Markets and operations

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

- *Uncertainty in financial markets relating to the war in Iraq passed.*
- *Forward interest rates declined globally.*
- *Equity indices rose, perhaps on reduced uncertainty and lowered perceptions of corporate risk.*
- *The dollar and, to a lesser extent, sterling continued to depreciate against the euro.*
- *Work continues to allow settlement of money market instruments in the CREST system and procedures have been announced for their migration into CREST from September 2003.*

Since the end of February, government bond yields have declined at almost all maturities, but equity markets have bounced back and credit spreads narrowed further. The US dollar has continued to depreciate against the euro and, to a lesser extent, sterling (Table A).

Table A
Summary of changes in market prices and forecasts

	3 March	30 May	*Change*
December 2003 three-month interest rate future (per cent)			
United Kingdom	3.30	3.41	*11 bp*
Euro area	2.22	2.02	*-20 bp*
United States	1.47	1.16	*-31 bp*
Ten-year nominal government forward rate (per cent) (a)			
United Kingdom	4.76	4.71	*-5 bp*
Euro area	5.45	5.35	*-10 bp*
United States	6.06	5.76	*-30 bp*
Equity indices			
FTSE 100 index	3685	4048	*9.9%*
Euro Stoxx 50 index	187	205	*9.5%*
S&P 500 index	835	964	*15.4%*
Exchange rates			
Sterling effective exchange rate	100.1	97.8	*-2.3%*
$/€ exchange rate	1.09	1.18	*8.2%*
2003 GDP growth forecasts (per cent) (b)			
United Kingdom	2.1	2.0	*-0.1 pp*
Euro area	1.1	1.0	*-0.1 pp*
United States	2.4	2.3	*-0.1 pp*

Sources: Bank of England, Bloomberg and Consensus Economics.

(a) Six-month forward rates, derived from the Bank's government liability curves.
(b) Consensus Economics, surveys conducted 10 March and 12 May.

Fluctuations in uncertainty

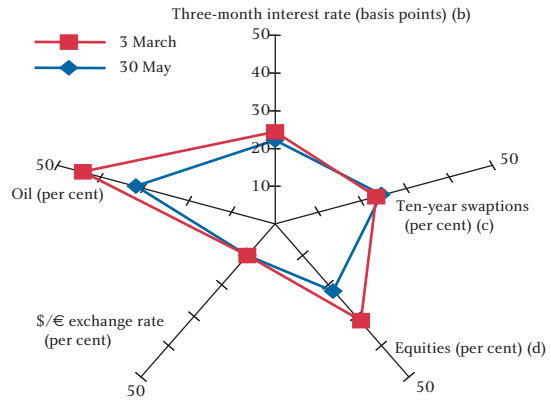
Early in March, ahead of the war in Iraq, equity prices fell and bond yields declined globally. While the picture was mixed, many indicators suggested that there was increased uncertainty in financial markets.

In mid-March, however, shortly before the war began, contacts suggest many leveraged market participants closed out positions that stood to gain from falling interest rates and US dollar depreciation. Equity markets rose, the US dollar appreciated, and there was a sharp sell-off in bond markets globally, with short-term forward interest rates rising. For example, sterling money market interest rates, which had fallen in preceding weeks, rose sharply as market participants reported heavy selling of short sterling futures on LIFFE.

In the first instance, this rise in equity prices and market interest rates was accompanied by increases in the implied volatilities derived from option prices on interest rates and equity indices. But, as the outcome of the war became clearer, these measures of uncertainty declined (Chart 1). Oil prices—one key channel through which the war might have had a significant

(1) The period under review is 3 March (the data cut-off for the previous *Quarterly Bulletin*) to 30 May.

Chart 1
Selected three-month implied volatilities(a)

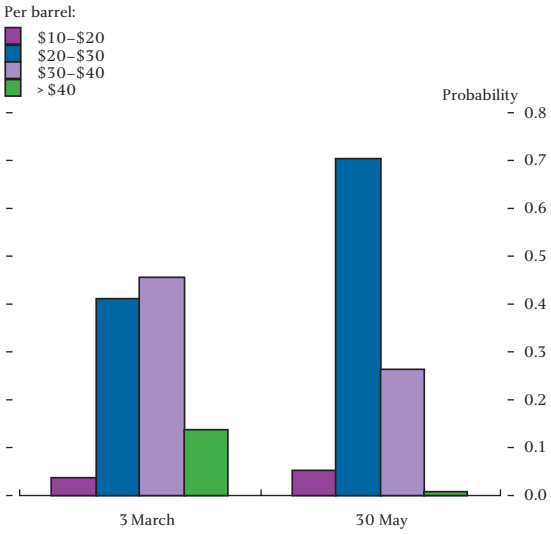


Sources: Bank of England, Bloomberg, CME, Eurex and NYMEX.

(a) Implied by option prices. Equal weighting where more than one instrument used.
(b) Options on eurodollar and euribor interest rate futures contracts.
(c) Euro and dollar three-month into ten-year swaptions.
(d) Options on S&P 500 and Euro Stoxx 50.

impact on the global economy—fell and uncertainty about future prices declined (Chart 2). Major equity market indices rose further (Chart 3).

Chart 2
Options-implied price probabilities three months ahead

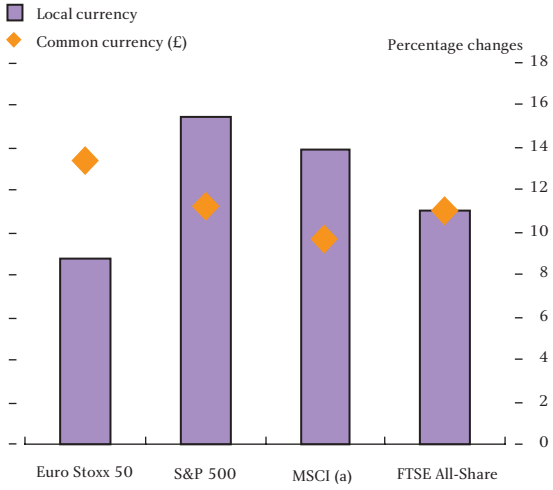


Sources: Bank of England and NYMEX.

Equity markets

Over the review period as a whole, the MSCI world equity index rose by nearly 14%. The US S&P 500 increased by more than the Euro Stoxx 50 index in local currency terms, but by a similar amount in common currency terms, suggesting that equity market prices might have adjusted to reflect the effect of the US dollar's depreciation against the euro on the earnings of international companies.(1)

Chart 3
Changes in selected equity indices

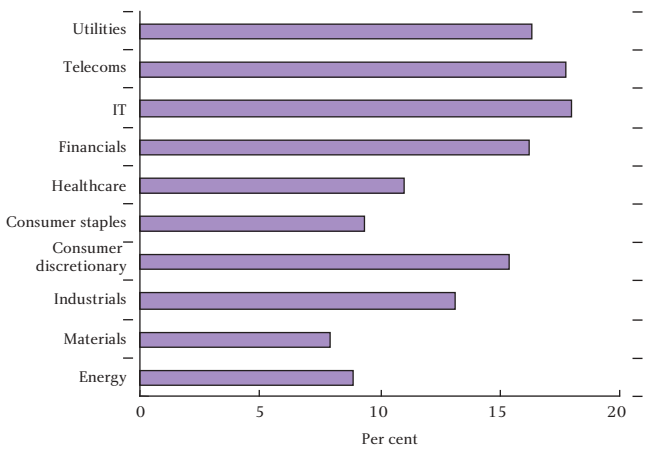


Source: Bloomberg.

(a) The Morgan Stanley Capital International (MSCI) World Index is a capitalisation-weighted index of stocks from around the world.

The rise in the MSCI index was broadly based across subindices of companies in different industry groups (Chart 4), consistent with one or more common factors lying behind the increases. With expectations of GDP growth having been revised downwards in many countries (Chart 5), reduced uncertainty is perhaps the most plausible explanation.

Chart 4
Sectoral performance of MSCI world equity index, 3 March–30 May

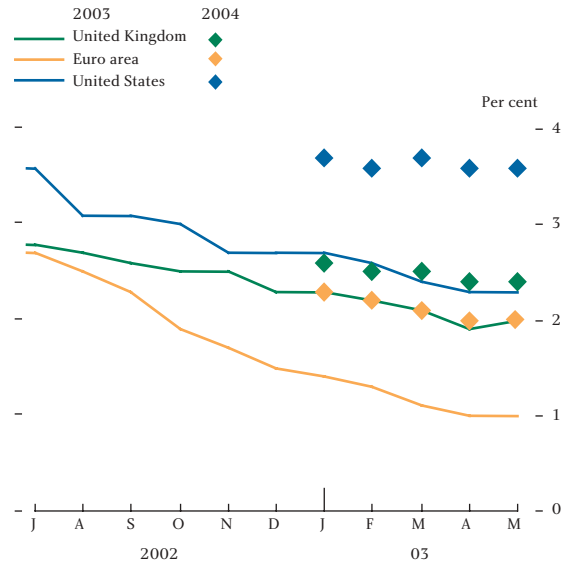


Source: Bloomberg.

