

Markets and operations

This article reviews developments in international and domestic financial markets, drawing on information from the Bank of England's market contacts, and describes the Bank's market operations in the period 15 February to 17 May 2002.

- The dollar, euro and sterling money market yield curves remained steeply upward-sloping during the period.
- Long-term interest rates rose in the United States, Germany and the United Kingdom.
- Effective exchange rates for the dollar and sterling depreciated, while the euro and the yen appreciated.
- Most major international equity indices rose slightly, while Japanese equity indices rose more strongly.

Macroeconomic background to market developments

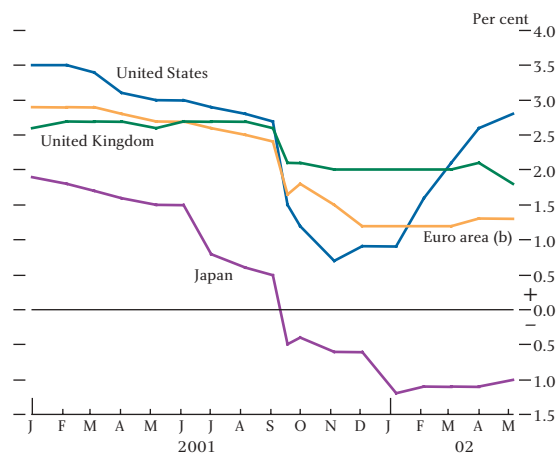
Consensus GDP growth expectations for 2002 increased further for the United States, but were altered little for the United Kingdom and the euro area (see Chart 1); expectations for 2003 were little changed for these three regions. Consensus growth expectations for 2002 increased slightly for the Asia/Pacific region, but fell for Latin America. Consensus expectations for consumer price inflation in 2002 and 2003 increased or were unchanged in all these regions (see Table A).

Short-term interest rate expectations

The Federal Open Market Committee (FOMC), the European Central Bank (ECB) and the Bank of England's Monetary Policy Committee (MPC) left official interest rates unchanged during the period. The Bank of Japan (BoJ) also kept its monetary policy unchanged.⁽¹⁾ The Bank of Canada and the Reserve Bank of Australia increased their official interest rates by 25 basis points, and the Reserve Bank of New Zealand by 75 basis points.

The steepness of the money market futures curves, as measured by the difference in interest rates implied by three-month futures twelve and three months ahead,

Chart 1
Forecasts for GDP growth in 2002^(a)



Source: Consensus Economics.

(a) Means of survey samples.

(b) Weighted average forecasts for France, Germany and Italy for the interim survey of 25 September 2001.

increased by around 50 basis points in the United States, to historically high levels, but changed relatively little in the United Kingdom and the euro area (see Chart 2). The steepness of money market yield curves continues to reflect market participants' views that official rates are likely to rise. In the United States, the further steepening reflected both a fall in the level of interest rates expected in the near term and a rise in the level expected further out. Near-term interest rate

(1) The main operating target for the BoJ's money market operations is the outstanding balance of the current accounts at the BoJ.

Table A
Forecasts for consumer price inflation

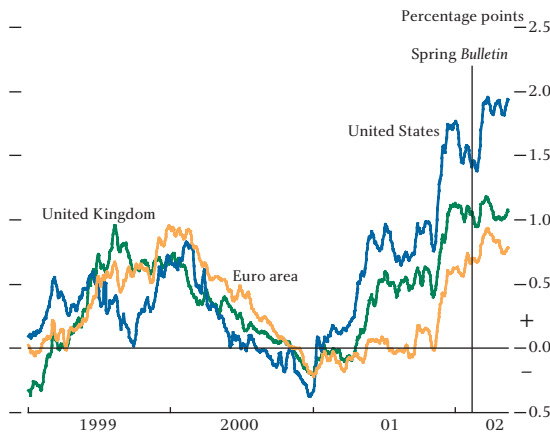
Per cent; percentage points in italics

	2002 forecasts			2003 forecasts		
	February	May	Change (a)	February	May	Change (a)
United States	1.4	1.6	<i>0.2</i>	2.4	2.4	<i>0.0</i>
Euro area	1.7	2.0	<i>0.3</i>	1.8	1.9	<i>0.1</i>
United Kingdom	2.0	2.2	<i>0.2</i>	2.3	2.3	<i>0.0</i>
Asia/Pacific	0.0	0.1	<i>0.1</i>	0.4	0.5	<i>0.1</i>
Latin America	12.1	15.6	<i>3.5</i>	6.9	8.6	<i>1.7</i>

Source: Consensus Economics.

(a) Changes between February and May 2002 surveys.

Chart 2
Steepness of US, UK and euro-area money market yield curves^(a)

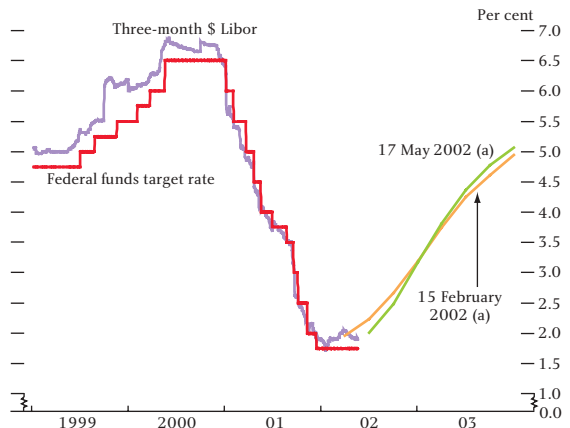


(a) Difference between three-month forward rates twelve months and three months ahead, derived using the Bank's bank liability curve. For further details, see Brooke, M, Cooper, N and Scholtes, C (2000), *Bank of England Quarterly Bulletin*, November, pages 392-402. Excluding the week of 14 September 2001. Five-day moving average.

expectations also fell in the United Kingdom. Financial market participants revised outwards their expectations for how long the FOMC and the MPC would keep their official interest rates unchanged (see Charts 3 and 4). But near-term rate expectations rose in the euro area (see Chart 5).

Changes in the future interest rate levels implied by interest rate futures contracts maturing in December 2002 are shown in Chart 6. Market participants' perception of the resilience and speed of the economic recovery in the United States played an important role in these changes. In late February and early March, a series of stronger-than-expected US data releases was followed by testimony from Federal Reserve Chairman Greenspan on 7 March, which market participants interpreted as being more optimistic about the US economy. These contributed to an increase in implied future interest rates in all three regions. In the United Kingdom, stronger-than-expected domestic economic data were also influential in March (see Table B).

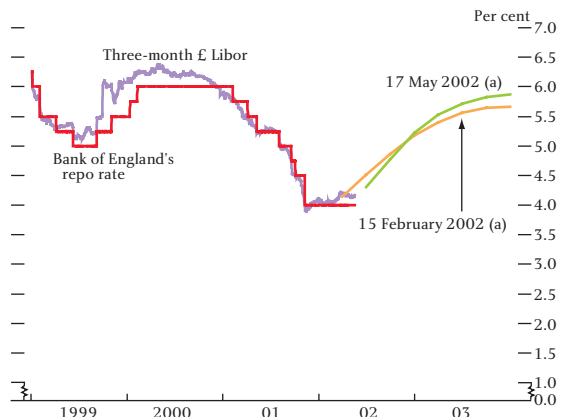
Chart 3
US interest rates



Source: Bloomberg.

(a) Three-month interest rates implied by eurodollar futures contracts at the dates specified. From February 2002 onwards, the horizontal axis relates to contract expiry dates.

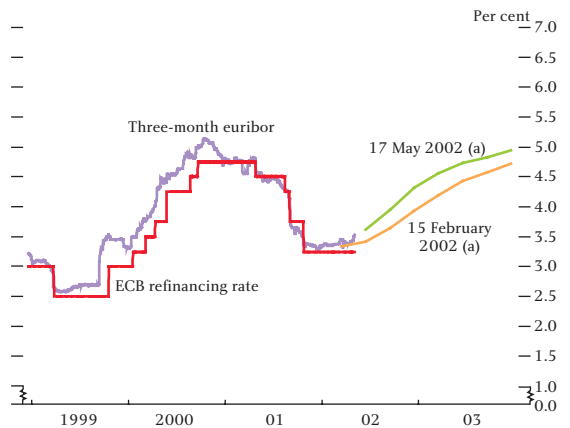
Chart 4
UK interest rates



Source: Bloomberg.

(a) Three-month interest rates implied by short sterling futures contracts at the dates specified. From February 2002 onwards, the horizontal axis relates to contract expiry dates.

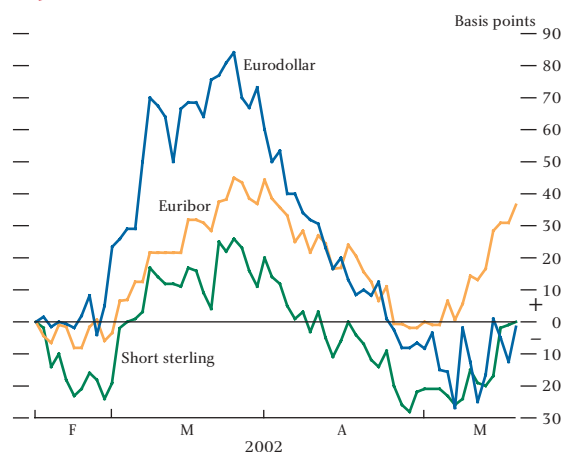
Chart 5
Euro-area interest rates



Source: Bloomberg.

(a) Three-month interest rates implied by euribor futures contracts at the dates specified. From February 2002 onwards, the horizontal axis relates to contract expiry dates.

Chart 6
Cumulative changes in short-term interest rate expectations for December 2002^(a)



Sources: Bloomberg and Reuters.

(a) As indicated by changes in interest rates implied by futures contracts maturing in December 2002.

Table B
Market interest rate reactions to some economic news and official publications and comments^(a)

	Expected (b)	Actual	Intraday change (basis points) (c)	Daily change (basis points)
Governor's <i>Euromoney</i> speech (19/2)	-	-	-7	-5
MPC minutes (20/2)	-	-	-4	-6
UK retail sales (m-o-m) (21/2)	0.7%	-0.3%	-8	-4
Halifax house prices (m-o-m) (7/3)	-	1.5%	4	8
Chairman Greenspan's testimony (7/3)	-	-	3	8
RPIX (y-o-y) (19/3)	2.4%	2.2%	-4	-6
FOMC announcement, and Governor's comments (19/3) (d)	-	-	-5	4
UK retail sales (m-o-m) (21/3)	0.5%	1.5%	7	11
US consumer confidence (March) (26/3)	98.0	110.2	5	-3
US weekly initial jobless claims (4/4)	380,000	460,000	-5	-5
US unemployment rate (March) (5/4)	5.6%	5.7%	-4	-3
CBI industrial trends survey (23/4)	-	-	4	3
UK Q1 GDP (q-o-q) (26/4)	0.4%	0.1%	-7	-8
UK manufacturing production (m-o-m) (8/5)	0.3%	-0.8%	-4	1
US retail sales (m-o-m) (14/5)	0.6%	1.2%	4	8
<i>Inflation Report</i> (15/5)	-	-	8	10

Source: Bloomberg.

- (a) Reactions in rates implied by short sterling futures contracts (June 2002 contract up to 20 March, subsequently September 2002 contract).
 (b) - indicates unavailability of data.
 (c) Change in rates implied by short sterling from 15 minutes before to 15 minutes after the economic news release, publication of document or start of speech, or for overnight news from closing price to 30 minutes after start of trading the following day.
 (d) These occurred after close of London trading. Therefore daily change is from 19 March to 20 March.

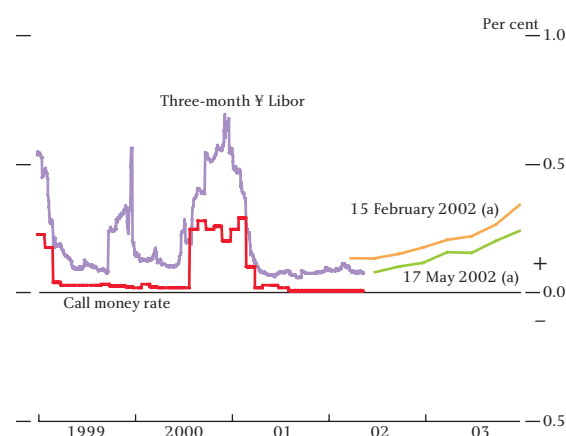
From late March, decreases in implied future short-term interest rates in all three regions largely reflected market concerns about the pace of the economic recovery in the United States. This followed a series of weaker-than-expected data releases. Concerns about the conflict in the Middle East and a possible adverse effect of higher oil prices on the US economic recovery contributed to the fall. Official comments were important in leading market participants to revise their

expectations about how long official rates would remain unchanged, particularly in the United States and the United Kingdom.

