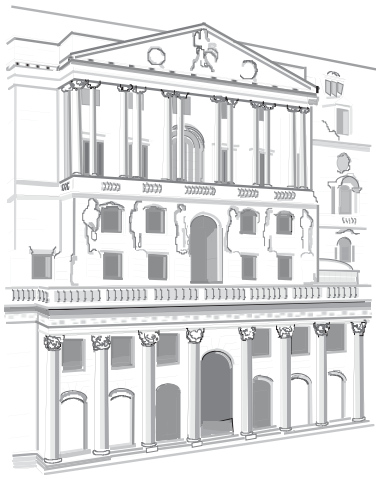
Bank of England Quarterly Bulletin



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The Quarterly Bulletin and Inflation Report

Inflation Report
(published separately)

The *Inflation Report* reviews developments in the UK economy and assesses the outlook for UK inflation over the next two years or so in relation to the inflation target. The first section provides a summary, while the second investigates money, credit, and financial market data, including the exchange rate, and the following three sections examine demand and output, the labour market and pricing behaviour respectively. The concluding sections present an assessment of medium-term inflation prospects and risks, and information about non-Bank inflation forecasts.

Markets and operations
(pages 5–19)

The final quarter of 1997 was volatile for financial markets, in part as the Asian crisis deepened. Major government bond markets rallied as investors favoured their higher credit ratings. Credit spreads widened for non-government unsecured borrowing, both in bond markets and money markets. Equity markets initially fell sharply in response to the Asian turbulence, but later recovered. The foreign exchanges were also volatile. The US dollar, commonly seen as a 'safe haven' in times of crisis, rose against most major currencies. The yen weakened, affected both by the crisis in neighbouring Asian countries and by the growing financial problems in Japan. Against this background, and with further news about the domestic economy, there were sharp changes in expectations of interest rates in UK markets. The Bank's Monetary Policy Committee raised the Bank's repo rate on 6 November to 7.25%. At the end of the quarter, there was little market expectation that UK official interest rates would rise further.

The international environment
(pages 20–9)

This article discusses developments in the international environment since the November 1997 *Quarterly Bulletin*. The financial and economic crisis in Asia has widened and deepened during 1997 and into 1998. There have been signs of contagion in other emerging markets. These developments are discussed separately in the note on page 26. The other main news is: growth in the United States remained strong in the third quarter of 1997, but the Japanese economy has continued to slow. The recoveries in Germany and France have strengthened. Activity in Germany remained dependent on net exports, while domestic demand strengthened in France. By December 1997, most major equity indices had recovered from the correction in October 1997. In Japan, equity prices fell steadily in the second half of 1997, but have strengthened in January 1998. Measured inflation remains low throughout the major six (M6) overseas economies. A majority of EU countries are expected to have fiscal deficits of 3% of GDP or less for 1997. Official interest rates were stable in most industrial countries, but bond yields have fallen. GDP in the M6 overseas economies grew by 0.8% in the third quarter, up from 0.1% in the second quarter. Growth in the United States remains strong, but activity in Japan has slowed.

Research and analysis
(pages 30–54)

Research work published by the Bank is intended to contribute to debate, and is not necessarily a statement of Bank policy.

The Inflation Report projections: understanding the fan chart (by Erik Britton, Paul Fisher and John Whitley of the Bank's Conjunctural Assessment and Projections Division). Since February 1996, the Bank's inflation forecast has been published in the form of a probability distribution—presented in what is now known as 'the fan chart'. This article discusses the motivation for the change, describes how the chart is produced and explains how it reflects the forecast process.

Investment in this recovery: an assessment (by Simon Whitaker, of the Bank's Structural Economic Analysis Division). Investment has grown less rapidly in this recovery than during the previous one, despite a relatively low user cost of capital, high levels of profitability and high stock market valuations of capital. Part of the reason may have been that firms were correcting for over-optimistic forecasts of demand in the late 1980s. Another possibility is that conventional measures of investment do not capture additions to the productive potential of the economy as accurately as they once did.