Consistent with this, the implied volatility of the S&P 500 index has declined since the end of the Iraq war, and by more than the market value weighted average of the implied volatilities of the individual stocks in the index.(2) The gap between these two

(1) See forthcoming June 2003 *Bank of England Financial Stability Review*, Section I.
(2) Derived from single stock options.

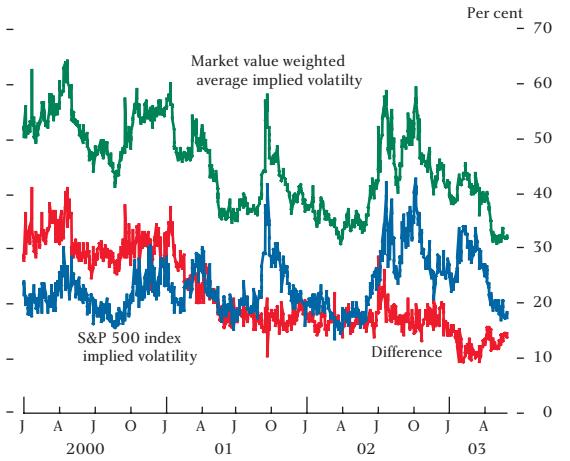
Chart 5
Expected 2003–04 real GDP growth



Source: Consensus Economics.

volatility measures—a measure of implied correlation between stocks, which is increasingly traded in options markets—had narrowed earlier in the year, suggesting an increase in the relative importance of general uncertainty, affecting all stocks more or less equally, compared with idiosyncratic uncertainty affecting particular stocks (Chart 6). The subsequent widening of this gap, as implied volatilities have declined, might be linked to reduced war-related uncertainty.

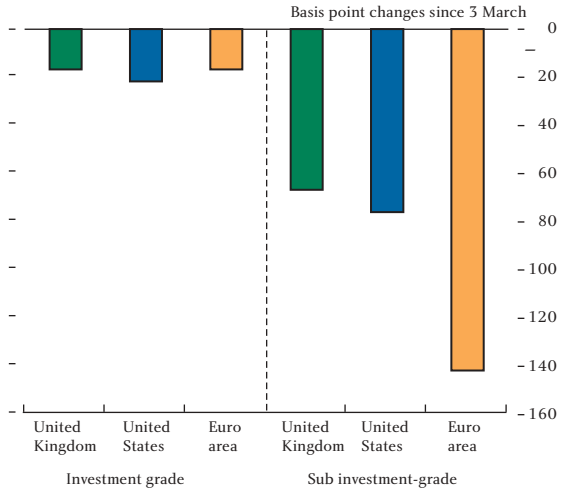
Chart 6
Implied volatility of S&P 500 index compared with market value weighted average implied volatility of S&P 500 stocks



Sources: Bank of England, Bloomberg, Standard & Poor's and Thomson Financial Datastream.

General uncertainty might also have declined if investors were somewhat less concerned about corporate risk following balance sheet restructuring, cost cutting and actions to address failings in corporate governance and accounting standards. This would be expected to have reduced perceptions of credit risk, and yield spreads of corporate bonds over swap rates have narrowed (Chart 7). Retail investor flows into corporate bond funds, particularly high-yield funds in the United States, have remained at high levels on both sides of the Atlantic.

Chart 7
Spreads over swaps of international investment and sub investment-grade corporate bonds

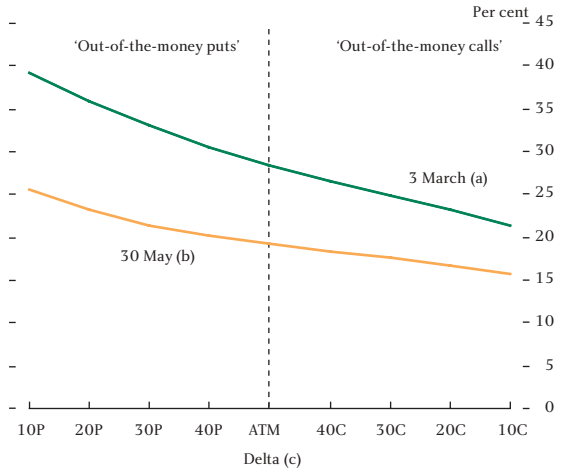


Source: Merrill Lynch.

At the beginning of the period, the term structure of the implied volatility of the FTSE 100 index, derived from options prices, had been downward sloping, suggesting expectations that the high actual volatility at that time would be short-lived. As one-month implied volatility has declined, this curve has become less inverted. The FTSE 100 volatility 'smile'—which plots implied volatility across options with different strike prices—has remained negatively sloped (Chart 8). Since mid-2002, it has been more negatively skewed than that of the S&P 500 (Chart 9).(1) One possible interpretation is that market participants associate a sharp fall in UK equity prices with greater price volatility, perhaps because of concerns that UK life insurers would have to liquidate equity holdings in such circumstances. But the higher implied volatilities—reflecting higher prices charged by dealers—might also indicate strong demand for downside protection from buyers that would suffer

(1) On a constant-maturity basis. For details about how the Bank derives implied risk-neutral probability density functions for assets upon which options contracts trade, 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.

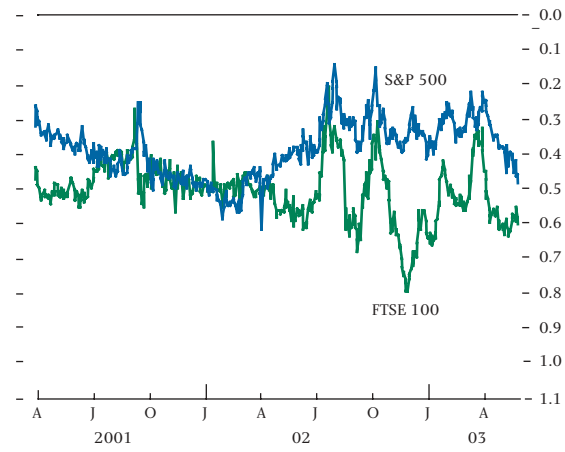
Chart 8
Option-implied FTSE 100 volatility smile



Sources: Bank of England and LIFFE.

(a) European options expiring June 2003.
(b) European options expiring September 2003.
(c) The at-the-money (ATM) implied volatility is for an option with a strike price equal to the FTSE 100 index future. Delta is the rate of change of the option price with respect to the underlying asset price, and its absolute value falls as strikes move further out-of-the-money. Increasingly out-of-the money put (P) options (low strikes) are shown to the left and call (C) options (high strikes) to the right.

Chart 9
Six-month implied FTSE 100 and S&P 500 skews



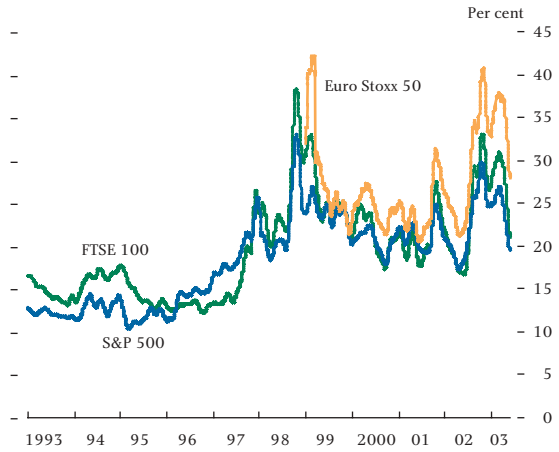
Sources: Bank of England, CME and LIFFE.

significant welfare losses if the market fell to those levels.

Anecdotally, UK life insurers, which have, at least until recently, held a larger proportion of their assets in equities than those in the United States and most other European countries, have been significant buyers of out-of-the-money put options, often financed by selling out-of-the-money calls or even more deeply out-of-the-money puts.(1) More recently, with equity markets rising, some institutions have reportedly bought back calls that they had written, leading dealers to purchase equities in order to unwind delta hedges.

Although implied volatilities of the major US and European equity indices have fallen, they remain higher than in the early to mid-1990s (Chart 10). One underlying macroeconomic reason for this might be continued uncertainty about the sustainability of the pick-up in US productivity growth in the late 1990s; whether the benefits of the associated technological advances could extend beyond the United States over time; and the extent to which this would translate into future corporate earnings. Such considerations may particularly affect technology stocks. Their share of the market capitalisation of the S&P 500 has declined sharply since 2000, but it remains higher than in the mid-1990s, probably increasing the implied volatility of the index.

