discussed whether additional reporting requirements to the FSA would apply to securities lending and repo.

The SLRC has worked to improve understanding of the securities lending and repo markets and explain their important role at the heart of the modern financial system. For example, the Committee has contributed to debates about how lenders of shares can meet their corporate governance responsibilities. To this end, in conjunction with a number of trade associations representing the various participants in the market and the London Stock Exchange, the SLRC has sponsored two publications:

(1) www.bankofengland.co.uk/markets/gilts/slrc.htm.

- *An Introduction to Securities Lending*, which aims to describe the modern markets for a non-expert; and
- *Securities Lending and Corporate Governance*.

Both publications are available on the SLRC pages on the Bank of England website.⁽¹⁾

One important function of the SLRC is to maintain voluntary codes of market conduct for the gilt repo, securities lending and equity repo markets. The Securities Borrowing and Lending Code and the UK Annex to the Code were first published in December 2000 and updated in December 2004. The Gilt and Equity Repo Codes are currently being updated and new versions should be issued later in 2006 or early 2007.

Other issues recently discussed by the SLRC included:

- *Basel II requirements*, in particular relating to the disclosure of underlying principals in securities loans. Except where borrowing is undertaken through what is classed as a 'central counterparty', this requirement will require borrowers to identify the individual lenders of securities and to identify what collateral is being allocated to the lender.
- *The ESCB/CESR⁽²⁾ standards on clearing and settlement*, which aim to promote the safety and efficiency of European clearing and settlement systems and to create a level playing field through the provision of a harmonised regulatory framework. Standards relevant to securities lending include a dedicated standard on securities lending and a standard on risk controls to address participants' failures to settle. The finalisation and subsequent implementation of the ESCB/CESR standards will continue to be monitored by SLRC.

- *Amendments to the FSA rules to allow securities lending through Euroclear's automated lending programme by UK insurance companies*. Securities lending is 'approved' if certain conditions are met concerning the assets lent, the counterparty and the collateral provided. Approval means the securities lent are still treated as being the lending company's assets for solvency purposes.
- *The 2003 Giovannini group report on EU cross-border clearing and settlement arrangements*, setting out a process to overcome 15 barriers to efficiency. Current issues include work under way to harmonise national rules relating to corporate actions processing, which could have an impact on securities lending.

An SLRC subgroup, comprising trade association representatives and legal advisers, is responsible for obtaining legal opinions on the effectiveness of the close-out netting provisions in the Global Master Securities Lending Agreement (GMSLA), the Overseas Securities Lender's Agreement (OSLA) and the Master Gilt Edged Stock Lending Agreement (GESLA) under different jurisdictions around the world. UK authorised firms are required to obtain these legal opinions in order to support the reporting of securities lending exposures to the FSA (on a net basis) for capital adequacy purposes.

Recently the subgroup has been discussing the potential to harmonise this exercise in gathering legal opinion with the similar process organised by the International Capital Markets Association (ICMA) and The Bond Market Association (TBMA) for repo transactions under the Global Master Repo Agreement (GMRA). That would probably yield cost savings and efficiency gains for participating firms. Further work will be carried out to finalise the format, timing and funding of combined opinions, as well as establishing the appropriate committee structures to review them.

(1) Available at www.bankofengland.co.uk/markets/gilts/securitieslending.pdf and www.bankofengland.co.uk/markets/gilts/skgjun05.pdf.

(2) European System of Central Banks/Committee of European Securities Regulators.

Bank rate, out to the next MPC decision date, with very limited day-to-day or intraday volatility in market interest rates at maturities out to that horizon.

- An efficient, safe and flexible framework for banking system liquidity management — both in competitive money markets and, where appropriate, using central bank money — in routine and stressed, or otherwise extraordinary, conditions.
- A simple, straightforward and transparent operational framework.
- Competitive and fair sterling money markets.

The framework is based on a system of voluntary remunerated reserves with a period-average maintenance requirement, together with standing borrowing and deposit facilities available on demand throughout the banking day to a wide range of commercial banks.