Macroeconomic policy and economic performance in developing countries (by Maxwell Fry, Director of the Bank's Centre for Central Banking Studies). In this article, Maxwell Fry, who became Director of the Bank's Centre for Central Banking Studies (CCBS) in September 1997, examines the relationship between monetary and fiscal policies for a sample of 70 developing countries. He finds that the size of the government's deficit and the methods by which it is financed determine monetary policy reactions to increases in both government credit and net foreign assets. In particular, Maxwell Fry finds that larger deficits and greater reliance by governments on the domestic banking system are associated with more accommodating monetary policies. In turn, such inflationary macroeconomic policies are associated not only with higher inflation, but also with lower economic growth.

Reports

(pages 55–78)

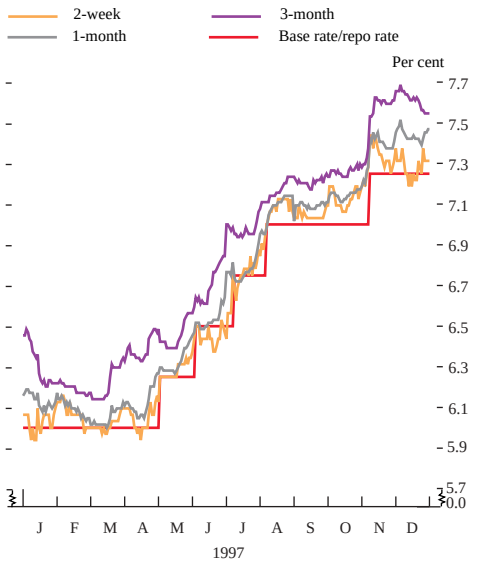
Gilt-edged and sterling money markets: developments in 1997. This article reviews developments in the gilt-edged and sterling money markets during 1997. There have been significant changes in these markets, as a result of both official and private sector initiatives and external developments. The economic backdrop was propitious, with economic growth sustained in the United Kingdom for the fifth successive year, and inflation remaining low. Bond yields fell, by more in the United Kingdom than in many other countries. In Europe, the prospect of EMU came into sharper focus, with implications both for market yields and trading arrangements. The Bank introduced reforms to its sterling money-market operations in March, widening the range of counterparties with whom the Bank would deal, and including gilt repo as a regular instrument in the Bank's open market operations. As a corollary, the Bank's counterparties in the gilt market, the gilt-edged market makers, were no longer required to be separately capitalised or specially supervised. Later in the year, the upgrading of the Central Gilts Office service at the Bank was completed, enabling the start of gilt strips trading. Looking ahead, work is under way to set up the UK Debt Management Office, which will assume responsibility for the Government's debt management from April 1998; changes to bring the sterling markets closer into line with the prospective euro markets are planned for 1998; and, following the introduction of index-linked auctions in the United States, HM Treasury is consulting the UK market about a similar initiative here.

Updating the Central Gilts Office (by Christopher P Mann of the Bank's Market Services Division and Controller of the CGO Project). The Central Gilts Office system, first introduced in 1986, was designed and built to meet basic market demands: the provision of settlement for gilt-edged securities through an efficient and secure system of electronic book-entry delivery of stock in real time against an assured payment. By 1994, it had become apparent that the system needed to be upgraded to reflect continuing improvements in information technology (especially in data security) and developments in market practices, as well as structural reforms in the gilt market and payments systems and the possibility of UK membership of European Monetary Union. This article explains the background to the decision taken in 1995 to upgrade the system, describes the process involved and sets out some of the features and changes introduced by the upgraded system.