Chart 10
Six-month implied volatilities of selected equity indices(a)



Sources: Bank of England, CME, Eurex and LIFFE.

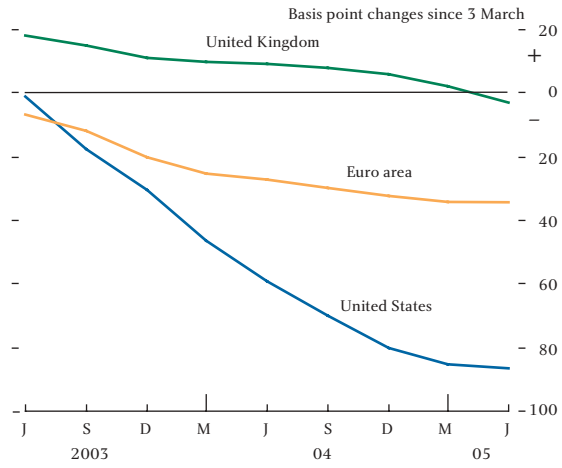
(a) 30-day moving averages.

Fixed-income markets

The rise in equity markets since early April stands in contrast to downward revisions to consensus expectations for the path of near-term GDP growth (Chart 5). But lower growth expectations are consistent with declines in short-term market interest rates. Broadly, the rise in rates in mid-March has unwound steadily since the end of the Iraq war. Over the review period as a whole, euro and US dollar rates have fallen, and sterling rates have changed little (Charts 11 and 12). Money market yield curves suggest expectations that official sterling, euro and perhaps US dollar interest

(1) A put (call) option is out-of-the-money when its strike price is below (above) the current price of the underlying asset. There is no incentive to exercise an out-of-the-money option, since this would result in a negative payoff.

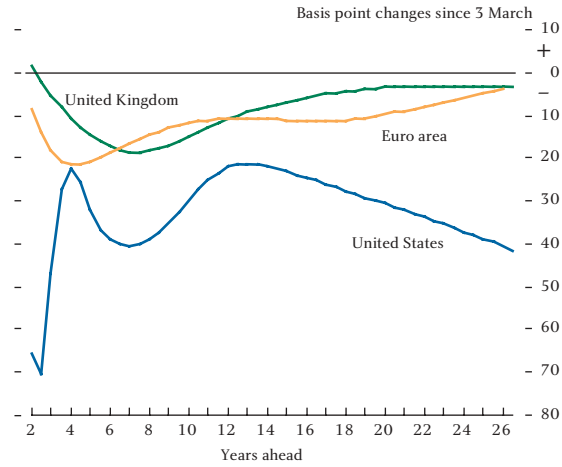
Chart 11
Changes in short-term interest rate expectations(a)



Source: Bloomberg.

(a) As implied by short-term interest rate futures contracts.

Chart 12
Changes in implied nominal forward rates(a)

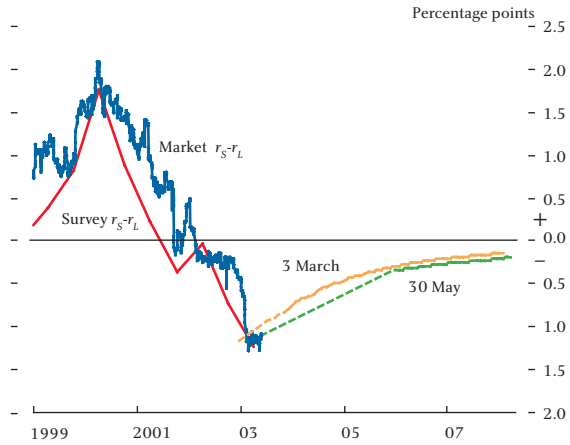


(a) Six-month forward curves derived from the Bank's government liability curves. (Estimates of the UK curve are published daily on the Bank of England's web site at: www.bankofengland.co.uk/statistics/yieldcurve/main.htm.)

rates will be reduced further in the next twelve months(1) and that the subsequent pace of interest rate rises will be gentle.

Chart 13 shows the difference between three-year spot sterling real interest rates (r_S) and five-year real rates five years forward (r_L), constructed both from index-linked gilts and by subtracting survey-based inflation expectations from nominal forward rates derived from conventional gilts. Short-maturity real rates (r_S) will be affected by the current outlook for economic growth, including the expected monetary policy response, whereas longer-maturity real rates (r_L) are likely to be

Chart 13
UK short versus long-maturity forward real interest rates



Sources: Bank of England and Consensus Economics.

affected rather less by the cyclical position of the economy.(2) Assuming that the real rate term structure is broadly flat in steady state, it is possible to trace out the path, implied by the yield curve, for short and longer-maturity real rates to reconverge.(3) This implied path has not altered greatly over the review period, with yields on short-dated index-linked bonds falling only a little, and this path does not suggest short and long real rates reconverging for some time. Short-term inflation expectations also fell slightly, but remained fairly close to the Bank of England's 2.5% inflation target.

Declines in implied forward interest rates have been significant at medium and long as well as short maturities (Chart 12). Long-term sterling real forward rates, derived from index-linked government bonds, have also fallen since early April, having risen in March. But moves in real forward rates have been smaller than in nominal forward rates, so that the fall in long-term nominal rates can be accounted for by both lower forward real interest rates and lower inflation expectations.

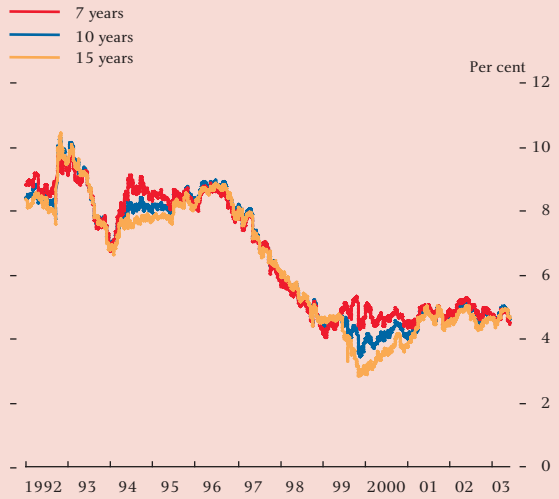
A weaker cyclical outlook for global economic growth over the next few years should not of itself lead to lower longer-term forward rates. Rather these might reflect changes in the balance of saving and investment in the economy or, more narrowly, the supply of and demand for government bonds. Or they might follow reassessments by market participants either of the underlying potential for economic growth or of monetary policy frameworks. For example, market

(1) On 5 June 2003, shortly after the end of the review period, the European Central Bank reduced its official interest rate by 0.5 percentage points to 2%.
(2) See Haldane, A and Read, V (1999), 'Monetary policy and the yield curve', *Bank of England Quarterly Bulletin*, May, pages 171–76.
(3) Treating real forward rates as expected future real rates ignores the possible presence of term premia.

Variability of nominal forward rates

Over the past ten years, sterling nominal six-month forward rates at 7, 10 and 15-year maturities have declined (Chart A), perhaps suggesting an increase in monetary policy credibility after the Bank was granted operational independence in May 1997.

Chart A
Six-month forward sterling rates(a)

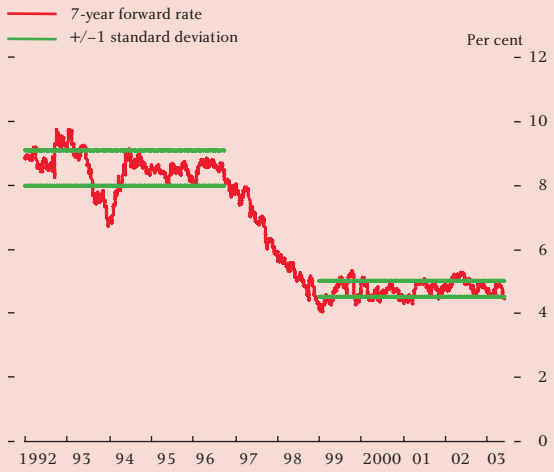


(a) Five-day moving averages. Six-month forward rates derived from the Bank's government liability curve.

Since early 1999, 7-year forward sterling rates have moved largely in a 4.25% to 5.25% range (Chart B).

There has been more variability at 10 and 15 years, including a period in 1999 when 15-year rates were very low. But this may have reflected the balance of supply and demand for longer-dated gilts, with UK institutional investors needing to match liabilities in the context of the Minimum Funding Requirement at a time of reduced gilt issuance.(1)

Chart B
Six-month sterling rates seven years forward(a)



(a) Five-day moving averages. Six-month forward rates derived from the Bank's government liability curve.