In early May, the fall in implied future interest rates was partly reversed in the euro area and to a lesser extent in the United Kingdom. In the euro area, higher-than-expected inflation data in some member states followed comments by ECB President Duisenberg on the inflation outlook. In the United Kingdom, publication of the *Inflation Report* led to significant increases in interest rates implied by short sterling futures contracts expiring up to early 2003; market participants noted that the MPC's projection for inflation was slightly above its target at the two-year horizon, with risks on the upside. Unexpectedly strong US retail sales data published on 14 May led to increases in implied rates in all three areas.

Implied future short-term interest rates in Japan fell slightly over the period, by up to 10 basis points out to the end of 2003 (see Chart 7). While the Bank of Japan kept its monetary policy unchanged during the period (see footnote 1 on page 125), it announced several changes to its open market operations at its meeting on 28 February, including an increase from ¥0.8 trillion to ¥1.0 trillion per month in its Rinban operations⁽¹⁾ and a pledge to provide ample liquidity towards the fiscal year-end. It also announced that it would ease the restriction on the use of its Lombard-type lending facilities and consider broadening the range of eligible collateral used in its operations (this was later approved).

Chart 7
Japanese interest rates



Source: Bloomberg.

(a) Three-month interest rates implied by euroyen futures contracts at the dates specified. From February 2002 onwards, the horizontal axis relates to contract expiry dates.

(1) In its Rinban operations, the BoJ provides funds to the banking system through outright purchases of Japanese government bonds.

These changes were made partly in response to the re-emergence of the 'Japanese premium' ahead of the financial year-end.⁽¹⁾

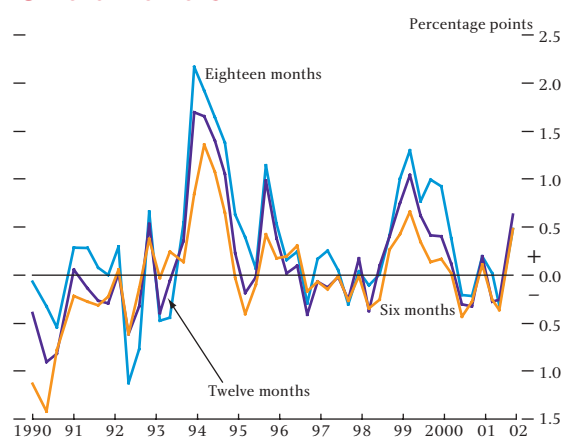
Term premia

As Charts 3 to 5 show, interest rate futures maturing to the end of 2002 reflect market participants' mean expectation that official rates will be increased before the end of 2002 Q3 in the United States, the euro area and the United Kingdom. However, over the period, market contacts have suggested that rates implied by interest rate futures have tended to be somewhat higher than market participants' mean expectations.⁽²⁾ In part, this may reflect risk premia, and more specifically 'term' premia.⁽³⁾ There are several possible explanations for the existence of term premia, which are not mutually incompatible, and three of them are described below. Risk premia may also reflect liquidity, credit and inflation risk, which might vary across different instruments. However, the box on pages 130–31 presents a comparison of the steepness of the sterling money market yield curve derived from cash and derivative instruments, which suggests that such differences are small.

Chart 8 compares three-month UK forward rates derived from the Bank of England's 'bank liability curve' (BLC)⁽⁴⁾ with economists' expectations of the three-month sterling Libor rate (from *Consensus* surveys) to provide estimates of term premia over time at various horizons. The term premia are estimated as the difference between the market forward rates and survey expectations. The chart shows that term premia have more often been positive than negative since 1993, when the period of downward-sloping yield curves of the early 1990s came to an end. It also indicates that, although positive, recent term premia are not extreme by historical standards. The survey-based estimates of term premia shown in Chart 8 also indicate that term premia have tended to increase with maturity since 1993.

Chart 9 compares market and survey-based measures of the steepness of the UK money market yield curve. Survey-based term premia changed relatively little over the period, but were somewhat higher in March and

Chart 8
Survey-based term premia^(a) at the 6, 12 and 18-month horizons^(b)

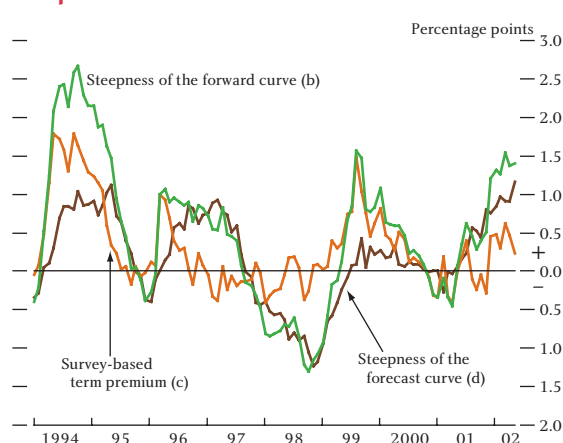


Sources: Consensus Economics and Bank of England.

- (a) Quarterly *Consensus* forecasts of three-month interbank rates at each horizon, minus three-month interbank rates at the same horizon (derived using the Bank's bank liability curve).
 (b) Slightly less than 7, 13 and 19 months from 1994 on. Before this, 5 to 6, 11 to 12, and 17 to 18 months.

April. It is broadly consistent with a view expressed by some market participants in April that only around 70% of the steepness in the short sterling yield curve out to one year at that time might have been explained by interest rate expectations.

Chart 9
UK survey-based term premia and yield curve steepness^(a)



Sources: Consensus Economics and Bank of England.

- (a) Observations are on *Consensus* survey dates.
 (b) Three-month interbank rate twelve months forward minus current three-month interbank rate.
 (c) Three-month interbank rate twelve months forward minus comparable *Consensus* forecast rate.
 (d) *Consensus* forecast of three-month interbank rate twelve months forward minus current three-month interbank rate.

(1) The Japanese premium is the interest rate premium over market interbank deposit rates which Japanese banks have to pay to attract uncollateralised funding.

(2) On using interest rate futures as a guide to expectations of official rates, see Brooke, M, Cooper, N and Scholtes, C (2000), 'Inferring market interest rate expectations from money market rates', *Bank of England Quarterly Bulletin*, November, pages 392–402.

(3) See the box on interest rate term premia in 'Markets and operations' (2002), *Bank of England Quarterly Bulletin*, Spring, page 9.

(4) The BLC data are derived from money market instruments and interest rate swaps. For more information, see Brooke, M, Cooper, N and Scholtes, C, *op cit*.

Finance theory suggests that term premia might be related to the steepness of the yield curve.⁽¹⁾ For example, if investors require a higher return on assets which pay out in states of the world in which they expect to be better off, then positive term premia might be associated with an upward-sloping yield curve, if an upward slope reflects expectations of higher output and consumption growth. Since 1994, the correlation between changes in survey-based term premia and changes in yield curve steepness (both at the twelve-month horizon) has been high at 0.81, although this may have reflected in part the fact that term premia are included in the measure of yield curve steepness (see Chart 9).

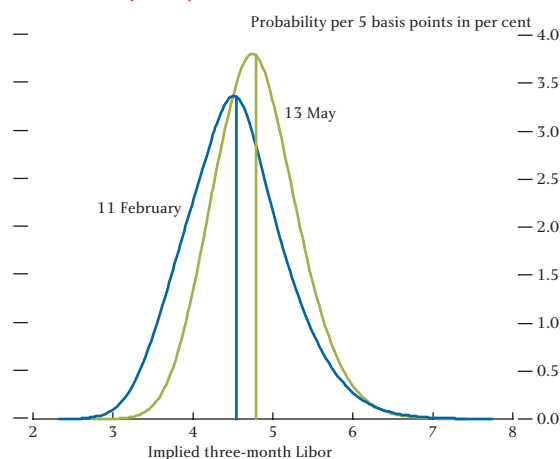
At various times, changes in the demand for, or supply of, fixed-rate funding may also have contributed to term premia. For example, during some periods in the past, market contacts suggested that an increase in mortgage lenders' demand to hedge fixed-rate mortgage loans to match their predominantly floating-rate liabilities may have contributed to a difference between forward interest rates and market participants' rate expectations around two to five years ahead. Mortgage lenders can hedge their fixed-rate loans for example by selling short sterling contracts or by paying fixed and receiving floating in interest rate swap contracts. In either case, the effect is to put upward pressure on the forward rates implied by these derivative instruments. This could contribute to a positive term premium at these maturities, if arbitrage does not close the gap immediately.

If term premia are at least partly caused by investors or borrowers requiring insurance against the risk of adverse future movements in interest rates, then they may also be affected by the shape of the distribution of investors' and borrowers' interest rate expectations. The shape of the distribution can be characterised partly by its standard deviation, which measures the width of the distribution; its skewness, which measures the asymmetry of the distribution around its mean; and its kurtosis, which measures the extent to which the tails of the distribution are 'fatter' than in a normal distribution. For example, positive term premia might in some situations be associated with a distribution that has a relatively high standard deviation, positive skew and high kurtosis, to compensate investors for a relatively

high perceived risk of a sharper-than-expected rise in interest rates.

An estimate of the shape of the probability distribution of market expectations of future interest rates can be inferred from the prices of options on interest rate futures (see Chart 10).⁽²⁾ However, options prices, and the implied probability distributions derived from them, are also affected by demand and supply factors in the options market (assuming that options prices are not

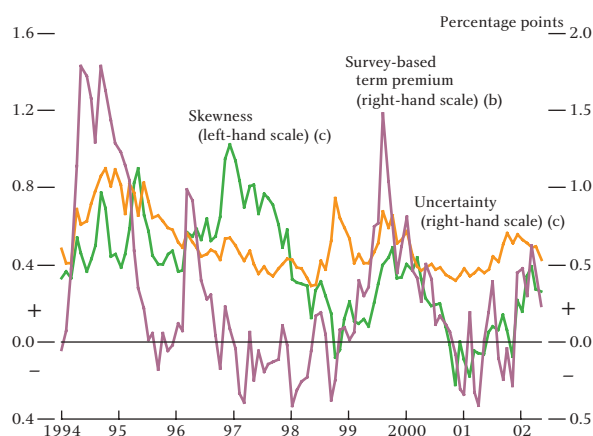
Chart 10
Short sterling implied probability density functions (PDFs)^(a)



Sources: LIFFE and Bank of England.

(a) Implied probability density functions six months ahead for three-month interest rates.

Chart 11
UK survey-based term premia and interest rate uncertainty and skewness^(a)



Sources: Consensus Economics, LIFFE and Bank of England.

(a) Observations are on *Consensus* survey dates.
(b) Three-month interbank rate twelve months forward minus comparable *Consensus* forecast rate.
(c) Standard deviations and skewness implied by six-month constant horizon options on interest rate futures contracts; five-day moving averages.

(1) See Soderland, P and Svensson, L (1997), 'New techniques to extract market expectations from financial instruments', *Journal of Monetary Economics*, Vol. 40, pages 383–429.

(2) For details on extracting information from options prices, 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.

Comparison of the steepness of sterling money market yield curves in cash and derivative markets

The current steepness of money market yield curves derived from both cash and derivative instruments is likely to reflect a combination of market participants' interest rate expectations and 'term' or risk premia.⁽¹⁾ Risk premia might differ between the various instruments, and between cash and derivative markets in particular: for example, due to differences in the way the instruments are used, varying degrees of exposure to counterparty credit risk and different levels of liquidity in the various markets. In principle, these might generate differences in the steepness of yield curves between the types of instrument, although in practice arbitrage opportunities are likely to keep them in line. Market participants have suggested that derivatives rather than cash instruments have increasingly been used by banks to express interest rate views in recent years. This box describes the different uses of some cash and derivative instruments, and shows that on the whole, there is little difference between the steepness of the money market yield curves implied by cash instruments on the one hand and by derivative instruments on the other.

An interbank deposit is a cash deposit with a bank where a lender deposits an agreed amount of money either at call or for a given period of time, at an agreed interest rate.⁽²⁾ Interbank deposits are primarily used to transfer funds from 'cash-surplus' to 'cash-deficit' financial institutions, primarily at short maturities.⁽³⁾ Interbank deposits can also be used by banks to take interest rate views. However, deposits are now used less widely than money market derivatives (eg short sterling futures and SONIA swaps) for this purpose, in part because on-balance-sheet instruments incur a higher regulatory capital requirement for the lending bank.