Markets and operations

- *The final quarter of 1997 was volatile for financial markets, in part as the Asian crisis deepened.*
- *Major government bond markets rallied as investors favoured their higher credit ratings. Credit spreads widened for non-government unsecured borrowing, both in bond markets and money markets. Equity markets initially fell sharply in response to the Asian turbulence, but later recovered.*
- *The foreign exchanges were also volatile. The US dollar, commonly seen as a 'safe haven' in times of crisis, rose against most major currencies. The yen weakened, affected both by the crisis in neighbouring Asian countries and by the growing financial problems in Japan.*
- *Against this background, and with further news about the domestic economy, there were sharp changes in expectations of interest rates in UK markets.*
- *The Bank's Monetary Policy Committee raised the Bank's repo rate on 6 November to 7.25%. At the end of the quarter, there was little market expectation that UK official interest rates would rise further.*

Chart 1
Sterling interbank interest rates(a)



(a) Middle-market rates at 4.30 pm.

Overview

Financial markets were volatile in the final quarter of 1997. The turmoil in Asia, which had been building up during the summer, deepened and spread further, and its effects rippled out across the major financial markets. Partly because of this, bond and equity markets in the major financial centres ended the quarter higher than they began it. Measures of credit spreads widened during the quarter, however, and the thin year-end markets were particularly susceptible to swings in sentiment.

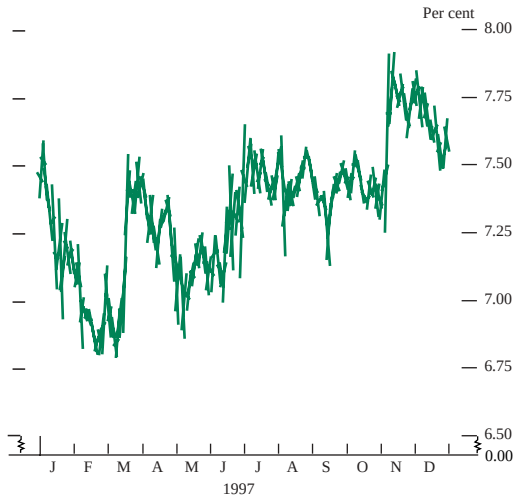
Domestically, the Bank's Monetary Policy Committee (MPC) decided to increase interest rates by 25 basis points on 6 November, taking the Bank's repo rate to 7.25%. Official interest rates in Germany had already been raised; in Japan and the United States, official rates were left unchanged during the quarter. Sterling markets were affected by the Asian turmoil, with gilts rallying at various points as they were seen as attractive assets at times of uncertainty.

Market developments

Short-term interest rates

Short-term interest rates in the United Kingdom were increased by 25 basis points during the final quarter of the year, at the November meeting of the MPC. This was the fifth increase in official interest rates in 1997, taking the Bank's repo rate to 7.25%. Chart 1 shows the path of several short-term market rates and the official repo rate through the year.

Chart 2
Short sterling: March 1998(a)



(a) Three-month Libor rate implied by short sterling futures prices.

Chart 3
Changes between end September and end December in three-month interest rates implied by futures contracts