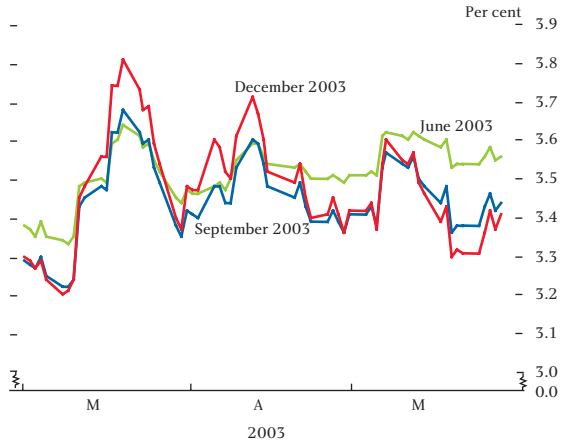
(1) See Brooke, M, Clare, A and Lekkos, I (2000), 'A comparison of long bond yields in the United Kingdom, the United States, and Germany', *Bank of England Quarterly Bulletin*, May, pages 150–58.

contacts have suggested that long-term US dollar interest rates may have fallen partly because of speculation that the Federal Reserve might purchase Treasury bonds if it were to implement so-called 'unconventional' monetary policy measures. They have also reported at times strong flows into longer-dated Treasuries, including by investors willing to take greater duration risk in search of higher yields. Falls in longer-term sterling forward rates have been smaller and not unusual by comparison with previous fluctuations in these rates. The box above shows that seven-year nominal forward sterling rates have been relatively stable since the Bank of England was granted operational independence in 1997.

Sterling money markets

The Monetary Policy Committee (MPC) maintained the Bank's repo rate at 3.75% during the review period. However, the level of interest rates implied by short

Chart 14
Short-term interest rates during the period(a)



Source: Bloomberg.

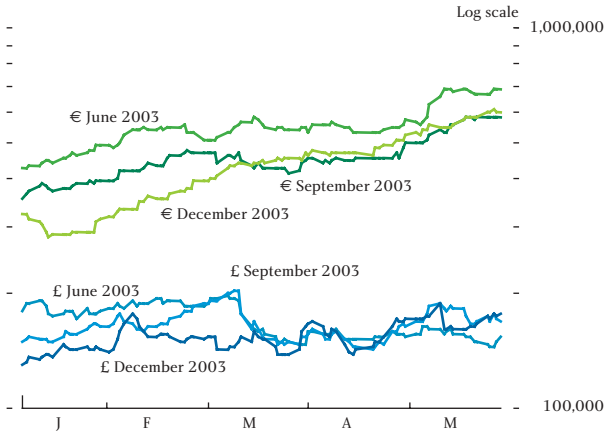
(a) As implied by short sterling interest rate futures contracts.

sterling futures fluctuated, as market participants reassessed the likelihood of further official rate reductions (Chart 14). In particular, interest rates implied by contracts maturing in 2003 rose following

the April and May MPC announcements, with market participants having priced in some expectation of a policy rate reduction prior to these meetings.

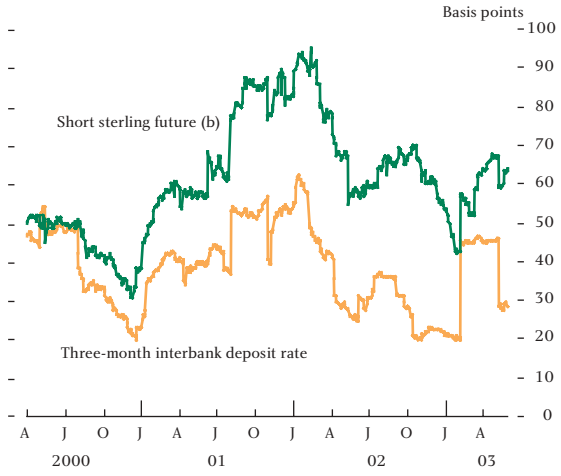
But the sharp movements in short sterling futures rates in March were difficult to explain in terms of changes in underlying interest rate expectations. Rather, market movements at that time seem to have been influenced by a build-up of leveraged long positions followed by their somewhat disorderly liquidation ahead of the Iraq war. Falls in the number of June and September 2003 short sterling contracts outstanding (open interest) were greater than in comparable euribor contracts or short sterling contracts at longer maturities (Chart 15). Historical short sterling volatilities were greater than those of three-month interbank deposit rates, although not unusually so (Chart 16).

Chart 15
Open interest in short-term interest rate futures (contracts outstanding)



Source: Bloomberg.

Chart 16
Volatility of three-month interest rates(a)

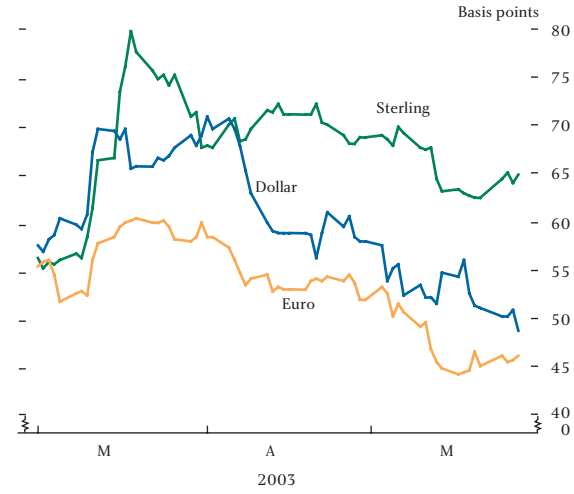


Sources: Bank of England and Bloomberg.

(a) Annualised standard deviation of daily changes over a 65-day rolling window.
(b) Derived three-month constant horizon.

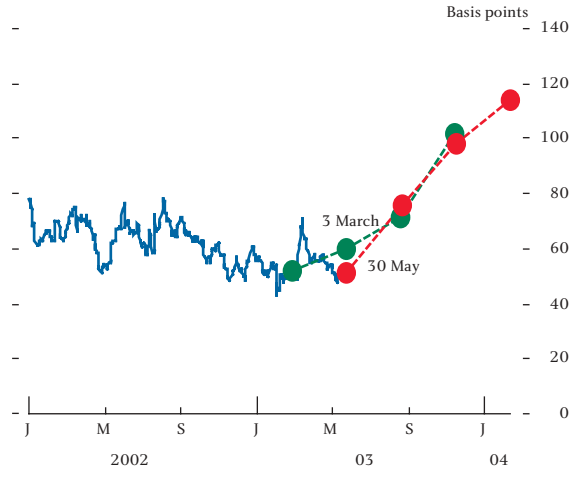
Options on short sterling futures provide forward-looking indicators of uncertainty about the path of short-term interest rates. The implied volatility of sterling rates has fallen since March, but the decline has been smaller than for equivalent euro and US dollar rates (Chart 17). However, the slope of the term structure of forward implied standard deviations for short sterling futures rates (Chart 18) is, in basis points, similar to its average over recent years.

Chart 17
Six-month option-implied volatility of short-term interest rates



Sources: Bank of England, CME, Eurex and LIFFE.

Chart 18
Option-implied three-month short sterling forward standard deviations



Sources: Bank of England and LIFFE.

Exchange rates

Interest rate expectations during the review period were at times influenced by changes in the sterling exchange rate index (ERI). The index declined by 3.0% to a low of 97.1 on 27 May, and ended the period at 97.6 (Chart 19). Sterling depreciated by 4.4% against the euro, but

appreciated by 3.6% against the US dollar (Chart 20). Euro-sterling implied volatilities increased relative to sterling-dollar implied volatilities, leading the one-year implied euro-sterling correlation to decline (Chart 21).