Certificates of deposits (CDs) are debt securities evidencing that a deposit has been made with a bank (or building society) for a fixed period of time, at the end of which it will be repaid with interest. Like interbank deposits, CDs are used by banks for funding, often at longer maturities, as their marketability makes them a more liquid investment for a lender. CDs held (excluding a bank's own CDs) are allowable, with certain constraints, in the Financial Services Authority's retail bank stock liquidity regime. A further use of CDs is as collateral. End-investors (eg pension funds) often lend gilts or other securities into the market on a collateralised basis, taking CDs as security.

Commonly used money market derivatives are short sterling futures, forward rate agreements (FRAs) and SONIA swaps.⁽⁵⁾ A short sterling future is an interest rate futures contract that settles on the three-month BBA Libor rate prevailing on the contract's delivery date. Contracts are standardised and traded between members of the London International Financial Futures and Options Exchange (LIFFE). An FRA is an over-the-counter interest rate contract, in which two counterparties agree to exchange the difference between an agreed rate of interest and an as yet unknown Libor rate of specified maturity that will prevail at an agreed date in the future. Payments are calculated against a pre-arranged notional principal. A SONIA swap is a contract that exchanges at maturity a fixed interest rate against a geometric average of the floating overnight rates that have prevailed over the life of the contract.⁽⁴⁾ Short sterling futures are predominantly used to speculate on, and to hedge against, future interest rate movements. The amount outstanding in this market—known as 'open interest'—increased slightly in the year to end-March, by 3% to £419 billion. Unlike futures, which are exchange traded, FRAs and

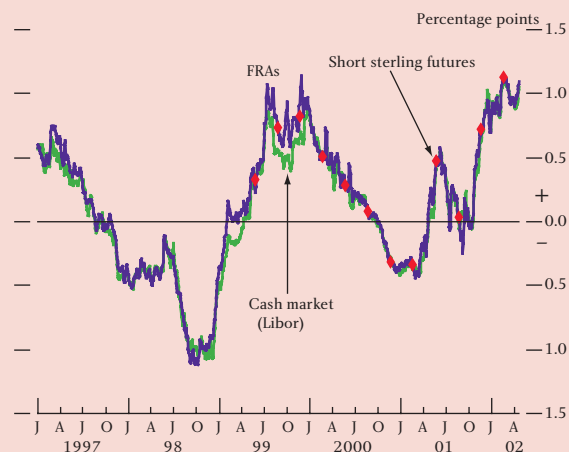
(1) See page 128.

(2) The British Bankers' Association (BBA) publishes London interbank offer rate (Libor) fixings daily, which are calculated as the average of the middle eight offer rates collected at 11 am from a number of financial institutions operating in the London interbank market.

(3) See the box on sterling money market instruments in Brooke, M, Cooper, N and Scholtes, C (2000), 'Inferring market interest rate expectations from money market rates', *Bank of England Quarterly Bulletin*, November, pages 392–402.

(4) The sterling overnight index average: a weighted average of rates on all unsecured sterling overnight cash transactions brokered in London between midnight and 4.15 pm each day.

Chart A
Steepness of sterling money market curve^(a)



Sources: Bloomberg and Bank of England.

(a) Three-month rates nine months minus one month forward; five-day moving averages.

SONIA swaps are traded over the counter. The greater flexibility of FRAs allows institutions to match the cash flows of outright positions, so that they are good instruments to use for hedging.

Chart A assesses whether differences in usage and liquidity between instruments might have led to a difference in steepness by comparing cash and derivative market yield curves. It shows the steepness of the cash market yield curve, as measured by the difference between three-month Libor rates nine months and one month forward, and the steepness derived from derivatives markets, using short sterling futures and forward rate agreements (FRAs).⁽⁵⁾ The steepness of the sterling money market yield curve is similar for a variety of cash and derivative instruments. The steepness of cash market and derivatives market yield curves have generally moved closely together, as might be expected given the arbitrage opportunities between the two sets of instruments. Since November 2001, when the money market curve steepened strongly, the cash market curve has on average been slightly less steep (by just over 2 basis points) than the FRA curve. (And on average since February 1997, it has been 4.5 basis points less steep.) The differences may partly reflect the fact that derivatives might be used to a greater

Chart B
Steepness of sterling cash market yield curves^(a)



Sources: Bloomberg and Bank of England.

(a) Twelve-month minus one-month spot rates for Libor fixings, interbank and CD offered rates (both at 4.30 pm); five-day moving averages.

extent than cash instruments for hedging purposes when interest rates are expected to rise, thereby possibly increasing the risk premium for derivative instruments.

Chart B compares the yield curves for different cash market instruments, to assess whether Libor fixings are representative of other cash market rates. The chart shows the steepness of the spot cash money market yield curves, as measured by the difference between the twelve and one-month spot rates, for CDs and unsecured interbank deposits as well as Libor fixings.⁽⁶⁾ On average since September 1997, the money market curve derived from interbank deposit rates has been equally steep as that derived from Libor fixings, and the curve derived from CD rates has only been around 3 basis points less steep.

In conclusion, the steepness of money market yield curves derived from the cash and derivative instruments considered here has been similar recently, despite a reduction in liquidity in longer-dated cash instruments reported by some market participants (see the section on the sterling money market), indicating that arbitrage between the two sets of instruments has remained effective.

(5) Note that the furthest horizon for which it is possible to calculate a three-month forward rate for a cash instrument is nine months ahead, using Libor fixings. With regard to short sterling, it is only possible to calculate yield curve steepness at this horizon from June 1999 (when one-month contracts were introduced), and then at three-month intervals to fit with the contract settlement dates.

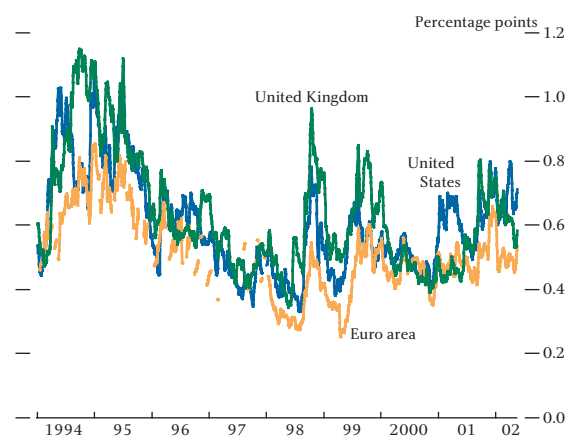
(6) We use the spot rates for CDs and interbank deposits because we cannot derive a back-run of three-month rates nine months forward for these instruments.

perfectly arbitrated) and may themselves contain risk premia. As a result, options prices do not just reflect interest rate expectations. Far 'out of the money' options, used to infer the tails of the probability distribution, tend to be particularly illiquid. Since 1994, the correlation between changes in interest rate uncertainty (as measured by implied standard deviations) and implied skewness, both at a six-month horizon, on the one hand, and changes in survey-based term premia at the twelve-month horizon, on the other, were 0.31 and 0.25 respectively. Chart 11 shows survey-based term premia alongside measures of uncertainty and skewness derived from options prices since 1994.

Interest rate uncertainty from options prices

Interest rate uncertainty in the United Kingdom at the six-month horizon, as inferred from options prices, fell from a relatively high level by historical standards, with much of the fall occurring in the second half of April (see Chart 12). Interest rate uncertainty also fell in the United States in April (although it remained higher than in the United Kingdom). According to market contacts, these decreases may have reflected expectations that official interest rates would remain unchanged for longer than thought previously. In the euro area, uncertainty fell slightly and is currently not high in historical perspective. The skewness of rate expectations at the six-month horizon remained positive in all three regions, indicating that market participants continued to think that there was a greater upside than downside risk to interest rate movements.

Chart 12
Interest rate uncertainty^(a)



Sources: LIFFE, Chicago Mercantile Exchange and Bank of England.

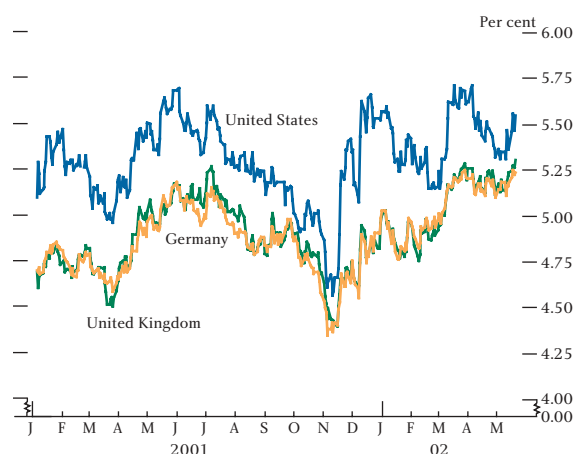
(a) Standard deviations implied by six-month constant horizon options on interest rate futures contracts; five-day moving averages.

Longer-term interest rates

Nominal government bond yields

Between 15 February and 17 May, ten-year government bond yields in the United States, Germany and the United Kingdom rose by 40, 32 and 43 basis points respectively (see Chart 13), following a somewhat similar pattern to that of money market interest rates during the period. Over the period, forward government bond yields rose across the curve (see Charts 14 to 16).

Chart 13
International ten-year government bond yields^(a)

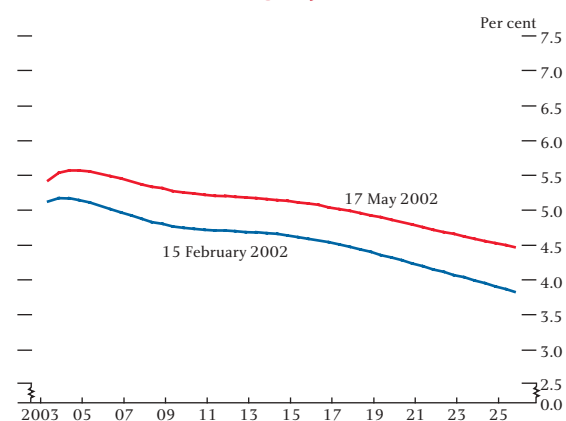


(a) Derived using the Bank's VRP curve-fitting technique. For further details see Anderson, N and Sleath, J (1999), 'New estimates of the UK real and nominal yield curves', *Bank of England Quarterly Bulletin*, November, pages 384-92.

Factors other than macroeconomic news also influenced government bond yields. Revisions to expected government budget balances and associated expectations of increased government bond issuance may have contributed to the rise in US and UK ten-year government bond yields. According to *Consensus* surveys, economists became more pessimistic about budget positions in the United States and the United Kingdom between 11 February and 13 May (see Table C). The UK Budget on 17 April had only a limited immediate impact on gilt yields, since the announcements for tax net of expenditure were largely as the market had expected. However, some market participants commented that if economic growth should turn out to be lower than the upwardly-revised estimate assumed in the Budget, this might lead to higher gilt issuance. Correlations between daily changes in ten-year government bond yields and equity indices rose in the United States, Germany and the United Kingdom (see Chart 17).

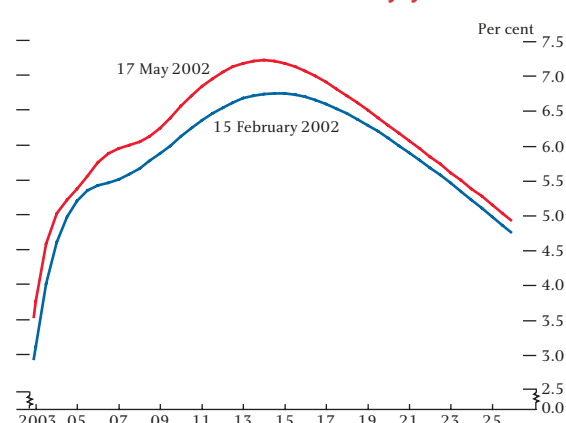
The yields of ten-year Japanese government bonds (JGBs) fell by around 15 basis points. Yields fell in the

Chart 14
Three-month forward gilt yields^(a)



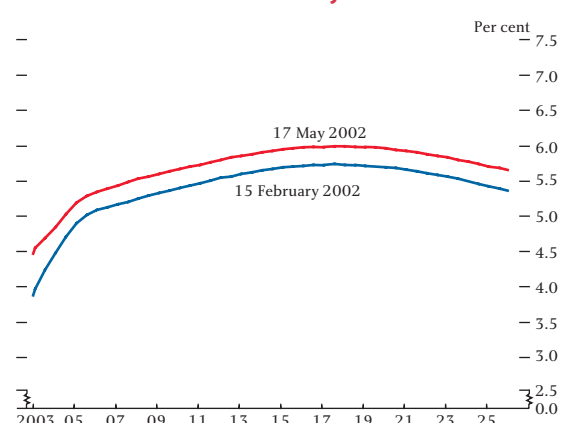
(a) Derived using the Bank's VRP curve-fitting technique.