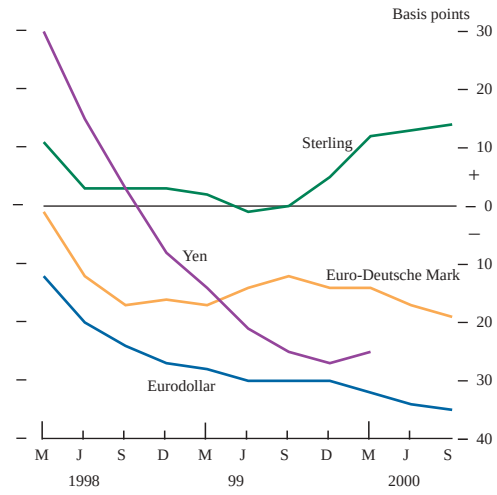


Chart 4
International ten-year bonds

The MPC's decision to raise interest rates in November was not anticipated by financial markets. On the day of the rate rise, the prices of short sterling futures contracts—the most liquid way for market practitioners to take an interest rate view—fell by about 20 basis points across the money-market yield curve. As an illustration, Chart 2 shows the path of the March 1998 short sterling contract. Immediately after the November rate rise, markets became bearish about the interest rate outlook, shown by the rise in implied interest rates for March 1998. Later in the month, short sterling contracts rallied a little, perhaps in reaction to the slowdown in activity forecast in the November *Inflation Report*, perhaps as the markets began to think that sufficient policy action might have been taken. Ahead of the December MPC meeting, the money markets were nervous (though there was little expectation of a further rate rise in December). During the quarter as a whole, expectations about the future level of official interest rates rose, though the short-term money-market yield curve remained downward-sloping.

Official interest rates in Japan and the United States were unchanged in the quarter; in Germany, the Bundesbank increased its repo rate by 30 basis points on 9 October, to 3.3%. In the exchange rate mechanism (ERM), the gap between official short-term interest rates narrowed further. Belgium, France and the Netherlands followed the Bundesbank's lead and immediately raised their key official interest rates to 3.3% on 9 October; Austria raised its official interest rates to 3.2%. By contrast, interest rates in Spain, Portugal and Italy, which were at a higher level, were cut during the quarter. The Bank of Spain reduced its repo rate from 5.25% to 5% on 3 October, followed by a further reduction to 4.75% on 15 December. The Bank of Portugal reduced its repo rate from 5.5% to 5.3% on 18 November, and the Bank of Italy lowered its discount rate by 0.75% to 5.5% with effect from 24 December.

Chart 3 shows the changes in expected three-month market interest rates for the three largest industrialised countries and the United Kingdom. In Germany and the United States, interest rate expectations ended the quarter lower. The financial crisis in Asia was a common factor affecting short-term interest rate markets.

Overall, markets interpreted the Asian crisis as reducing the likelihood that the Federal Reserve would raise interest rates; this change in sentiment also helped to reduce expected interest rates in other major countries. German and Japanese money markets were also affected by domestic factors. German markets were affected by changing views about the level at which European short-term interest rates might converge: toward the end of the quarter, there was a growing market view that interest rates would converge at lower levels than previously expected. Japanese interest rate expectations were affected mainly by the growing financial problems of domestic banks and securities firms. This pushed up expected unsecured borrowing rates, as derived from futures prices, for the first half of 1998, as Chart 3 shows.

Long-term interest rates

Bond markets rallied during the final quarter of 1997, influenced by the crisis in Asia. Government bonds in the industrialised countries were favoured by investors, because of their high credit ratings and

Chart 5
Implied forward inflation expectations(a)

(a) The implied forward inflation rates are annualised six-month rates derived from the yields on conventional and index-linked gilts.

Chart 6
Effective exchange rate indices: United Kingdom, United States, Germany and Japan

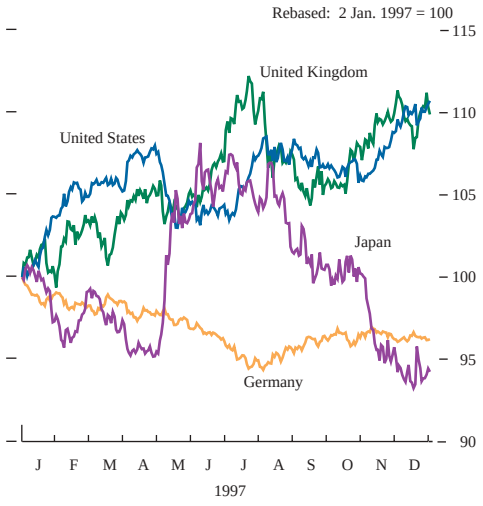


Table A
Exchange rates

	15 Sept. 1992	1 Aug. 1996	31 Dec. 1996	30 Sept. 1997	31 Dec. 1997	Percentage change over quarter
Sterling ERI	99.5	84.7	96.1	100.4	104.4	3.98
DM /£	2.7812	2.2946	2.6373	2.8525	2.9558	3.62
$/£	1.8875	1.5568	1.712	1.6153	1.6453	1.86
DM /$	1.4735	1.4739	1.5405	1.7659	1.7965	1.73
Yen/$	123.80	106.75	116.05	120.71	130.12	7.80