Chart 19
Sterling effective exchange rate

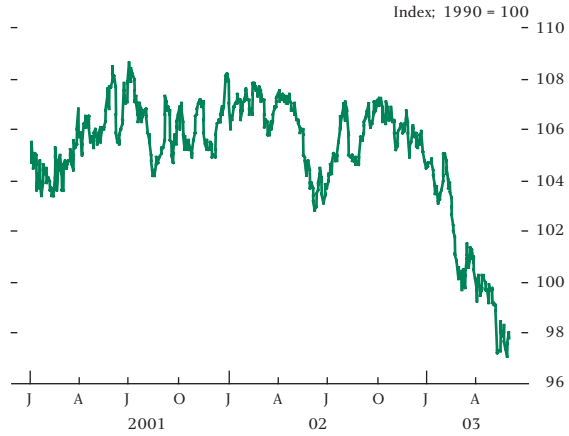


Chart 20
Sterling exchange rates

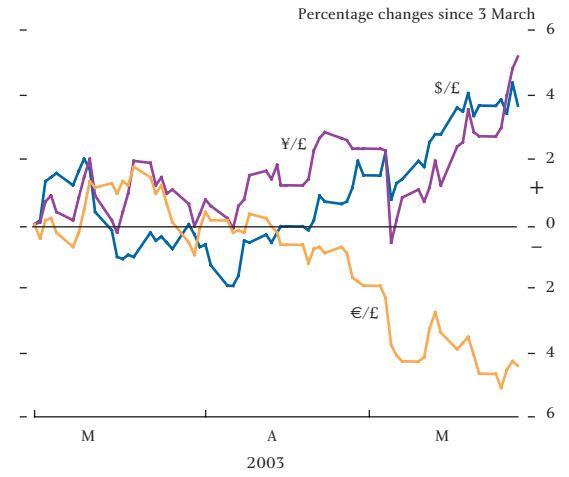
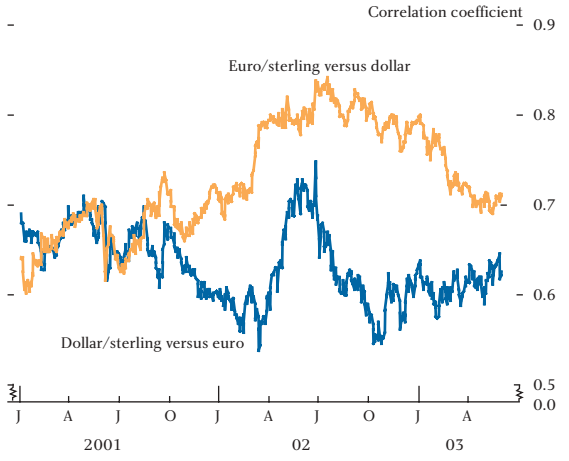


Chart 21
One-year implied exchange rate correlations



Source: UBS.

Movements in sterling, euro and US dollar market interest rates only partially accounted for movements in sterling's exchange rate over the period. Table B decomposes exchange rate movements according to the uncovered interest parity (UIP) condition, which seeks to assess the impact of interest rate news on the exchange rate.(1) Interest rate news here is measured as the change in the differences between ten-year UK and overseas government bond yields. Assuming constant medium-term exchange rate expectations, a fall in relative UK interest rates would be expected to lead to an immediate depreciation in the exchange rate followed by a gradual appreciation. While the appreciation of sterling against the US dollar was consistent with interest rate news being an important factor behind the move, sterling's depreciation against the euro was not.

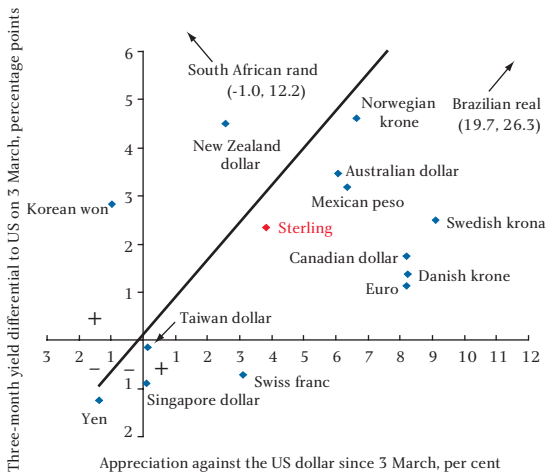
Table B
Exchange rate movements and news: 3 March–30 May

	£ ERI	€/£	$/£	$/€
Actual change (per cent)	-2.3	-4.4	3.6	8.4
Interest rate news (percentage points)	1.7	1.5	3.4	2.0
of which: domestic	*-1.5*	*-1.5*	*-1.5*	*-2.9*
foreign	*3.2*	*2.9*	*4.9*	*4.9*

'Carry trades' were said to be popular over the period, including in sterling. Such trades involve borrowing in one currency and investing in a higher-yielding one with the aim of earning the interest differential (the 'carry'). Changes in short-term interest rates and exchange rates relative to the US dollar are shown in Chart 22. The risk in the trade is that the higher-yielding currency depreciates, as suggested by the UIP framework, removing the profit made on the interest differential before the trader can close out the position. In consequence, such trades tend to be more popular if exchange rate volatility is perceived to be low and markets liquid. Positions tend to be built up gradually but can be reversed in the full size of the position, which, at least temporarily, can lead to sharp changes in exchange rates. Sterling's fall against the yen on 7 May (the outcome of the May MPC meeting was announced the following day) was reportedly in part driven by the unwinding of carry trades. Long positions in the Canadian and Australian dollars against short positions in the yen or US dollar were said to have been particularly popular trades with hedge funds and other speculators.

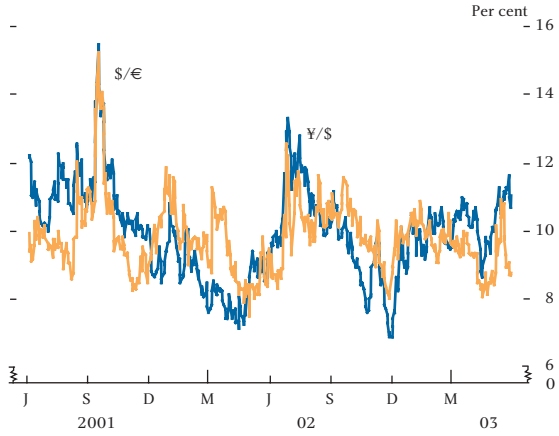
(1) See Brigden, A, Martin, B and Salmon, C (1997), 'Decomposing exchange rate movements according to the uncovered interest rate parity condition', *Bank of England Quarterly Bulletin*, November, pages 377–89.

Chart 22
Yield differentials and exchange rate movements



Source: Bloomberg.

Chart 23
Foreign exchange one-month option-implied volatilities



Source: UBS.

The main exchange rate development over the review period was the depreciation of the US dollar against the euro. Possible explanations for dollar depreciation centre around similar issues to those discussed in the previous *Bulletin*: the sustainability of the US current account deficit, overseas demand for US equities, and the degree of uncertainty about productivity growth. Some market commentators suggested that earlier concerns about a war in Iraq acted as a catalyst for the US dollar to move closer to its expected long-term level and that, once closer to this level, there has been little impetus for a reversal.

The expected volatility of exchange rate movements seems to have increased, with a sharp rise in US dollar-yen implied volatility in particular (Chart 23). Despite market speculation about Bank of Japan intervention to sell yen, the US dollar-yen volatility 'smile' is skewed towards yen calls, suggesting market participants are willing to pay more for protection from (or to bet in favour of) a yen appreciation rather than a depreciation. That is said to be linked in part to hedging in the yen-US dollar foreign exchange options market of large positions linked to structured notes (for example, so-called 'power reverse dual currency' notes) sold to Japanese investors in a form of exotic carry trade.

Developments in market structure

This section reports some significant changes in sterling market infrastructure, as well as developments in instruments and trading patterns.

NIPs Code: undisclosed principal trading

The Foreign Exchange Joint Standing Committee announced on 28 May a change in the Non-Investment Products (NIPs) Code(1) to discourage the practice of undisclosed (unnamed) principal trading(2) in the foreign exchange market, a practice which leaves banks potentially unable to assess credit exposures and legal risks.

Under the revised Code, a fund manager should notify the credit and/or compliance functions of its bank counterparty of the identity of the principal for which it is acting. The bank's front office should remain unaware of the principal's identity (a 'Chinese wall' should operate), so market-sensitive information would not be released.

A period of one year to June 2004 has been agreed to implement the change, giving fund managers and banks time to make systems changes and to amend procedures and legal agreements. Among other things, the change should enhance the management of counterparty credit risk in foreign exchange markets.

Settlement of sterling money market instruments

Much has been done in recent years to reduce settlement risks facing banks. In the United Kingdom, work continues on the planned settlement of money market instruments (MMIs) through CREST from September this year, which would bring a welcome

(1) A code of good market conduct for the sterling, foreign currency and bullion wholesale deposit markets, and the spot and forward foreign exchange and bullion markets. See www.bankofengland.co.uk/markets/nipscode.pdf.
(2) Undisclosed (unnamed) principal trading typically occurs when a fund manager deals in foreign exchange with a bank but does not disclose full details of the client, ie the principal for which it is acting, because the client wishes to preserve anonymity in the market. For more information, see *Bank of England Quarterly Bulletin*, Spring 2003, pages 98–99.

reduction of settlement risk in the sterling money markets.(1)

On 6 May, HM Treasury laid before Parliament the draft Uncertificated Securities (Amendment) (Eligible Debt Securities) Regulations 2003. Once passed they will pave the way for the integration of non-material money market instruments—to be known as 'eligible debt securities' (EDS)—into the CREST securities settlement system.