Chart 15
Three-month forward US Treasury yields^(a)



(a) Derived using the Bank's VRP curve-fitting technique.

Chart 16
Three-month forward Bund yields^(a)



(a) Derived using the Bank's VRP curve-fitting technique.

early part of the period, as concerns about possible further financial sector distress at the end of the financial year (end-March) decreased. In part, that

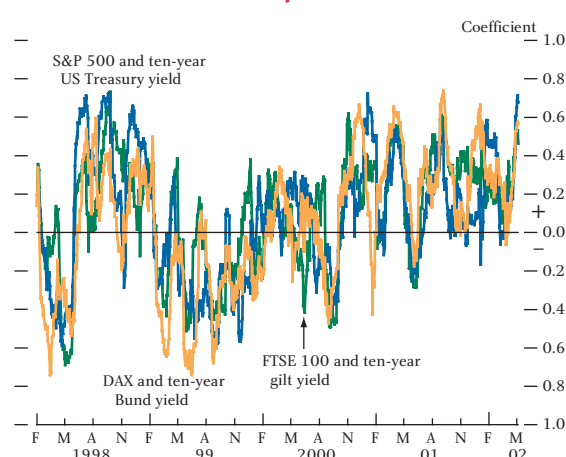
Table C
Forecasts for government budget positions^(a)

	United States (\$ billions) 2001/02 (b)	Germany (€ billions) 2002	United Kingdom (£ billions) 2002/03 (b)
14 January	-18.0	-52.3	-7.5
11 February	-38.0	-54.9	-9.1
11 March	-31.0	-54.8	-10.0
8 April	-41.0	-55.8	-10.6
13 May	-78.0	-55.0	-11.3

Source: Consensus Economics.

(a) Survey means.
(b) US fiscal year is to September, UK fiscal year is to March.

Chart 17
Correlations between equities and bonds^(a)



Sources: Bloomberg and Bank of England.

(a) Thirty-day rolling correlations of daily percentage changes in the relevant equity index and daily yield changes in the relevant government bond.

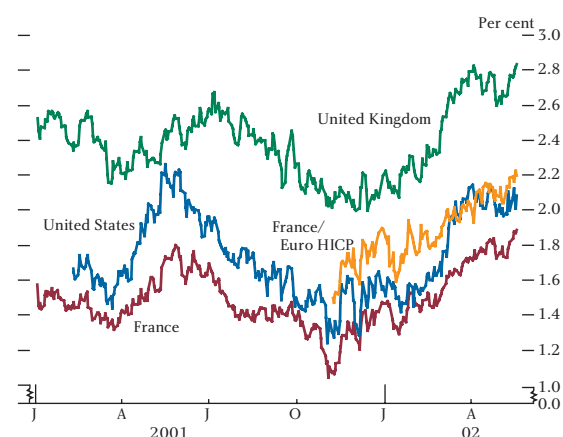
followed measures announced by both the BoJ on 28 February and the government in its anti-deflation package on 27 February. Some of the fall in yields was subsequently reversed as market participants focused on the fall in popularity of Prime Minister Koizumi and its impact on upcoming by-elections, together with expectations of a rating agency downgrade of Japan's sovereign debt.

Breakeven inflation rates

Nominal government bond yields can be decomposed into real yields and implied breakeven inflation rates, using the yields on conventional and index-linked government bonds. Ten-year breakeven inflation rates in the United States, the euro area and the United Kingdom rose by 49, 42 and 53 basis points respectively between 15 February and 17 May (see Chart 18).⁽¹⁾ In the United Kingdom, where a yield curve from index-linked gilts (IGs) can be estimated over a wide range of maturities, forward breakeven inflation rates rose across the curve (see Chart 19), including at long

(1) Based on the difference between yields on conventional government bonds and the yields on Treasury inflation indexed securities, French government bonds linked to the euro area's harmonised index of consumer prices (HICP), and index-linked gilts, respectively.

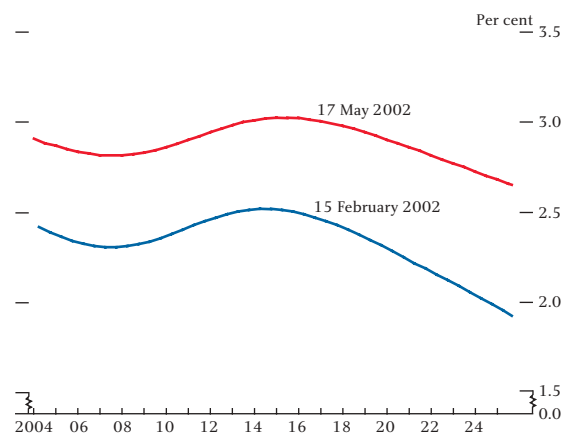
Chart 18
International ten-year breakeven inflation rates^(a)



Source: Bloomberg.

(a) Breakeven inflation rates are calculated as the difference between the yield of a conventional bond and the yield of an index-linked government bond with a maturity of approximately ten years. Indexation is based on the following: RPI for the United Kingdom, CPI excluding tobacco for France, HICP excluding tobacco for French index-linked bonds indexed to euro-area inflation, and the CPI Urban index for the United States.

Chart 19
Twelve-month forward UK inflation expectations^(a)



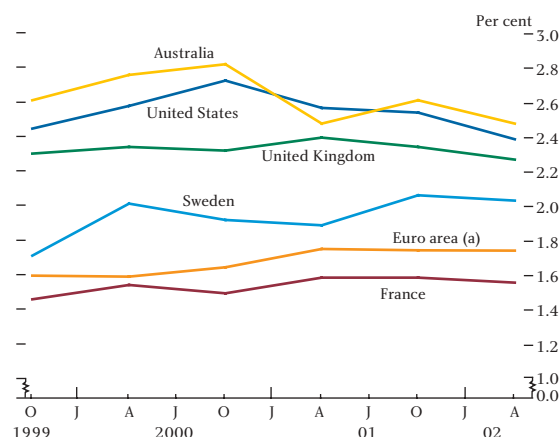
(a) Derived using the Bank's VRP curve-fitting technique.

maturities. However, this change was not particularly large by historical standards.

Breakeven inflation rates inferred in this way may differ from market participants' mean inflation expectations if investors require inflation risk premia or if institutional or regulatory features of the market affect the demand for or supply of government bonds and arbitrage does not keep their prices at levels corresponding to market participants' interest rate expectations, particularly in illiquid markets.⁽¹⁾

According to the two most recent half-yearly *Consensus* surveys, expectations of average inflation over the next

Chart 20
Consensus inflation expectations (average over next ten years)



Source: Consensus Economics.

(a) The euro area is proxied by a simple GDP-weighted average of Germany, France and Italy.

ten years in some major economies changed little or fell between 8 October 2001 and 8 April 2002 (see Chart 20). Over the same period, ten-year breakeven inflation rates rose by 68, 48 and 67 basis points in the United States, France and the United Kingdom, respectively.⁽²⁾

Market participants have suggested that the rise in ten-year breakeven inflation rates in the United States, the euro area and the United Kingdom might have been partly due to a rise in the inflation risk premium. This is said to have reflected a greater dispersion in inflation expectations among market participants, partly due to rising oil prices and accommodative monetary policy. In the euro area, wage negotiations and rising service sector prices were thought to have contributed to a rise in the inflation risk premium.

Market participants suggested that the rise in US, euro-area and UK breakeven inflation rates was also partly due to bond-market demand factors. They reported that there had been increased demand for French index-linked government bonds, associated with greater purchases of inflation-linked interest rate products among retail customers in the euro area, particularly in Italy. Much of this demand was thought to have been the counterpart of a shift away from equities, which have also been considered to offer protection against inflation. There was also thought to have been increased demand for index-linked gilts as an alternative to equities in the United Kingdom. A shift in

(1) See Scholtes, C (2002), 'On market-based measures of inflation expectations', *Bank of England Quarterly Bulletin*, Spring, pages 67–77, and page 7 of the Bank of England's May 2002 *Inflation Report*.

(2) French government bonds linked to euro-area HICP had not yet been issued on 8 October 2001.

Table D
Sterling bond issuance in 2002 Q1

DMO gilt auctions (a) (£ millions)

Conventional	<u>Date</u>	<u>Amount issued</u>	<u>Stock</u>			
	27.03.02	2,250	5% Treasury Stock 2012			
Index-linked	<u>Date</u>	<u>Amount issued</u>	<u>Stock</u>			
	24.01.02	500	4 $\frac{1}{8}$ % Index-linked Stock 2030			
Corporate issuance		<u>Amount (£ billions)</u>	<u>By credit rating:</u>			
	<u>Number of issues</u>	<u>Total (b)</u>	<u>AAA</u>	<u>AA</u>	<u>A</u>	<u>BBB and lower</u>
<i>Fixed-rate issues</i>						
UK corporates	26	5.2	1.0	0.8	1.5	1.9
UK financials	9	2.7	0.2	0.2	2.2	0.2
Supranationals	3	0.5	0.5	0.0	0.0	0.0
Overseas borrowers	15	3.5	1.4	0.0	1.7	0.5
Total (b)	53	11.9	3.0	0.9	5.4	2.6
<i>FRNs</i>						
UK corporates	2	0.1	0.0	0.0	0.1	0.0
UK financials	15	2.5	1.2	0.4	0.7	0.2
Supranationals	3	1.4	1.0	0.4	0.0	0.0
Overseas borrowers	8	1.0	0.8	0.1	0.2	0.0
Total (b)	28	5.1	3.0	0.8	1.0	0.3

Sources: Bank of England, Debt Management Office, Moody's and Standard and Poor's.

(a) On 1 March 2002 HM Treasury issued to the DMO additional nominal amounts of each gilt-edged stock in order to ensure that all gilt-edged securities, irrespective of when they were originally issued, fall within the terms of Article 15 of the draft EU Savings Directive (see www.europa.eu.int/eur-lex/en/com/pdf/2001/com2001_0400en01.pdf). The additional nominal amounts of each gilt-edged stock will be used as collateral in the DMO's cash management operations. The overall nominal total issued was £691.0 million with the increase in the nominal amount outstanding of each gilt ranging from £0.25 million to £30 million for conventional gilts and from £5 million to £15 million for index-linked gilts.

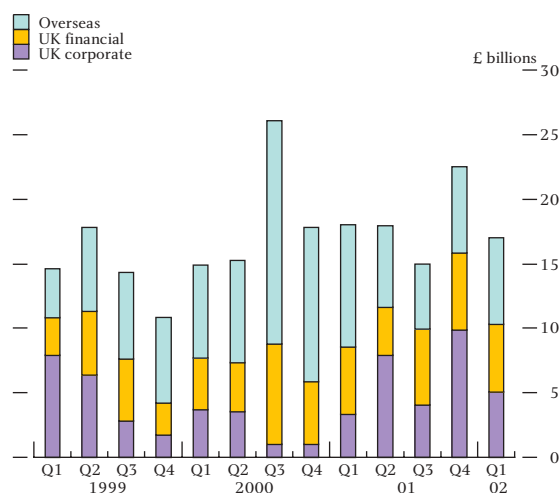
(b) Totals may not sum exactly due to rounding.

issuance by the Agence France Trésor away from government bonds linked to French CPI towards bonds linked to euro-area HICP was thought to have increased the investor base, since the latter were likely to be more attractive in other euro-area member states.

Bond issues and credit spreads

The outstanding stock of gilts increased by about £3.5 billion in nominal value in 2002 Q1, to almost £279 billion, having decreased by £8 billion in 2001 Q4. The Debt Management Office (DMO) held two outright auctions during the quarter, and there were no redemptions (see Table D).