Table B
Selected emerging market currencies against the US dollar

	1 July	30 Sept.	31 Dec.	Percentage change 1 July-31 Dec.
Indonesian rupiah	2432	3269	5402	-55
Thai baht	24.4	36.2	47.0	-48
Korean won	888.0	911.1	1600.0	-45
Malaysian ringgit	2.53	3.43	3.88	-35
Philippine peso	26.4	34.0	39.5	-33
Singapore dollar	1.43	1.53	1.68	-15

liquidity. Chart 4 shows how ten-year yields fell during the quarter, continuing the trend of most of last year.

In the United States, the 30-year long bond yield fell by nearly 50 basis points in the quarter, to 5.93%. US markets were affected not only by the 'flight to quality' during the Asian market turbulence, but also by producer and consumer price data that were interpreted by the market as relatively benign for fixed-interest investments; and by a lower likely supply of bonds as markets focused on the improving federal government budget position.

Gilt-edged market

Gilt yields rose in the first part of the quarter. Gilt prices fell in reaction to lower US bond prices, following comments by Federal Reserve Chairman Greenspan about US employment growth and potential wage pressures. Gilt prices also fell after the release of UK RPI data in October, which were higher than the market expected. Later, as turbulence in Asian equity and currency markets increased, the gilt market benefited from its status as a safe haven at times of uncertainty. During the quarter as a whole, 20-year yields fell by around 30 basis points while five-year yields rose slightly. The gilt yield curve altered from being broadly flat between 5 and 20 years, to being downward-sloping (inverted).

The fall in nominal long-term interest rates did not alter market expectations of inflation, derived by comparing yields on conventional and index-linked gilts. Inflation expectations, as derived, are shown in Chart 5. In both the short and the long term, derived inflation expectations remained at around 3%–3.3% during the quarter.(1) The divergence between short and long-term inflation expectations at the end of September unwound in the following weeks. The institutional and liquidity factors that caused this divergence were described in the 'Monetary operations' article in the November 1997 *Quarterly Bulletin*, pages 329–45.

Foreign exchange

(i) International background

Chart 6 shows the effective exchange rates of sterling and the three major international currencies—the dollar, the Deutsche Mark and the yen. During the fourth quarter, the US dollar and sterling appreciated by 4%. The Deutsche Mark was almost unchanged. The yen fell by more than 6%, partly because of the Asian crisis and concerns about financial fragility. Table A shows that the dollar strengthened against the yen and Deutsche Mark (by around 8% and 2% respectively). In December, it rose above ¥130 for the first time since May 1992.

The turbulence in Asian currency markets, which began in the third quarter after Thailand floated its currency, continued (see Table B). During the fourth quarter, the Korean won and Indonesian rupiah both fell against the dollar by about 40%. Requests by these countries for assistance from the International Monetary Fund (IMF) were accepted. Chart 7 shows that other dollar-bloc currencies, such as the Australian dollar and the New Zealand dollar, also depreciated against the US dollar. Market commentary

(1) These derived inflation expectations may also include an inflation risk premium, and hence may exceed 'true' expectations.