Work remains under way on three key strands of legal documentation.

- EDSs will be created under a deed made by the issuer(s). After extensive consultation, *pro forma* terms were discussed at a meeting of the Money Market Liaison Group's Next Steps Group in early June and the terms and an explanatory memorandum finalised.(2)

- To become a 'participating issuer' of EDS in CREST, an issuer must submit an Issuer Application Form; CRESTCo has recently published a standard form. Issuers must also be party to an agreement with an Issuing and Paying Agent (equivalent to a Central Moneymarkets Office (CMO) lodging agent). It is envisaged that versions of these documents will be sent to existing issuers via their current CMO lodging agents.

- In addition, CRESTCo requires issuers incorporated or established outside the United Kingdom to provide legal opinions as to the validity and enforceability of the EDS arrangements and the capacity of the issuer to enter into those arrangements. To make this process as simple as possible, CRESTCo has announced that it is willing to accept capacity opinions from in-house lawyers; and the Bank and CRESTCo have been discussing with the Association of Foreign Banks how the market might co-ordinate the gathering of jurisdictional opinions.(3)

The Bank and CRESTCo invited eligible banks to attend seminars on 11, 12 and 13 June to discuss preparations and documentation required by accepting banks and drawers of eligible bills. More than 50 banks attended.

Procedures for the migration of MMIs into the CREST settlement system are set out in the CREST *White Book* (Migration of MMIs from the Central Moneymarkets Office into CREST). From 15 September the CMO counter will be closed to lodgements and all new issuance will take place in CREST. Remaining euro-denominated securities in CMO will migrate on 22 September, HM Treasury bills on 29 September, bankers' acceptances on 6 October and certificates of deposit (CDs) on 13 October. The *White Book* explains that CMO members should make bilateral arrangements to ensure that all collateral is returned to the entitled owner by the Friday before the relevant migration day, although it will be possible to return collateral early on the migration day.

In line with these procedures, the Bank proposes that counterparties with outstanding repos in open market operations (OMOs) collateralised by HM Treasury bills or eligible bank bills at the respective migration dates substitute other eligible security types for them.(4) It will be possible to substitute CMO instruments with EDS issued into CREST. In the interests of an orderly migration, counterparties are asked to perform substitutions ahead of the migration dates where possible. The Bank will manage the migration of HM Treasury bills and eligible bank bills purchased on an outright basis in OMOs.

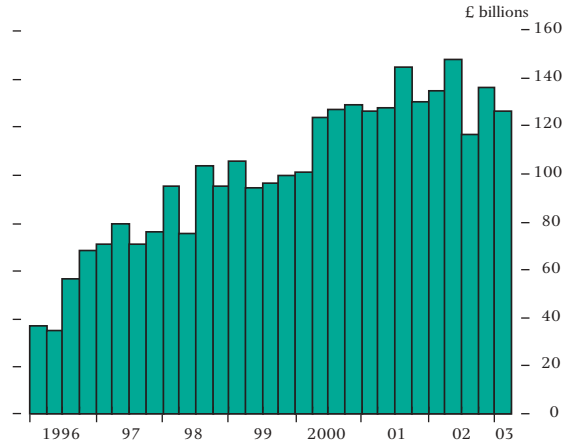
CDs in particular are used as collateral for stock borrowing of other securities, including gilts. CRESTCo and the Bank are consulting market participants to seek to ensure that the migration of CDs occurs without widespread recalls of outstanding stock loans, which could have an adverse effect on, for example, gilt repo market liquidity.

Developments in the gilt repo market

In the gilt repo market, the Bank's quarterly repo and stock lending (RSL) survey found the level of outstanding business at the end of February to be £126 billion, some £10 billion lower than at the end of November (Chart 24). Neither the RSL survey nor data for banks only(5) suggest any clear trends in gilt repo outstanding since early 2000. And there has been little change in RSL survey stock borrowing volumes over the same period. This contrasts with the euro repo market,

(1) See *Bank of England Quarterly Bulletin*, Winter 2002, pages 367–68 and Spring 2003, page 15.
(2) Available on the Bank's web site: www.bankofengland.co.uk/markets/money/mmfuture.htm.
(3) *Pro forma* opinions and other documentation are available from CRESTCo's web site: www.crestco.co.uk/home.html#news/cmo-migration.
(4) A list of OMO eligible security types can be found in the Operational Notice (www.bankofengland.co.uk/markets/money/mmopnot.pdf).
(5) See *Bank of England Monetary and Financial Statistics*, Table B1.2. (A sharp increase in gilt repo amounts outstanding in March 2003 reflected a change in the reporting population.)

Chart 24
Gilt repo amounts outstanding



which appears to have grown since 2000, at least up to mid-2002.(1)

Market participants have suggested a number of reasons for the apparent lack of expansion in the gilt repo market. CDs are often used to collateralise gilt borrowing, and lower spreads between general collateral gilt repo and sterling CD rates may have made it less attractive for banks and securities dealers to borrow gilts from potential stock lenders. One influence on this spread may have been relative supply. The value of CDs outstanding has been fairly steady over this period, while relative gilt availability may have increased following the extension in late 1999 of collateral eligible in the Bank OMOs and the sterling stock liquidity regime to include euro-denominated European Economic Area (EEA) government debt securities.

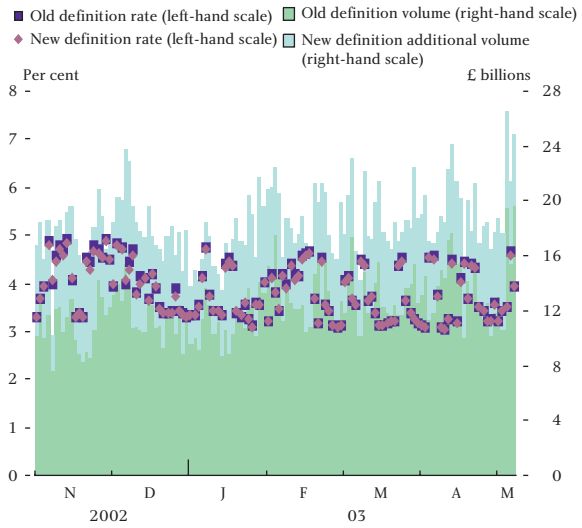
Other possible explanations for lack of expansion of gilt repo market outstandings include a decline in 'specials' activity(2) and the increased popularity of derivatives, including overnight indexed swaps (OIS), to hedge or create interest rate positions.

Calculation of SONIA

Sterling OIS are referenced to the Sterling Overnight Index Average (SONIA), a weighted average of rates on unsecured sterling overnight cash transactions broked in London. On 2 June, after extensive consultation, the Wholesale Markets Brokers' Association (WMBA) broadened the definition of qualifying transactions used in the calculation of SONIA. The calculation had previously been based only on interbank transactions.(3) This has been extended to all sterling overnight cash transactions with a minimum size of £25 million, irrespective of counterparty status.

For a period prior to the extension, the WMBA calculated SONIA on both definitions. The average difference between calculations was less than 3 basis points, and the average value of transactions captured was around 50% higher than under the previous definition (Chart 25). This shows that there is significant non-bank involvement in the sterling overnight wholesale deposit market.

Chart 25
SONIA rates and volumes



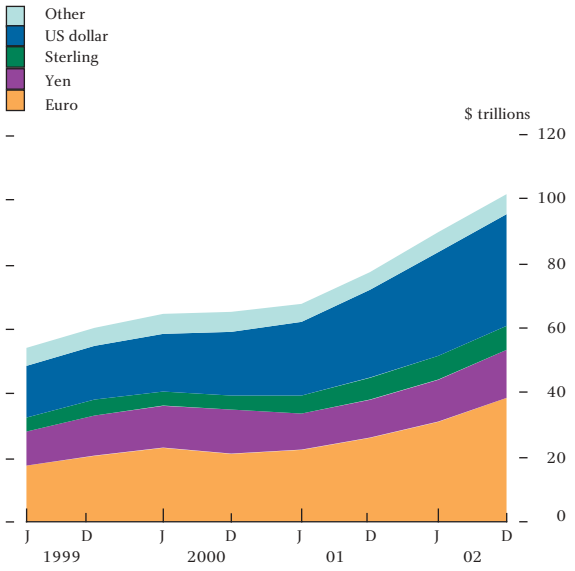
Source: Wholesale Markets Brokers' Association.