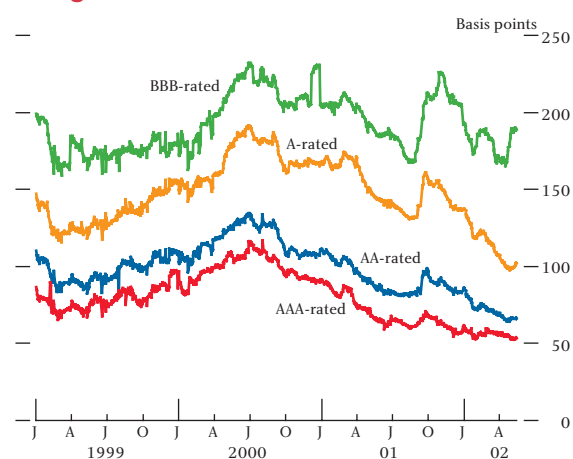
Chart 21
Sterling-denominated non-government bond issuance by issuer type



Issuance in the sterling-denominated non-government bond market was about £17 billion in 2002 Q1 (see Chart 21 and Table D) compared with over £22 billion in 2001 Q4. Issues were more or less evenly split between UK non-financial companies, UK financial companies and overseas and supranational institutions, with the largest proportions in the AAA and A-rated categories. Elsewhere, issuance of US dollar-denominated non-government bonds by all issuers increased in 2002 Q1 in comparison with both 2001 Q4 and 2001 Q1, but euro-denominated non-government bond issuance fell. Increased US dollar-denominated issuance was due, in part, to a switch by a number of US corporates from funding in the commercial paper market to the issuance of long-term debt, partly as a result of concerns about corporate liquidity following the Enron bankruptcy.

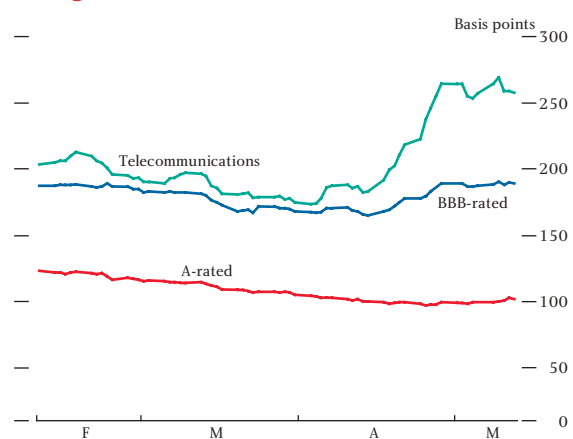
Sterling issuance by UK corporates fell in 2002 Q1, particularly in January and February after a rise in 2001 Q4. This may partly have been since some issues were brought forward to 2001 Q4, as demand for non-government bonds was high during that quarter. Except for bonds rated BBB or lower, spreads over gilt yields on Merrill Lynch non-government bond indices narrowed over the period, despite credit concerns following the Enron bankruptcy (see Chart 22). However, spreads over gilts on government bond yields of bonds issued by some telecommunications companies, many of which have an A or BBB rating, increased significantly (see Chart 23). This might help

Chart 22
Spreads of sterling non-government bond yields over gilts



Source: Merrill Lynch.

Chart 23
Spreads of sterling non-government bond yields over gilts

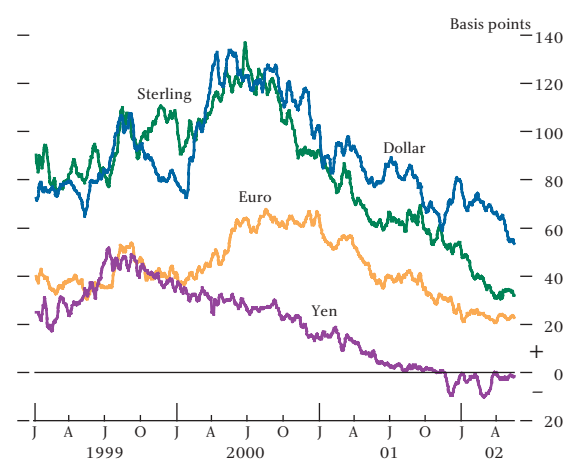


Source: Merrill Lynch.

to explain why telecommunications companies issued fewer bonds in 2002 Q1 than in any quarter in 2001. The rise in credit spreads for bonds issued by telecommunications companies was global, also occurring in the US dollar and euro-denominated markets.

Ten-year US dollar swap spreads (the difference between swap rates and government bond yields) fell by 18 basis points, while ten-year sterling and euro-denominated swap spreads declined by 8 and 3 basis points respectively (see Chart 24). In Japan, swap spreads rose slightly but remained negative. US dollar swap spreads may have decreased as a result of an announced increase in the supply of US Treasury notes and the US government's decision not to conduct any buy-backs in 2002 Q2. In the United Kingdom too, swap spreads

Chart 24
Ten-year swap spreads^(a)



Source: Bloomberg.

(a) Five-day moving averages of yield differences between ten-year swap rates and ten-year government bond yields.

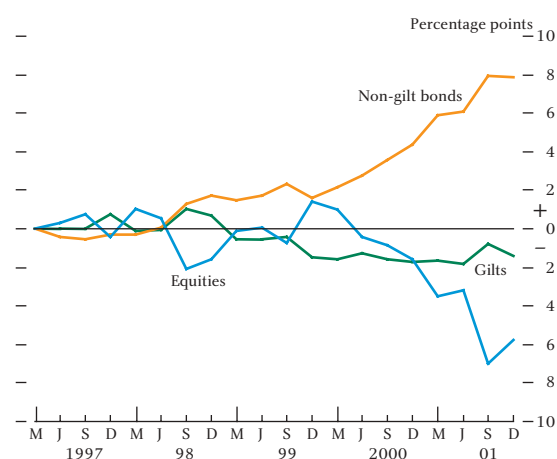
narrowed, perhaps partly due to market speculation about an increase in gilt supply following the Budget. Relatively high levels of corporate issuance will also have contributed to the narrowing of swap spreads, as some issuers switched their fixed-rate liabilities into floating by agreeing to pay the floating-rate leg of interest rate swaps. In the euro area, the narrowing partly reflected ongoing demand from the Agence France Trésor to receive fixed in longer-maturity interest rate swaps, so as to shorten the average duration of the French government's debt portfolio.

On the demand side, recent switching from equities into bonds by pension funds (the largest class of institutional investor in the sterling bond market) seems to have decreased in 2001 Q4, although market contacts continue to report such flows. As shown in Chart 25, non-gilt bond holdings of insurance companies and pension funds were little changed, while the gradual decrease in equity holdings appears to have reversed a little. According to the Investment Management Association (IMA), there were net inflows into UK equity income⁽¹⁾ unit trusts and investment funds for all types of investors in 2002 Q1, following a net outflow between March and December 2001.

Demand from pension funds for non-government bonds may have fallen slightly, perhaps partly as a result of a shift from defined benefit pension schemes to defined contribution pension schemes by a number of companies. Unlike defined contribution schemes, defined benefit schemes have been influenced by

(1) UK equity income funds refer to IMA sectors quoted in their monthly statistics, available at www.investmentfunds.org.uk/industry_data/ukbusiness/default.htm

Chart 25
Insurance corporation and pension fund financial asset allocations^(a)



Source: Office for National Statistics.

(a) Figures given are cumulative percentage point changes in the proportion of funds allocated to each asset.

anticipation of the abolition of the Minimum Funding Requirement (MFR) and the introduction of Financial Reporting Standard 17,⁽¹⁾ both of which are thought to have encouraged the purchase of non-government bonds rather than equities or gilts. In most defined benefit pension schemes, the fund pays retired employees pensions linked to a percentage of their final salary. This means that the pension fund (and ultimately the employer) bears most of the risks of the investments made in order to be able to make this payment. In a defined contribution scheme, pensioners receive a capital sum based on the returns on the money invested in the scheme, and consequently it is the employee who bears the investment risk. A small number of UK companies have closed their defined benefit schemes to all employees, while several other companies have closed their defined benefit schemes to new employees only.

Equity markets

Most major international equity indices rose slightly over the period (see Table E and Chart 26). The notable exception was the Japanese Topix index, which rose strongly from a two-year low in February. The anti-deflation package, announced by the Japanese government on 27 February, may have had an immediate effect. But equity prices continued to rise, with signs of recovery in the United States benefiting Japanese exporters. Despite an increase in *Consensus* survey expectations for US GDP growth in 2002 (see Chart 1), the main US equity indices were little changed, with technology and telecoms subindices falling. Most European indices were slightly higher.

Table E
International equity market performance

Percentage changes between start and end of period in local currencies

	2001 Year	2001/2002 26 Oct. to 15 Feb.	2002 15 Feb. to 17 May
United States			
S&P 500	-13.0	0.0	0.2
Wilshire 5000	-12.1	1.5	1.5
Europe			
Euro Stoxx	-19.7	0.6	1.0
CAC 40	-22.0	-2.3	1.5
DAX 30	-19.8	0.9	3.6
FTSE All-Share	-15.4	0.8	1.4
FTSE 100	-16.2	-0.1	0.7
Japan			
Topix	-19.6	-10.8	12.8
Technology			
Nasdaq Composite	-21.1	2.0	-3.5
FTSE techMARK 100	-42.6	-10.1	-18.2
Neuer Markt	-60.2	-7.2	-11.5

Source: Bloomberg.

Chart 26
International equity indices^(a)



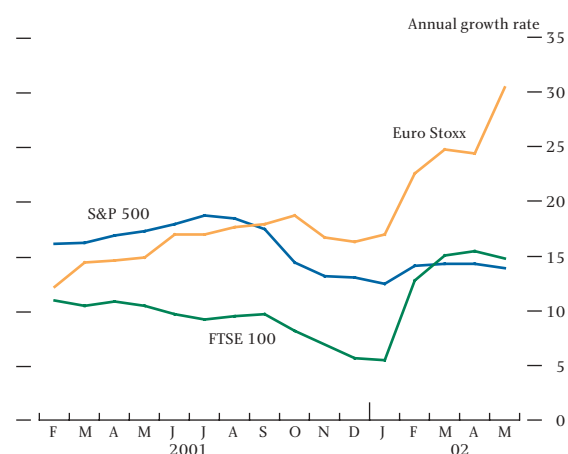
Source: Bloomberg.

(a) In local currencies.

Over the period, analysts' short-term earnings per share (EPS) growth forecasts for 2002 for the FTSE 100 and Euro Stoxx indices, as reported by IBES (Institutional Brokers Estimate System) rose (see Chart 27). But equity prices are more likely to be affected by sentiment about earnings over a longer horizon. Long-term (3–5 year horizon) IBES forecasts for EPS growth for the FTSE 100 and S&P 500 indices fell over the period, continuing the decline since January 2001 (see Chart 28), while the forecast for the Euro Stoxx was little changed. Concerns about the quality of earnings reports may have increased, especially in the United States. The Securities and Exchange Commission (SEC) cautioned investors that pro forma earnings (excluding items that firms choose to describe as extraordinary) may create a 'confusing or misleading impression'. In addition, confidence in views of equity analysts may have been undermined by

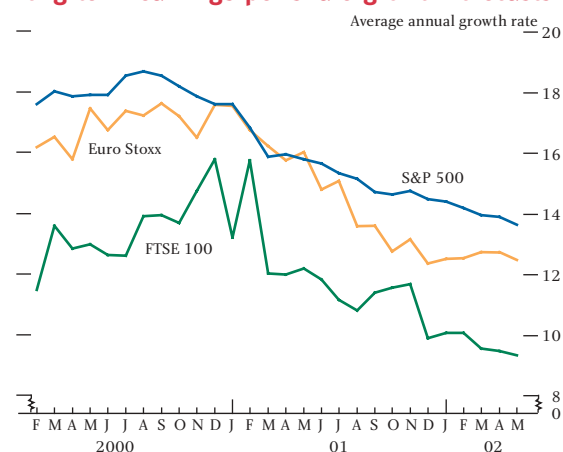
(1) See the *Bank of England Quarterly Bulletin*, Spring 2002, page 14 for a description of FRS17.

Chart 27
2002 earnings-per-share growth forecasts



Source: Institutional Brokers Estimate System.

Chart 28
Long-term earnings-per-share growth forecasts

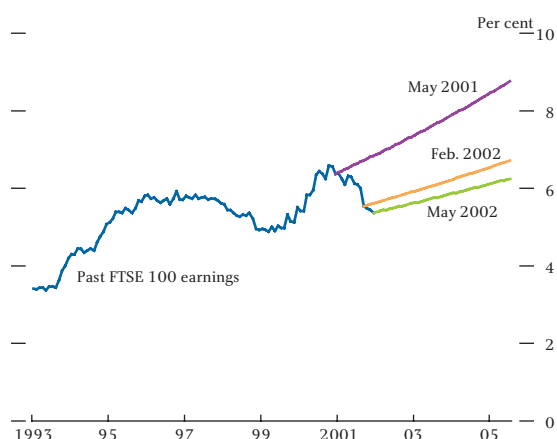


Source: Institutional Brokers Estimate System.

investigations into equity research at major investment banks, which showed that analysts' private views had sometimes been much less positive than their recommendations to clients.