Reserve accounts are current accounts with the Bank that are remunerated at the official Bank rate decided by the MPC. Banks target average balances with the Bank over the periods between the MPC's monthly interest rate decisions rather than having to 'square up' at close of business every day, making it easier for them to manage day-to-day cash flows. In the interests of simplicity, it has therefore been possible to discontinue two facilities previously used by banks to manage their end-of-day payments flows.

Specifically, the Bank of England Late Transfer Scheme (BELTS) End-of-Day Transfer Scheme (EoDTS) facilities ended on 17 May. There is, however, still a short window for settlement banks to make payments to each other after the payment system has closed on the last day of each maintenance period (when banks need to achieve their average reserve targets). This is in addition to the overnight standing facilities.

The averaging mechanism for reserves allows banks to run their balances at the Bank up or down in response to changes in market interest rates. Arbitrage should smooth overnight market interest rates so that they do

not deviate materially from the rate expected to prevail on the final day of the monthly maintenance period. And on the final day of the maintenance period, the standing facilities perform a rate-setting function, setting a narrower ± 25 basis points corridor for market rates.

The standing facilities provide liquidity insurance to financial institutions. A wide range of banks and building societies can borrow (against collateral) from, or deposit money with, the Bank in unlimited amounts. Except on the final day, the penalty rates are ± 100 basis points (around the official Bank rate).

The Bank has also changed its open market operations (OMOs). The purpose of OMOs is to finance banknotes in circulation and ensure that the banking system can achieve its aggregate reserves target over the maintenance period. The Bank's short-term OMOs have changed to weekly repo operations for one-week maturity. A routine overnight fine-tuning operation is conducted on the final day of the maintenance period.

To reduce the size of the weekly short-term OMOs, monthly long-term repo OMOs were introduced in January 2006. These provide financing at market rates, at maturities of three, six, nine and twelve months. The Bank also plans to purchase conventional gilts and high-quality foreign currency bonds swapped into fixed-rate sterling to back the enduring part of the banknote issue;⁽¹⁾ further details will be announced following consultation with OMO counterparties, and liaison with the DMO.

The Bank's new framework is set out in more detail in its 'Red Book' issued on 15 May.⁽²⁾

Bank of England official operations

Changes in the sterling components of the Bank of England balance sheet

The size of the sterling components of the Bank's balance sheet grew following the reforms to the Bank's sterling monetary operations (Table A). To reflect better the structure of the balance sheet following the launch of the new framework, the Bank has revised the weekly Bank Return published on its website.⁽³⁾

(1) A joint statement by the Bank and the DMO was issued on 15 May and is available at www.bankofengland.co.uk/markets/money/documentation/boe_dmo.pdf.

(2) 'The Framework for the Bank of England's Operations in the Sterling Money Markets' is available at www.bankofengland.co.uk/markets/money/publications/redbook0506.pdf.

(3) Available at www.bankofengland.co.uk/publications/bankreturn/index.htm.

Table A
Simplified version of Bank of England consolidated^(a) balance sheet^(b)

£ billions

Liabilities	26 May 2006	17 Feb. 2006	Assets	26 May 2006	17 Feb. 2006
Banknote issue	41	40	Short-term sterling reverse repo	37	23
Settlement bank balances/reserve balances	22	<0.1	Long-term sterling reverse repo	15	6
Standing facility deposits	0	n.a.	Ways and Means advance	13	13
Other sterling deposits, cash ratio deposits and the Bank of England's capital and reserves	9	10	Standing facility assets	0	n.a.
Foreign currency denominated liabilities	15	14	Other sterling-denominated assets	4	4
			Foreign currency denominated assets	18	18
Total^(c)	87	64	Total^(c)	87	64

(a) For accounting purposes the Bank of England's balance sheet is divided into two accounting entities: Issue Department and Banking Department.