Derivatives volumes

According to a Bank for International Settlements survey, the notional outstanding amount of sterling over-the-counter (OTC) interest rate derivatives was $7.4 trillion at end-December 2002, compared with $7.0 trillion in June 2002 (Chart 26), an annual growth rate of over 10%. Over the past two years, the amount outstanding has increased by over 50%, a similar increase to the notional amount outstanding in all currencies. The growth of interest rate derivatives has far outpaced that of other OTC derivative products (Chart 27).

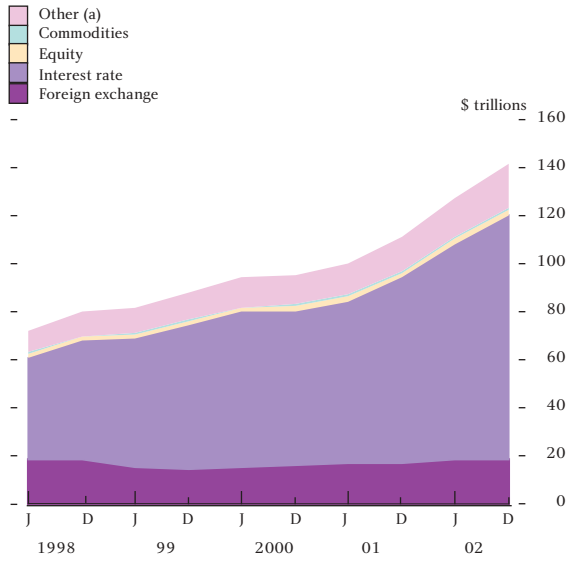
(1) See, for example, the International Securities Market Association (ISMA) European Repo Market Survey, December 2002, and the European Central Bank Euro Money Market Study 2001. The ISMA survey includes non-government debt collateral but around 90% of repo reported has been against government debt securities.
(2) For an explanation of 'specialness' in repo, see *Bank of England Quarterly Bulletin*, Winter 2002, page 360.
(3) 'Section 43' listed money market institutions and their overseas branches. The Financial Services Authority Section 43 regime ceased on 1 December 2001.

Chart 26
Notional amounts outstanding of OTC interest rate derivatives by currency



Source: Bank for International Settlements.

Chart 27
Notional amounts outstanding of OTC derivatives by type of underlying



Source: Bank for International Settlements.

(a) Estimated positions of non-regular reporting institutions.

The growth in OTC interest rate derivatives is not surprising. Interest rate swaps are bilateral transactions used to take interest rate views and hedge interest rate positions. When dealers want to adjust or close out a position, they will typically enter into a new offsetting transaction rather than cancel the original trade. As time has passed, the number of swap contracts outstanding has therefore increased. But the existence of overlaid swaps increases operational costs and risks. This has led to market initiatives to introduce the early termination of interest rate swaps, or 'tear up' facilities.(1)

SFD designation of London Clearing House

On 23 April 2003, following consultation with the Bank of England on payment aspects, the Financial Services Authority designated the London Clearing House (LCH) under the Financial Markets and Insolvency (Settlement Finality) Regulations 1999, which implement the European Union Settlement Finality Directive (SFD) in the United Kingdom.

SFD designation reduces the disruption to a system arising from insolvency proceedings brought against a participant located in the EEA. Together with the protection provided in the United Kingdom by Part VII of the Companies Act 1989, LCH's designation provides protection to the system in the event of default arising from the insolvency of one of its participants.

Four other high-value payment and settlement systems are already accorded SFD protection through a designation under UK law: CHAPS Sterling, CHAPS Euro, CREST and Continuous Linked Settlement.(2)

Bank of England official operations

Changes in the Bank of England balance sheet

Both the foreign currency and sterling components of the Bank's balance sheet increased between 26 February and 28 May (Table C).(3)

On 18 March 2003, the Bank auctioned a further €1.0 billion of the 2006 note as part of its euro-denominated notes programme. The auction was covered 2.7 times and the average accepted yield was 2.858%, some 18.5 basis points below the three-year swap rate. This increased the total nominal value of the 2006 note outstanding in the market to €2.0 billion, and the total nominal value of Bank three-year euro notes outstanding in the market to €6.0 billion.

(1) For example, TriOptima's TriReduce product terminated euro-denominated interest rate swaps of over €420 billion nominal value in its first production run on 25 April. TriOptima expects to extend this service to sterling interest rate swaps in the coming months.
(2) Continuous Linked Settlement, operated by CLS Bank International, settles bought and sold currencies on a 'payment-versus-payment' basis. See *Bank of England Quarterly Bulletin*, Autumn 2002, pages 257–58 and Winter 2002, pages 365–66, and *Bank of England Financial Stability Review*, December 2002, pages 82–85.
(3) For an explanation of the main components of the Bank of England's balance sheet, see page 18 of *Bank of England Quarterly Bulletin*, Spring 2003.

Table C
Simplified version of Bank of England consolidated balance sheet as at 28 May 2003(a)

£ billions

Liabilities	28 May	26 Feb.	Assets	28 May	26 Feb.
Bank note issue	33	31	Stock of refinancing	21	19
Settlement bank balances	<0.1	<0.1	Ways and Means advance to HM Government	13	13
Other sterling deposits, CRDs and the Bank of England's capital and reserves	5	6	Other sterling-denominated assets	3	4
Foreign currency denominated liabilities	11	11	Foreign currency denominated assets	11	11
Total (b)	**49**	**47**	**Total** (b)	**49**	**47**

(a) Based on published weekly Bank Returns.
(b) Figures may not sum to totals due to rounding.

The Bank maintained the nominal value of its three-month and six-month euro-denominated bills outstanding at €3.6 billion, rolling over maturing bills at auctions held monthly during the period.

Growth in the sterling components of the Bank's balance sheet over the period as a whole largely reflected increased demand for bank notes. During the period, there were seasonal peaks in demand for currency, at Easter and the May Bank Holidays.

Bank notes represent by far the Bank's largest liability, making growth of the note issue a key underlying determinant of changes in the size of the overall balance sheet. In recent years, expansion of the note issue has been mirrored by an increase in the size of the Bank's stock of refinancing (SoR) via open market operations (OMOs), mainly two-week reverse repos of government securities. The difference between note issue liabilities and the SoR is largely accounted for by the 'Ways and Means' (W&M) loan, an illiquid advance to HM Government, held constant since the transfer of responsibility for UK central government cash management to the United Kingdom Debt Management Office (DMO) in April 2000. Prior to the transfer, W&M fluctuated with the level of government expenditures and receipts, requiring the Bank to adjust the scale of its OMOs each day to offset cash flows between the government and the private sector; the DMO now offsets those fluctuations through its cash management (Chart 28).

Over recent years there have been changes in the composition of the collateral against which the Bank's monetary operations are secured. In particular, reverse repos of euro-denominated securities issued by EEA governments have increasingly accounted for a larger share (Chart 29). The choice of collateral to deliver in OMOs varies from counterparty to counterparty, depending on a number of factors: technical capacity to deliver and substitute collateral in different settlement systems; the composition of a counterparty's asset book; and the relative cost of different eligible collateral types.

Chart 28
Bank notes in circulation, the stock of refinancing and 'Ways and Means'

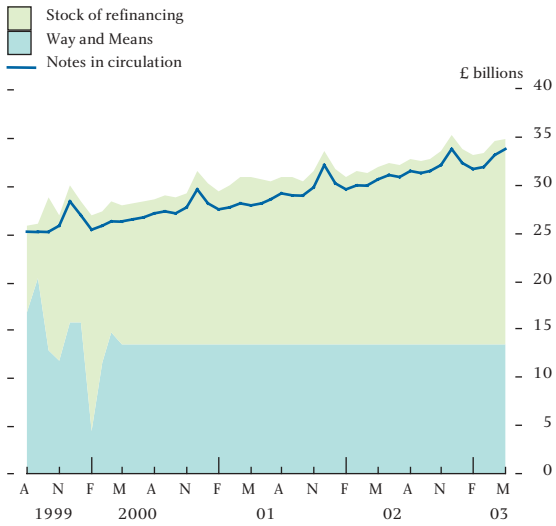
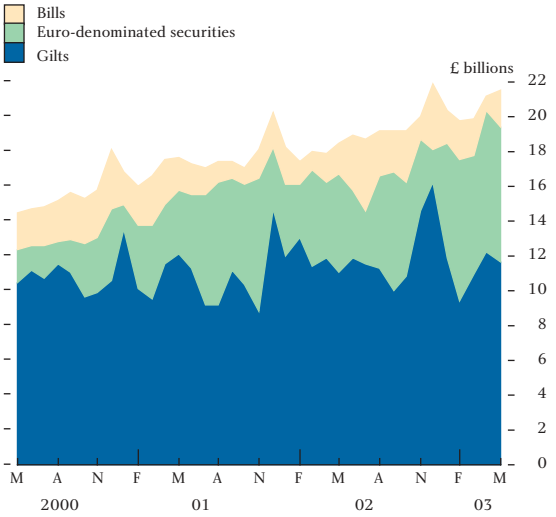
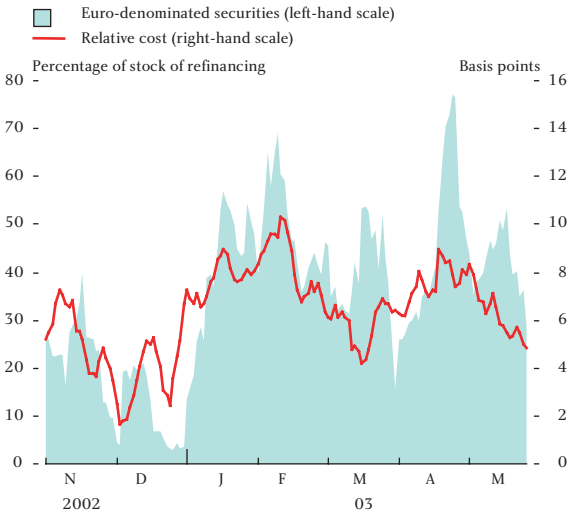