Using current earnings outturns and long-term IBES growth rates as a proxy for the market's expectations of future profitability, the Bank's three-stage dividend discount model (DDM)⁽¹⁾ gives a decomposition of changes in the FTSE 100 and S&P 500 indices. With projected profitability down (see Chart 29), and long-term real interest rates relatively little changed, the model decompositions include large positive residuals (see Table F), which might suggest that these proxies do not fully capture investors' views about future profitability, or perhaps that risk premia which investors require for taking equity risk have fallen a little between the IBES 14 February and 17 May surveys.

Chart 29
FTSE 100 earnings as a percentage of GDP and long-term IBES forecasts^(a)



Sources: IBES, Thomson Financial Datastream and Bank of England.

(a) Earnings calculated using market value and P/E ratios from Thomson Financial Datastream.

Table F
Decomposition of changes in equity indices:
14 February to 17 May 2002

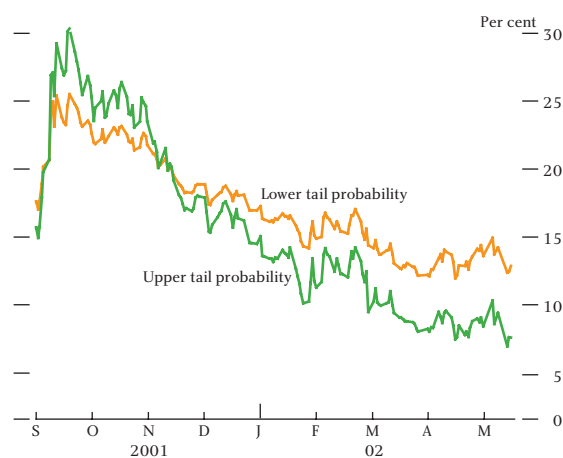
Percentage point contributions	FTSE 100	S&P 500
Real interest rate	2.2	-3.9
Earnings	-9.5	-11.6
Residual (equity risk premium)	7.5	14.6
Total percentage change	0.2	-0.9

Information from options markets also suggests that perceived equity risks may have fallen since February. Options prices can be used to derive implied probabilities that the FTSE 100 index will experience a rise or fall of more than 10%. The probability of a fall of 10% or more was higher over the period than the probability of a rise of 10% or more, perhaps indicating a greater perceived downside risk to equity prices (see Chart 30). However, both the upper and lower tail probabilities decreased, suggesting a reduced probability of extreme movements in stock prices. This may, in part, have reflected the decline in historical volatility of equity indices this year.

The number of profit warnings by UK-listed firms peaked in 2001 Q4, after the terrorist attacks in the United States and a reminder from the Financial Services Authority (FSA) of its power to fine companies for breaching its rules on disclosing information. In 2002 Q1, 98 firms issued statements warning that their profits would not meet expectations, which was lower than in any quarter in 2001 (see Chart 31). The number of warnings fell further in April and early May, though only to around the historical average since

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

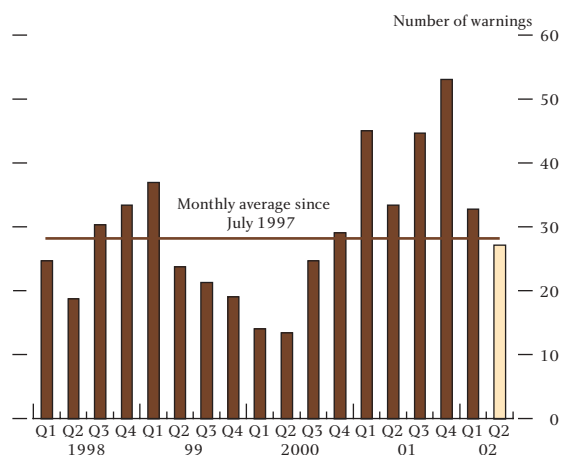
Chart 30
Time series of the upper and lower tail probabilities (10% or more above or below spot) for FTSE 100 implied probability density functions^(a)



Sources: LIFFE and Bank of England.

(a) Derived from options on FTSE 100 futures, for a constant three-month horizon.

Chart 31
Profit warnings by UK firms^{(a)(b)}



Sources: Reuters Business Briefing and Bank of England.

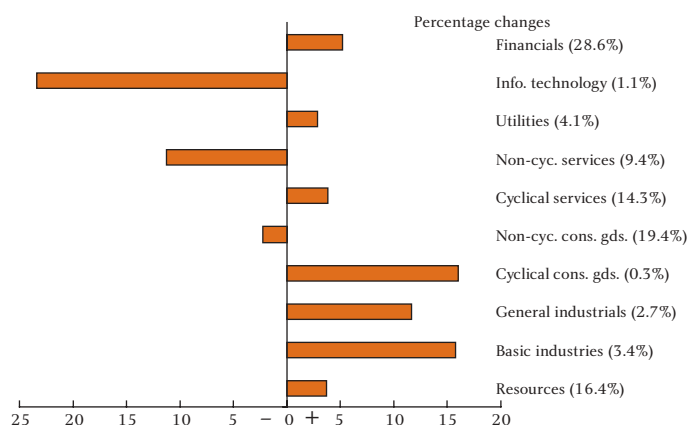
(a) Monthly average number of UK firms listed on the London Stock Exchange issuing a profit warning.
(b) 2002 Q2 refers to 1 April to 17 May and is adjusted pro rata.

July 1997. The falls may reflect lower earnings expectations—low earnings growth may no longer be a surprise.

Within the FTSE All-Share index, subindices for the basic industries and cyclical consumer goods sectors increased most (see Chart 32), as monthly manufacturing output rose from its lowest level since April 1996. Once again, subindices for the IT and non-cyclical services sectors fell. Slow subscriber and revenue growth affected telecoms stocks (a large part of non-cyclical services).

(1) May-June 2000, November-December 2000, July-August 2001.

Chart 32
Changes in the FTSE sectoral equity indices between 15 February and 17 May 2002^(a)



Source: Thomson Financial Datastream.

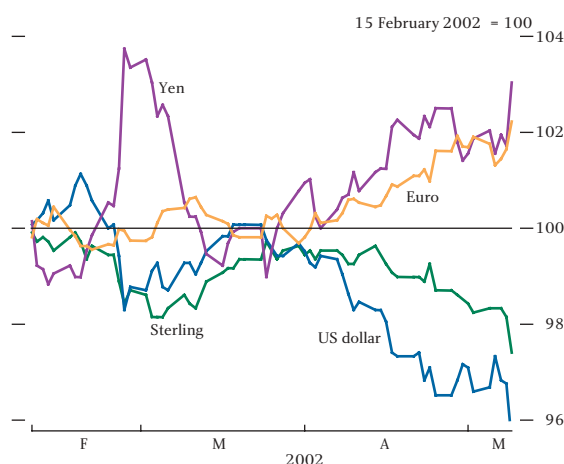
(a) Weights as of 17 May in parentheses.

Foreign exchange markets

The dollar and sterling both depreciated on an effective basis over the period, most notably towards the end, while the yen, and to a lesser extent the euro, appreciated (see Chart 33). The depreciation of the dollar between 15 February and 17 May was broad based. The dollar fell by 5.2% against both the euro and the yen, and by 1.9% against sterling. However, in recent historical perspective, the magnitude and speed of this fall in the dollar were not unusual—three similar episodes may be identified between the beginning of 2000 and the end of 2001,⁽¹⁾ during which time the US dollar ERI increased overall from 104.1 to 122.2.

Movements in short-term interest rates were broadly consistent with movements in the euro-dollar exchange

Chart 33
Effective exchange rate indices



rate—euro-area short-term interest rates rose by more than those in the United States (see the section on short-term interest rates).

Changes in relative growth prospects do not appear consistent with the US dollar's weakness against the euro. Over the period the Consensus Economics survey of growth expectations for 2002 was revised up considerably for the United States (by 1.2 percentage points), but by much less for the euro area (see Chart 1).

During the period there was considerable market discussion of the 'sustainability' of the US current account deficit, and of the cross-border capital flows required to finance it. This was prompted in part by official comment, notably Federal Reserve Chairman Greenspan's observation in a speech on 13 March, in the context of a long-term survey of US saving and investment, that 'eventually the current account deficit will have to be restrained'. US Treasury data on cross-border portfolio flows released during the period showed a fall in foreign purchases of US equities and corporate bonds: the net inflow in February into corporate bonds was the lowest since January 1999. Market participants also noted the relatively weak performance of US equity markets during the period, and perceptions that US equities continue to look expensive on fundamental valuation measures compared with some other major markets. The extent to which particular categories of capital flow determine exchange rate movements is uncertain,⁽¹⁾ but it is likely that concerns over this issue contributed to the weakness of the dollar.

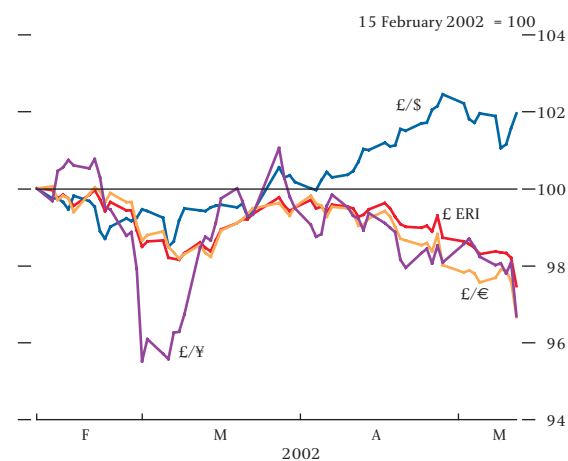
There was also further market discussion of the US Administration's policy towards the dollar. The announcement that tariffs were to be imposed on certain foreign steel products was interpreted by some market participants as indicating sensitivity towards the impact of the strong dollar on the US manufacturing industry.

The Japanese yen appreciated on an effective basis over the period as a whole, moving sharply at times; for example, the dollar-yen exchange rate fell from a close of ¥132.28 on 5 March to an intraday low of ¥126.36 on 7 March. Market participants suggested that this move was driven by repatriation flows ahead of the financial

year-end, and by foreign capital inflows associated with the sharp rise in Japanese equity markets at this time. Ministry of Finance portfolio flow data confirm that such flows occurred. Positioning may have also been a factor: IMM data⁽²⁾ suggest that speculative players switched from a net short position in the yen to a net long position. Implied volatility ahead of the movement was low, suggesting that the market had not attached much probability to the actual size of the appreciation. This rise in the yen was reversed by the end of March after comments from Japanese officials were interpreted as signalling that their view was that the appreciation had been too rapid. Towards the end of the period, the dollar-yen exchange rate fell again, moving below ¥126. Market participants suggested that this appreciation of the yen was associated with the passing of the financial year-end without further financial sector distress, the recovery in Japanese equity prices and tentative signs of a cyclical recovery in activity in Japan.

Between 15 February and 17 May sterling depreciated by 3.3% against the euro and appreciated by 2.0% against the dollar (see Chart 34). The sterling ERI ended the period 2.6% lower. Sterling's depreciation against the euro was consistent with movements in relative short-term interest rates, but this was less so for its appreciation against the dollar. And while sterling's depreciation against the euro was broadly consistent with the decline in relative growth prospects for 2002, according to *Consensus* surveys, its change against the dollar was not. It would be difficult to associate movements in sterling with data announcements over the period: for example, the surprisingly weak first

Chart 34
Sterling bilateral exchange rates



(1) See Bailey, A, Millard, S and Wells, S (2001), 'Capital flows and exchange rates', *Bank of England Quarterly Bulletin*, Autumn, pages 310–18, and chapter 2 of the IMF May 2001 *World Economic Outlook*.