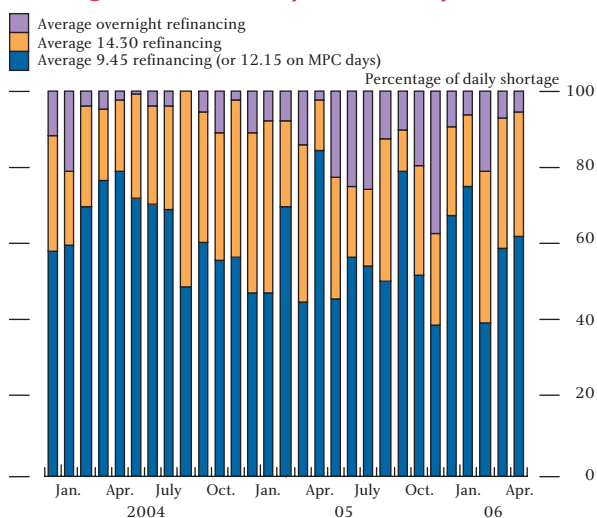
See 'Components of the Bank of England's balance sheet' (2005), *Bank of England Quarterly Bulletin*, Spring, page 18.

(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 38–39 and 61–69 for a description.

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

Until mid-April, the majority of lending in the Bank's short-term OMOs continued to be carried out daily at a two-week maturity at the official Bank rate (Chart 14). From the middle of April the Bank changed the maturity of its daily repos from two weeks to one week. This change was implemented in order to smooth the transition to the larger, weekly short-term OMO following the introduction of the new framework on 18 May.

Chart 14
Lending via the Bank's open market operations^{(a)(b)}



(a) Monthly averages.

(b) Up to and including 17 May 2006.

A key element of the money market reforms is that eligible UK banks and building societies may choose to hold remunerated reserves with the Bank. The initial group of 41 reserve account holders set an aggregate reserves target for the first maintenance period (18 May to 7 June) of £23 billion.⁽¹⁾

(1) A list of institutions participating in the reserves scheme is available at www.bankofengland.co.uk/markets/money/documentation/participants060515.pdf.

(2) These measure the difference between the lowest accepted rate and the weighted average accepted rate and so give an indication of the spread of accepted bid rates.

The introduction of these reserves significantly increased the amount of funds the Bank needs to provide to the market via its OMOs. Broadly, the Bank has to provide sufficient financing to meet demand for banknotes and to enable reserve banks to achieve their targeted reserves. Notes in circulation remained the largest liability on the Bank's balance sheet and rose slightly over the period as a whole.

Since the launch of the new framework, the Bank has conducted weekly OMOs for one-week repo at its official rate. The first two operations, for settlement on 18 and 25 May, were for £36 and £37 billion and were covered 1.03 and 1.90 times respectively.

In order to help manage its balance sheet and limit the size of its short-term repo lending, the Bank has provided £15 billion of longer-term financing through three, six, nine and twelve-month repos at market rates determined in monthly tenders, which began in January.

The Bank held three long-term repo operations during the review period. These were fully covered and yield 'tails'⁽²⁾ were small, particularly in the nine and twelve-month repos where the amounts on offer were smallest (Table B).

From late February to April, there was a slight increase 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 short-term OMO collateral (Chart 15). Following the launch of the new framework, the Bank's counterparties used a slightly

higher proportion of gilts in short-term OMOs than in the period running up to the reforms. In the longer-term repo operations, counterparties used a slightly larger proportion of euro-collateral relative to that used in the short-term operations. Contacts suggested that this was mainly due to cost considerations.