Chart 7
Dollar-bloc currencies versus US dollar

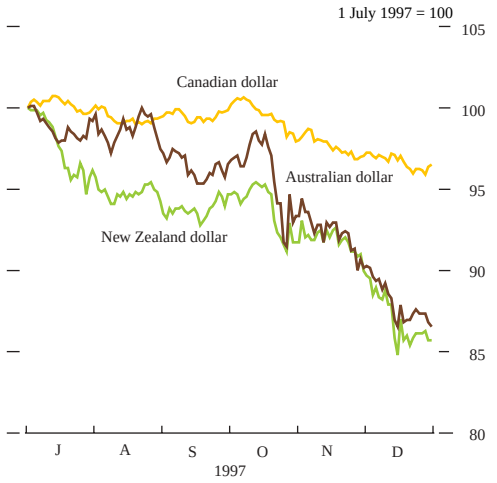
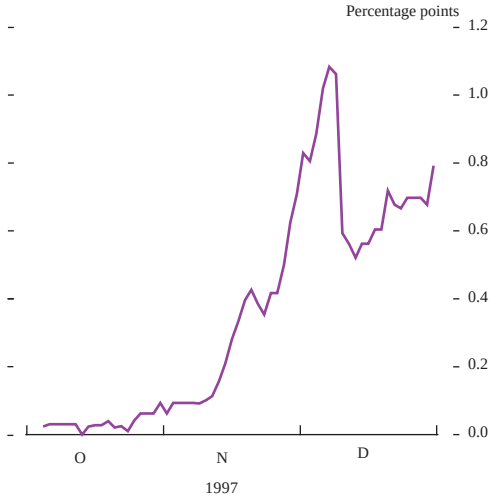


Chart 8
Japanese banks' funding premium over three-month US dollar Libor



Note: The chart takes an average of several Japanese banks' Libor rates over non-Japanese banks' Libor.

Chart 9
Deutsche Mark/dollar exchange rate

suggested that those currencies were partly affected by 'contagion' effects from neighbouring countries' currencies. The IMF's economic forecast, published in December, suggested that GDP growth in Australia and New Zealand was likely to be more than ½% lower in 1998 as a result of the Asian crisis.(1)

The yen's weakness was periodically attributable to concerns about financial fragility in Japan. On 24 November, one of Japan's largest stockbrokers, Yamaichi Securities, ceased trading, leading to a 'flight to quality' in the foreign currency and deposit markets; the Deutsche Mark and Swiss franc strengthened against the yen by 1.5% and 1.9% respectively. Chart 8 shows the funding premium on unsecured three-month dollar borrowing over Libor paid by Japanese banks (the chart shows the average of several banks' rates quoted on screens). The premium rose sharply during the fourth quarter, to an unprecedented level. It lessened subsequently on market comment that the Japanese authorities were providing foreign currency liquidity to support troubled financial institutions. In December, speculation that the Bank of Japan was selling dollars boosted the yen temporarily. It strengthened from ¥131.5 to ¥126 because of reports of intervention by the Bank of Japan on 17 December (which coincided with the announcement of an unexpected one-off income tax cut worth ¥2 trillion). But uncertainty about the yen's future value persisted, and markets perceived this strength as temporary. Implied volatility on $/Yen currency options rose sharply, but dealers were unwilling to pay a substantial premium for put options to sell US dollars against the yen (suggesting that they did not think the yen had much potential to rise in the short term). The yen subsequently weakened to a new five-year low at ¥131.5 before the end of the fourth quarter, partly because of the perception that concerted intervention by a number of central banks was unlikely.

Chart 9 shows that the dollar depreciated against the Deutsche Mark at the start of the quarter. The Bundesbank raised interest rates unexpectedly on 9 October (see section on money markets) and the Deutsche Mark strengthened, as markets saw this as the first move towards interest rate convergence ahead of EMU. Chart 10 shows that the dollar's subsequent recovery against the Deutsche Mark coincided with the US stock market's rally. The US dollar also strengthened against the Canadian dollar. The Bank of Canada tightened monetary policy, raising interest rates from 3.75% to 4.5% in response to currency market developments, but the Canadian dollar subsequently fell against the US dollar to C$ 1.44 on 30 December.