Chart 29
Instruments used as OMO collateral



The cost of collateral can be proxied by the spread between the rate at which it can be repoed (ie the return on cash placed against it) and the unsecured interbank cash rate at the same maturity. A measure of the relative cost of collateral in different currencies is, therefore, the spread of those spreads. Chart 30 suggests that there is some correlation between the cost of euro-denominated EEA debt relative to gilts and use of EEA debt by counterparties in the Bank's OMOs.

Chart 30
Relative cost and delivery in OMOs of euro-denominated EEA government securities(a)



Source: Bloomberg.

(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.

There was slightly less recourse to the Bank's overnight lending facilities than in the previous period (Chart 31). This may have contributed to greater use of euro-denominated securities, because the Bank's 15.30 overnight facilities are restricted to sterling-denominated securities as a result of settlement system timetable constraints. It also had the effect of increasing the average maturity of the SoR, thereby decreasing the size of the banking system's average daily liquidity shortage in March-May compared with November-February (Chart 32).

Chart 31
Refinancing provided in the Bank's open market operations

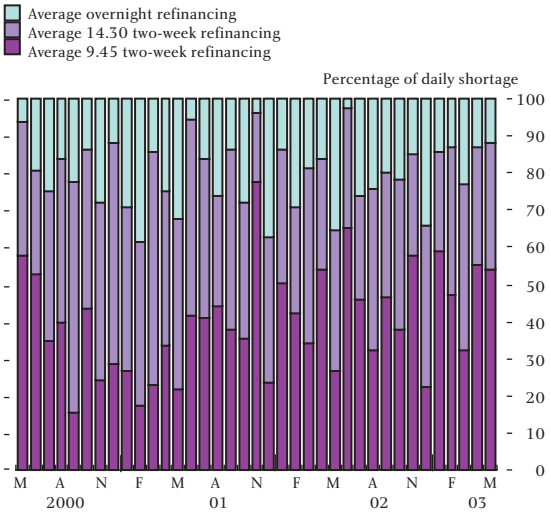
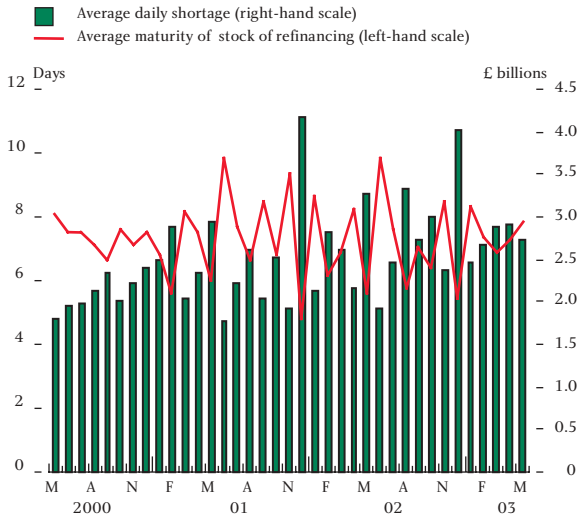


Chart 32
Average maturity of stock of refinancing and average daily shortage



Forecasting the liquidity shortage

Uncertainty about demand for bank notes increased over Easter and with the possibility of industrial action by staff at one of the companies responsible for their distribution. This led the Bank between 14 and 28 April to increase from £200 million to £400 million the amount of the banking system's forecast liquidity need held over from the 9.45 to the 14.30 round of OMOs in order to minimise the risk of oversupplying liquidity intraday. Partly as a result of this greater uncertainty, revisions to the 9.45 liquidity forecast were larger in April than in surrounding months (Table D).

Table D
Intraday forecasts versus actual shortages

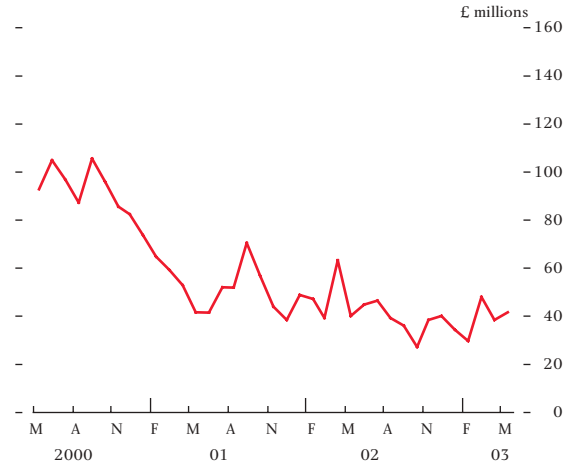
Mean absolute difference (standard deviation), £ millions

	9.45 forecast		14.30 forecast		16.20 forecast	
2000 (a)	121	(96)	99	(64)	103	(56)
2001	98	(205)	56	(51)	30	(73)
2002	83	(107)	43	(82)	30	(73)
Jan. 2003	79	(82)	41	(56)	24	(25)
Feb. 2003	93	(81)	54	(61)	49	(37)
Mar. 2003	67	(57)	42	(46)	26	(24)
Apr. 2003	167	(183)	68	(119)	39	(51)
May 2003	114	(119)	46	(37)	46	(43)

(a) From April 2000.

Over a longer period, the size of errors in the Bank's final, 16.20, forecast has remained fairly steady since the transfer of central government cash management to the DMO. The typical level of settlement banks' overnight balances at the Bank has also declined (Chart 33). This has occurred without an increase in the incidence of negative individual end-of-day balances.

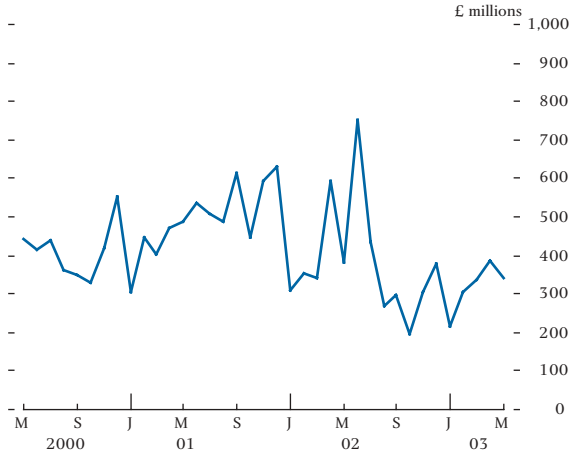
Chart 33
Settlement account balances(a)



(a) Monthly averages. Settlement-bank accounts are the accounts of banks with final settlement of sterling payments at the Bank of England.

Settlement banks may also have improved the quality of their own liquidity forecasting in recent years. One piece of evidence for this has been a decline in average flows in the End of Day Transfer Scheme (EoDTS, Chart 34). Settlement banks aim to achieve small end-of-day credit balances on their settlement accounts at the Bank, but failed settlements or incomplete

Chart 34
End of Day Transfer Scheme volumes(a)



(a) Monthly averages.

information about customer flows may leave some banks unexpectedly long or short.

Every day, settlement banks report their balances to the Association for Payments Clearing Services after the close of CHAPS. Transfers of long and short balances then take place across settlement banks' accounts at the Bank of England to achieve a smoother distribution of end-of-day settlement account positions.(1)

(1) Further details on the EoDTS can be found on the APACS web site: www.apacs.org.uk/downloads/EoDT.pdf.