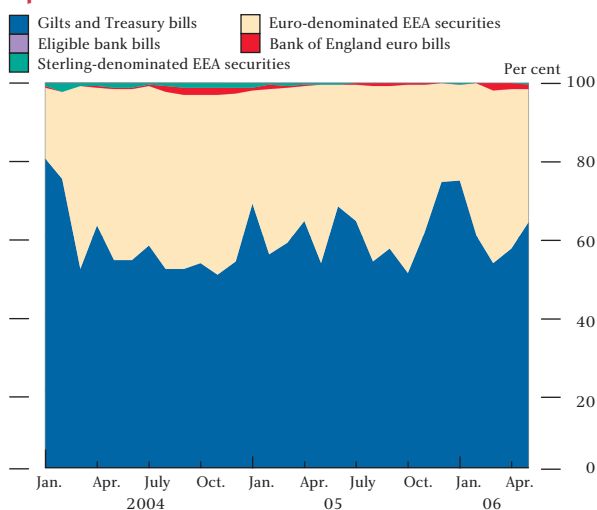
Table B
Long-term repo operations

	Three-month	Six-month	Nine-month	Twelve-month
14 March 2006				
On offer (£ millions)	2,850	750	400	200
Cover	2.67	5.12	3.25	5.15
Weighted average rate ^(a)	4.417	4.457	4.515	4.565
Highest accepted rate ^(a)	4.430	4.460	4.515	4.565
Lowest accepted rate ^(a)	4.410	4.455	4.455	4.565
Tail ^(b) (basis points)	0.7	0.2	0	0
18 April 2006				
On offer (£ millions)	2,850	750	400	200
Cover	2.34	3.35	3.25	3.75
Weighted average rate ^(a)	4.468	4.513	4.575	4.64
Highest accepted rate ^(a)	4.48	4.515	4.575	4.64
Lowest accepted rate ^(a)	4.46	4.505	4.575	4.64
Tail ^(b) (basis points)	0.8	0.8	0	0
16 May 2006				
On offer (£ millions)	2,850	750	400	200
Cover	3.16	2.48	2.31	4
Weighted average rate ^(a)	4.548	4.65	4.755	4.845
Highest accepted rate ^(a)	4.57	4.65	4.755	4.845
Lowest accepted rate ^(a)	4.541	4.65	4.755	4.845
Tail ^(b) (basis points)	0.7	0	0	0

(a) Per cent.

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

Chart 15
Instruments used as OMO collateral in short-term operations^(a)



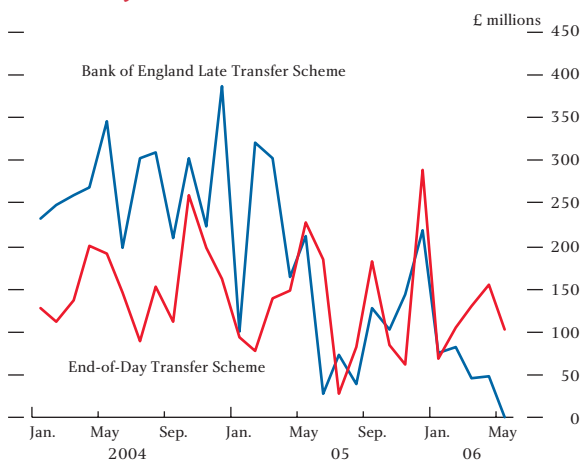
(a) Monthly averages.

Late transfer schemes

The relatively low level of flows in the end-of-day schemes continued (Chart 16). Average daily payments in the Bank of England Late Transfer Scheme (BELTS) were less than £50 million on average, while average daily flows in the End-of-Day Transfer Scheme (EoDTS) were generally less than £150 million. As reported

above, these facilities are not needed in the modernised system and have been withdrawn.

Chart 16
Bank of England Late Transfer Scheme and End-of-Day Transfer Scheme^{(a)(b)}



(a) Monthly averages.

(b) Up to 17 May 2006.

Changes in the foreign-currency components of the Bank of England balance sheet

As part of the new monetary regime introduced in 1997, the Bank has been able to hold its own foreign exchange reserves. These, and other assets used to facilitate participation in the euro area's TARGET payment system, are financed by issuing foreign-currency securities.

On 28 March 2006, the Bank auctioned €1 billion of the 2009 note as part of its euro-denominated notes programme; the first €2 billion tranche had been auctioned on 24 January 2006. Cover in the auction of the second tranche was 2.8 and the average accepted yield was 3.393%, approximately 13.2 basis points below the euro swaps curve at the time. This was the second and final auction of the 2009 note and increased the value outstanding in the market to €3 billion. The total nominal value of Bank euro notes outstanding in the market rose to €7 billion.

On 24 April, the Bank of England announced it would issue no further euro bills, with the April 2006 euro bill auction being the last in the series. The final euro bill will mature on 12 October 2006.

Employment of the Bank of England's capital

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 £1.1 billion) of approximately

the same size as its capital and reserves and aggregate cash ratio deposits with the Bank. These investments are generally held to maturity. Over the current review period, gilt purchases were made in accordance with the published screen announcements: £37.6 million of 4.75% 2020 in March, £37.6 million of 4.75% 2015 in April and £37.6 million of 5% 2014 in May. A screen announcement on 1 June 2006 detailed the purchases to be made over the following three months.