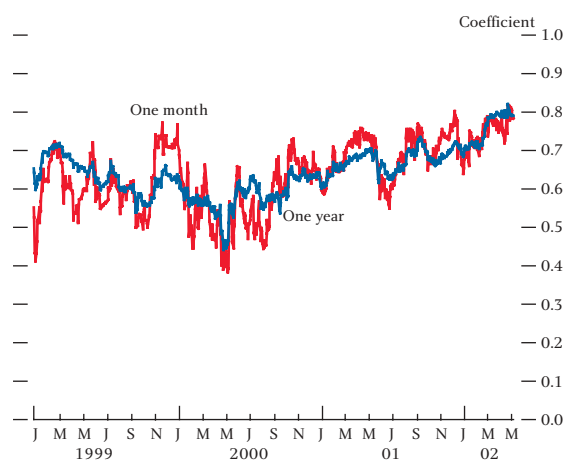
(2) IMM stands for International Money Market. The data measure the net (long minus short) number of Japanese yen futures contracts bought by non-commercial (speculative) traders on the Chicago Mercantile Exchange.

quarter 2002 GDP release in April had no discernible effect on sterling.

The possibility of EMU entry by the United Kingdom continued to be a subject of market commentary. In particular, there was discussion of what an appropriate entry rate might be, with some market participants suggesting that sterling could join at a somewhat stronger rate than previously thought likely. During the first half of the period, the one-year implied volatility of euro-sterling fell sharply to historical lows. This could be consistent with market participants assigning an unchanged (or increased) probability to the United Kingdom joining, and market views that the likely entry rate was closer to current market levels, but it must also be considered against the background of falling exchange rate volatility globally (see the box on pages 142–43).

Sterling's depreciation against the euro was broadly consistent with the historical correlation between the euro-sterling and euro-dollar exchange rates. When the dollar has depreciated against the euro, sterling has tended to depreciate against the euro as well. Looking forward, options prices can give an indication of how closely correlated the euro and sterling exchange rates are expected to be. On this measure, the implied correlation of sterling with the euro (against the dollar) has steadily increased since mid-2000, both for short and longer-term movements, as reflected in the one-month and one-year measures (see Chart 35). Between 15 February and 17 May, the one-year measure

Chart 35
Implied correlation between the euro and sterling
(versus the dollar)



(1) The interpretation of these measures as possible indicators of the market's perceptions of potential UK EMU entry is discussed (along with the methodology for calculating such measures) in Butler, C and Cooper, N (1997), 'Implied exchange rate correlations and market perceptions of European Monetary Union', *Bank of England Quarterly Bulletin*, November, pages 413–23.

(2) For which data are only available to end-February.

was little changed, and the one-month measure increased by 0.07 to 0.79. Both were at historically high levels.⁽¹⁾

A number of countries increased their official interest rates during the period—signalling to some the start of a global tightening cycle. The Bank of Canada was the first central bank in the Group of Seven industrialised nations to raise official rates since 2000, by 25 basis points on 16 April. This was not fully expected by the market and the Canadian dollar appreciated in response. Other countries to increase official interest rates included New Zealand, which raised official rates on three occasions during the period, by a total of 75 basis points, Australia and Sweden, which both increased rates by 25 basis points. The New Zealand and Australian dollars appreciated significantly against the US dollar over the period, by 9.9% and 7.0% respectively. The Swiss National Bank reduced official interest rates by 50 basis points on 2 May due to continued concern over exchange rate developments: the Swiss franc appreciated by 7.4% against the dollar during the period. Some market participants ascribed this to 'safe haven' flows, in response to the crisis in the Middle East.

The sterling money market

Amounts outstanding in the sterling money market rose by £35 billion to £576 billion in 2002 Q1, having fallen by £14 billion in the previous quarter (see Table G). Stock lending saw the largest increase (by £18 billion), with more business also recorded in gilt repo,⁽²⁾ certificates of deposit and interbank deposits.

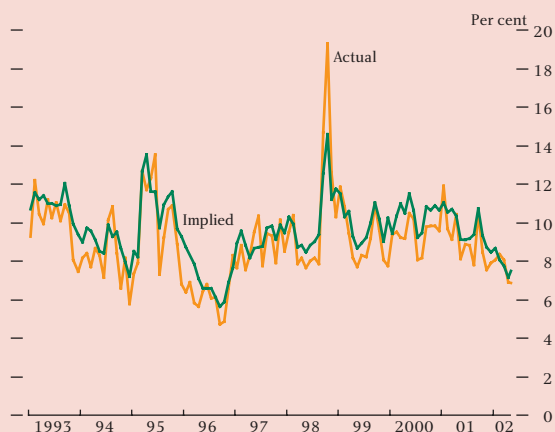
Average daily turnover in short sterling futures contracts rose by £7 billion to £76.4 billion in Q1 (see Table H). After December's fall in turnover, the increase in Q1 represents a return to the rates of growth seen in 2001.

Nominal amounts outstanding in gilt repo at end-February rose by about £4 billion from end-November, after having fallen by £14 billion in the previous quarter. Gilt repos outstanding in the on-call and next-day maturities increased by £17 billion, while repos with maturities between two and eight days decreased by £16 billion. At longer maturities, amounts outstanding in Q1 were larger at maturities between nine days and one month and longer than three months,

Exchange rate volatility

Exchange rate volatility for many major currencies has fallen in recent months. Chart A shows the average one-month implied volatilities (derived from options prices) and actual volatilities for the five most traded currency pairs.⁽¹⁾

Chart A
One-month implied and actual exchange rate volatility^(a)



(a) Each observation in the chart shows the average volatility within each calendar month for the five most traded currency pairs in April 2001 (see text). Implied volatility is measured as the one-month ahead at-the-money volatility. Actual volatility is calculated as the monthly standard deviation of daily logarithmic returns.

Implied volatility is a measure of the degree of uncertainty market participants attach to the forward exchange rate. Actual volatility has been statistically persistent—with periods of low volatility likely to be followed by further periods of low volatility—and so part of the reason implied volatility is currently low may be that many exchange rates have been very stable.

Other asset price volatilities have not been at such low levels recently (see Table 1). It might at first seem odd to observe both an increase in interest rate uncertainty and a fall in exchange rate uncertainty, since higher interest rate uncertainty might suggest that the degree of certainty with which the forward exchange rate is expected to be realised is lower. That said, what matters is not the forward-looking volatility of interest rates, but rather of the interest rate *differential* between currencies. And the implied volatility of interest rate differentials need not have increased.

Table 1
Average implied volatilities for different instruments (per cent)^(a)

	1999–2000	2001 to 17 May 2002
Currencies		
Euro-dollar	11.6	10.8
Dollar-yen	12.8	10.3
Sterling-dollar	8.6	8.1
Dollar-Canadian	6.4	6.2
Dollar-Swiss	11.5	10.5
Equities		
S&P 500	21.5	21.7
FTSE 100	22.6	20.4
DAX	23.9	25.0
Nikkei	22.9	29.1
Interest rates		
Eurodollar	8.5	24.5
Euribor	14.1	15.4
Short sterling	10.4	13.6

Sources: Reuters, Bloomberg and Bank of England.

(a) For currencies, the data are one-month ahead volatilities; for interest rates, volatilities for three-month constant maturity interest rate futures, and for equities, volatilities for the front futures contracts.

Similarly, even if increased equity market uncertainty reflects increasing uncertainty over macroeconomic growth prospects (and if exchange rates are influenced by relative growth prospects), that might not necessarily lead to an increase in uncertainty over *relative* growth prospects, and so to an increase in exchange rate uncertainty.

The implied volatility of exchange rates might be expected to decline if the current spot and the expected future spot rate become closer to one another. The experience of the euro-dollar exchange rate is consistent with this view. When the euro was introduced in January 1999, the mean one-year ahead *Consensus* survey expectation for the euro-dollar exchange rate was \$1.212. As the euro depreciated away from this level, implied volatility rose. Since then the euro has traded at considerably lower levels, and subsequently expectations have been revised down (in May 2002 the mean one-year ahead *Consensus* survey expectation was \$0.941), while implied volatility has declined.

The last time implied volatility was as low as it has recently been was in 1996. At that time market anecdote suggested that supply-side factors in the foreign exchange options market were significant. First, there were reported to be far more option

(1) As reported in the Bank for International Settlements (BIS) *Triennial Central Bank Survey* (April 2001), the five most traded currency pairs by turnover are the US dollar against: euro; yen; sterling; Swiss franc and Canadian dollar.

sellers (notably French corporates and hedge funds) than today, and, second, it is widely believed (in retrospect) that these options were sold too cheaply.⁽²⁾

Currently, market participants suggest demand-side factors may also be important in determining the level of implied volatilities. Interest rate implied volatility increased sharply last year in the United States, partly because of demand generated by an increase in the hedging of mortgage-prepayment risks.

From a longer-term perspective the recent BIS *Triennial Central Bank Survey* showed an 86% increase in turnover of over-the-counter (OTC) interest rate derivative products since 1998. By contrast, turnover for OTC foreign exchange derivatives declined by 12%.⁽³⁾

Another factor in 1996—for European currencies at least—was the imminence of monetary union. Convergence trades may have contributed to falling implied volatilities, and this could also be a factor behind some recent declines in implied volatility.⁽⁴⁾

- (2) There was an increase in the use of relatively newly developed double-barrier binary range options. The buyer of such an option is short volatility. If volatility rises and either barrier is breached the underlying option becomes worthless. The option has limited downside risk to the seller as only a predetermined sum is paid out on expiry. It is thought that pricing techniques were originally unsophisticated and resulted in the option price not fully reflecting the underlying risk. The option price is an increasing function of implied volatility.
- (3) The increase in interest rate derivative turnover between April 1998 and April 2001 was mainly driven by an increase in demand for interest rate swaps. Option turnover for interest rate products declined by 19%, and turnover for foreign exchange products declined by 31%.
- (4) For example euro-Swedish krona one-year implied volatility fell sharply from 7.2% on 9 January to 5.5% on 11 January due to increased speculation about EMU entry.

while less business was conducted at maturities between one and three months.

The size of the unsecured interbank deposit market (in nominal amounts outstanding) increased in 2002 Q1, bringing the increase in the year to end-March to £19 billion (see Table G). Market contacts suggested that the increase might reflect an increased flow of investment funds from equities into money market assets, although data on deposits from 'other financial corporations' show a decline of £4.3 billion to £208.4 billion in the year to March.

The CD market grew by £8 billion in Q1, although this follows a fall of £3 billion in 2001 Q4, with amounts outstanding remaining slightly lower than a year ago (see Table G). Several market participants have reported that in both the CD and interbank deposit markets, there has been a shift in the balance of funds

towards shorter maturities of up to three months or less. Among the factors which might play a part in explaining this are: uncertainty about the future path of official interest rates, which might have discouraged institutions from taking longer-term cash positions; the increasing use of derivatives rather than cash instruments by banks to express interest rate views; and a movement out of interbank lending into corporate paper in search of higher yields by some institutions which are willing to lend over longer periods. The growth in the interbank deposit market may therefore reflect differences between banks in the relative growth rates of their customer loans and deposits, leading to wholesale market funding flows. Another factor that market contacts have cited as a possible reason for the lack of growth of the CD market is that some banks might have issued paper in other currencies and swapped the proceeds back into sterling.⁽¹⁾ Some market contacts have also reported a

Table G
Sterling money markets

Amounts outstanding: £ billions

	Interbank (a)	CDs (a)	Gilt repo (b)	Stock lending (b)	Eligible bills (a)	Commercial paper (a)	Other (c)	Total
2000 Q1	156	132	100	51	14	15	6	474
Q2	159	135	124	54	12	16	7	507
Q3	162	125	127	53	12	16	7	502
Q4	151	130	128	62	11	18	9	509
2001 Q1	171	141	126	67	13	19	7	544
Q2	177	131	128	67	12	22	6	543
Q3	187	134	144	52	11	21	6	555
Q4	185	131	130	48	11	20	16	541
2002 Q1	190	139	134	66	11	22	14	576

(a) Reporting dates are end-quarters.

(b) Reporting dates are end-February for Q1, end-May for Q2, end-August for Q3, end-November for Q4.

(c) Including Treasury bills, sell/buy-backs and local authority bills.

(1) The sterling leg of such a swap is included in amounts outstanding of interbank deposits, shown in Table G.

Table H
Turnover of money market instruments

Average daily amount, £ billions

	2000	2001				2002
		Q1	Q2	Q3	Q4	Q1
Short sterling futures (a)	45.0	60.0	66.0	71.5	69.6	76.4
Gilt repo (b)	17.8	15.7	17.9	18.2	20.0	21.3
Interbank (overnight)	10.4	10.3	11.1	9.3	10.8	12.4
CDs, bank bills and Treasury bills	n.a.	11.8	12.4	11.4	11.7	10.5

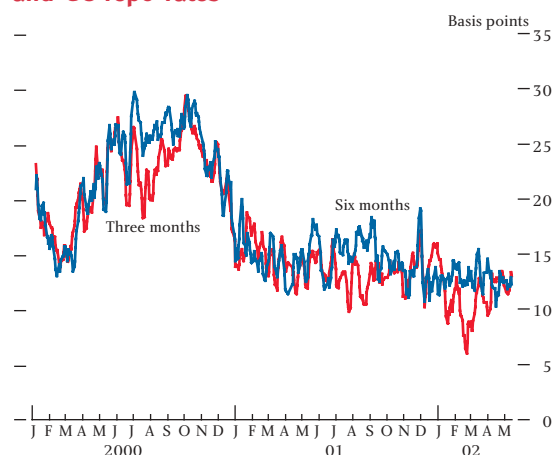
n.a. = not available.

Sources: CrestCo, LIFFE, Wholesale Markets Brokers' Association and Bank of England.

(a) Sum of all 20 contracts outstanding, converted to equivalent nominal amount.

(b) Quarters are to end-February (Q1), end-May (Q2), end-August (Q3) and end-November (Q4).

Chart 36
Spreads between three and six-month interbank and GC repo rates^(a)



(a) Interbank is the offer rate, GC repo is the bid rate, five-day lagging moving averages.

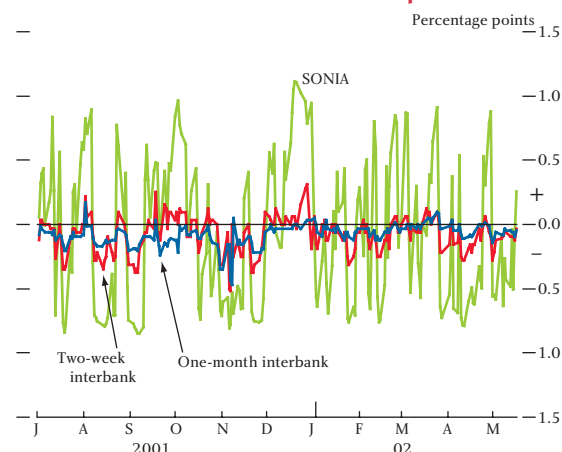
reduction in the demand for CDs for use as collateral for stock loans.

Spreads between three and six-month general collateral repo (GC) and interbank rates averaged 11 and 13 basis points respectively between 15 February and 17 May (see Chart 36). However, during the period there has been some volatility in spreads, with spreads at the three-month maturity narrowing to around 5 basis points in late February and early March when overnight cash rates were on average close to the Bank's repo rate, but widening again in April when overnight rates were lower. Spreads between three-month GC repo and CDs averaged around 12 basis points. Although spreads between six-month CDs and GC repo widened slightly to 14 basis points, this was lower than seen in 2001.

Spreads between the Bank's repo rate and one-month GC, CD and interbank cash rates averaged 14, 4 and 1 basis points respectively, compared with 26, 12 and 10 basis points during 2001. Overnight cash rates remained within the range determined by the Bank's collateralised overnight lending and deposit facilities.

During February and March the average spread of SONIA over the Bank's repo rate was close to zero, although in April this widened to minus 31 basis points (see Chart 37).

Chart 37
Spread of SONIA, two-week and one-month interbank rates over the Bank's repo rate



Intraday volatility in the overnight interbank interest rate (determined from the daily open, high, low and closing rates) declined in late March and early April from the levels seen since the beginning of December 2001. Volatility, as measured by the standard deviations of the daily changes in two-week interbank interest rates over a one-month window, has been broadly constant throughout 2002, at around 11 basis points. By contrast, during 2001 volatility on a monthly basis was higher, averaging 18 basis points, and varied more from month to month.

Market participants report that the introduction of electronic trading platforms has led to increased liquidity in repo markets. They have reported that dealing times have fallen, the cost of settlement has reduced and collateral management improved. It is expected that the London Clearing House's RepoClear service will soon be directly linked to electronic trading platforms via straight-through processing. The introduction of balance-sheet netting through RepoClear is expected to increase the amount of outstanding gilt repo further. The experience of the Government Securities Clearing Corporation (GSCC) in the US government bond repo market suggests that a central counterparty can provide a stimulus to growth in market volumes. Following the introduction of netting for repos by the GSCC in 1995, the proportion of securities used in US government bond repo rose from around 25% to over 40% in 1998.⁽¹⁾ Market participants

(1) See 'The financial stability conjuncture and outlook' (1999), *Bank of England Financial Stability Review*, June, pages 4–39.

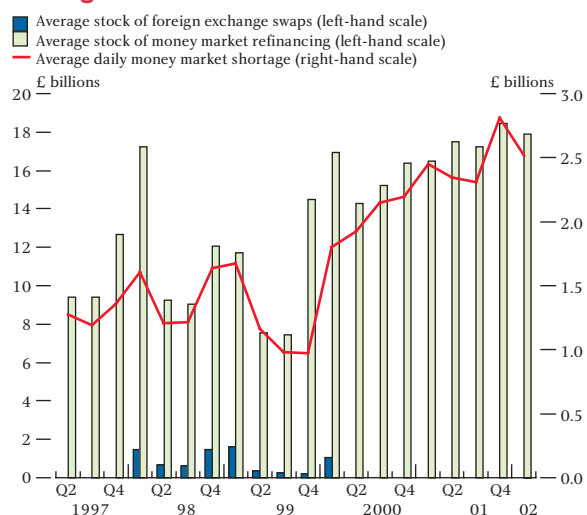
also report that the introduction of RepoClear from 1999 for some euro-denominated European government securities increased liquidity in the euro government bond repo market.

The market in gilt-repo specials continued to be dominated by those gilts that are deliverable into the long gilt futures contracts, with the 9% Conversion 2011 for March delivery and the 5% Treasury 2012 for September delivery trading at the widest spreads below GC repo. In the weeks prior to the first delivery date for the March contract, the DMO's special standing facility was used to create temporary supplies (at a penal rate) of the 9% Conversion 2011, thus relieving overnight shortages in gilt stock. While other special gilts have traded at a premium to GC repo, volumes continued to be low.

Open market operations

The stock of money market refinancing held on the Bank's balance sheet (which comprises the short-term assets acquired via the Bank's open market operations—OMOs) averaged £18 billion between February and April (see Chart 38). This was some £1 billion lower than over the previous three-month period, reflecting the unwinding of the temporary growth of the bank note circulation (which is the principal sterling liability on the Bank's balance sheet) over the Christmas period.

Chart 38
Stock of money market refinancing and daily shortages



Daily money market shortages averaged £2.5 billion between February and April, compared with £2.7 billion

over the previous three-month period (see Table I). As well as reflecting the fall in the stock of refinancing, the shortages were slightly smaller, on average, because of a small fall in the rate of turnover of the stock.⁽¹⁾ Over February, March and April, counterparties chose to refinance 81% of the daily money market shortages at the 9.45 am and 2.30 pm rounds of operations (which largely have a two-week maturity) and 19% in the late rounds of operations, on an overnight basis (see Chart 39).

Table I
Average daily money market shortages

£ billions		
1998	Year	1.4
1999	Year	1.2
2000	Year	2.0
2001	Year	2.5
2002	Jan.	2.1
	Feb.	2.8
	March	2.6
	April	2.2

Chart 39
Refinancing provided in the Bank's open market operations

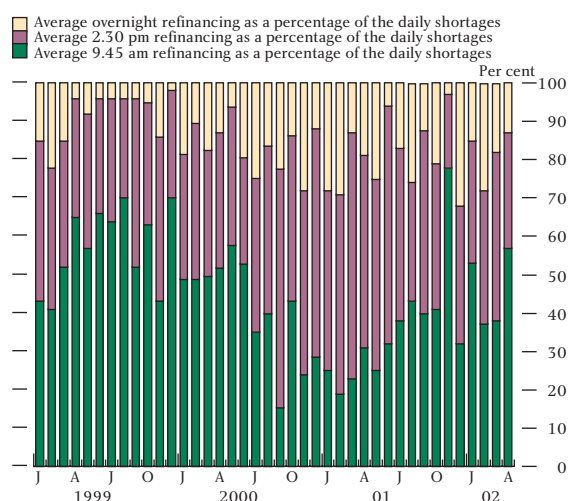


Chart 37 shows the spread between various short-dated money market interest rates and the Bank's repo rate. The one-month interbank rate traded nearer to the Bank's repo rate than had been the case in late 2001, as market expectations of changes in the official repo rate by the MPC in the near term were minimal.

The Bank wrote to its OMO counterparties in November 2001 to inform them that it may, on a more frequent basis, scale down an individual counterparty's bid for OMO liquidity in order to facilitate the Bank's

(1) Although most of the Bank's open market operations are conducted via two-week reverse repo transactions, the average rate of turnover of the stock is usually around seven to eight working days. This is because the Bank's counterparties can choose to obtain refinancing by selling eligible bills with less than a two-week residual maturity on an outright basis, or can obtain overnight repo refinancing at a penal interest rate if they choose.

operations, and, in particular, to help ensure that access to the liquidity provided by the Bank is available as smoothly as possible to all market participants. Since then, occasional concentrations of the Bank's stock of refinancing in the hands of a very small number of its counterparties have diminished and participation in OMOs has broadened.

Counterparties made use of the Bank's 3.30 pm overnight deposit facility on three days during the review period. In order to leave the market square by close of business, the Bank increased the amount of refinancing available at the 4.20 pm late repo facility by the size of the deposit and, on each occasion, the settlement banks borrowed the full amount of refinancing available. As intended, the deposit facility has continued to provide a 'floor' to the interbank overnight rate, and consequently other short-dated market interest rates.

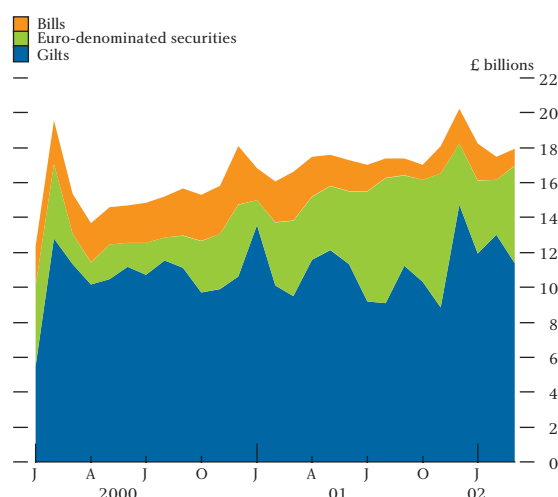
Gilts accounted for around £12 billion (or 65%) of the stock of collateral taken by the Bank in its OMOs during February, March and April (see Chart 40). Euro-denominated eligible securities⁽¹⁾ (issued by European Economic Area governments and supranational bodies) comprised around £4 billion (or 25%) of the collateral, compared with £5 billion in the previous three-month period.

On 16 May, the Bank published a paper 'The Bank of England's operations in the sterling money markets', which provides a full description of the Bank's money market operations. No changes to the operations were announced: the paper updated a previous paper issued in February 1997 to take account of the number of adaptations that have occurred over the past five years.⁽²⁾

HM Treasury and Bank of England euro issues

The Bank of England continued to hold regular monthly auctions during the period. €900 million of Bills were auctioned each month, comprising €600 million of three-month and €300 million of six-month Bank of

Chart 40
Instruments used as OMO collateral



England euro Bills. The stock of euro Bills outstanding increased on 15 March from €3.5 billion to €3.6 billion, remaining at this level for the rest of the period. The auctions continued to be oversubscribed, with the issues being covered an average of 6.81 times the amount on offer; bids were accepted at average yields of between euribor minus 8 and 11 basis points.

On 19 March the Bank re-opened the Bank of England Euro Note maturing in January 2005 with a further and final tranche auctioned on 16 April 2002. The auctions of €500 million each raised the total amount of this Note outstanding with the public to €2.0 billion. The auctions were on average 3.77 times covered and the accepted bids were in the range of 4.499%–4.625%.

UK gold auctions

The programme of gold auctions held by the UK government was completed during the period under review. Twenty tonnes of gold were sold on 5 March 2002. A price of \$296.50 per ounce was achieved and the auction was covered 3.7 times. This sale brought to an end the programme to restructure the United Kingdom's official reserves that was announced by HM Treasury on 7 May 1999.

(1) A list of eligible securities is available on the Bank's web site: www.bankofengland.co.uk/markets/money/eligiblesecurities.htm

(2) The paper is reprinted on pages 153–61 of this *Bulletin*.