Chart 11 shows that the ERM currencies generally remained close to their ERM central rates. Forward exchange rates suggest that the market attaches a high probability to the present bilateral ERM central rates being used as EMU conversion rates for most countries. As an example, Chart 12 shows that divergence between the Italian lira's twelve-month forward rate against the Deutsche Mark and its bilateral central rate narrowed considerably during 1997. On 2 January 1998, interest rate differentials implied that the Italian lira's exchange rate would be about Lit 994 on 4 January 1999 (after EMU is scheduled to begin), within 0.5% of its present ERM bilateral parity against the Deutsche Mark. The market Ecu was also strong, relative to its theoretical equivalent: it traded at a

(1) The article on 'The international environment' on pages 20–9 covers some of these themes in more detail.

Chart 10
The dollar and the US stock market

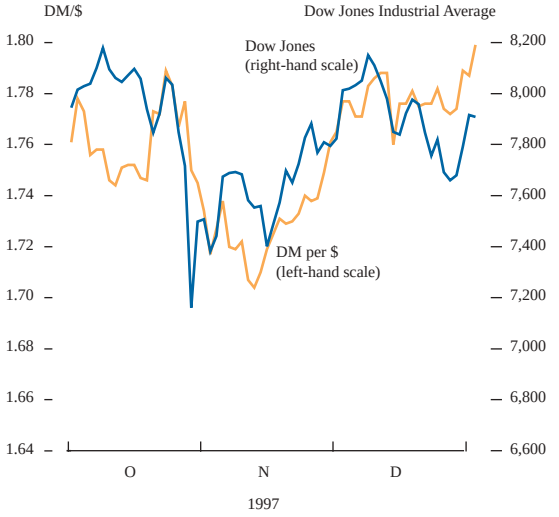


Chart 11
ERM exchange rates: divergence from the Deutsche Mark central rate

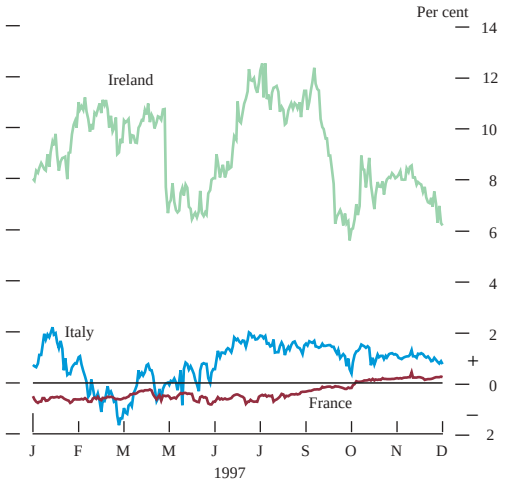


Chart 12
The Italian lira versus the Deutsche Mark

premium to its theoretical value for the first time since September 1992 (when the participation of sterling and the Italian lira in the ERM was suspended).(1) This is consistent with a high probability being placed on eventual one-for-one conversion between the Ecu and the euro. The premium may be related to the presence in the theoretical basket of currencies that may not participate in EMU from 1 January 1999, such as sterling.

The international background was also affected by the weakness of the gold price. It fell by 13% to $289.20, and it 'fixed' at its lowest since August 1979 at $283.25 on 9 December. Gold prices continued to be sensitive to news of further sales by central banks and its likely role in the European Central Bank's reserves.

(ii) Sterling

Sterling rose by 4% to 104.4 on the effective exchange rate index between the end of the third and fourth quarters. It strengthened against the Deutsche Mark from DM 2.85 to DM 2.95, and against the dollar from $1.62 to $1.65 (see Table A). Sterling peaked at $1.71 on 12 November, its highest since January 1997. It peaked at DM 3.00 on 2 December, and reached a five-year high against the yen at ¥219 on 26 December (see Chart 13).

During the third quarter, sterling fell against the Deutsche Mark from its high at DM 3.08 to DM 2.85, partly because of a rise in the probability attached by the market to sterling participating in EMU on, or fairly soon after, 1 January 1999.(2) Specifically, a *Financial Times* report on 26 September suggested that sterling was likely to enter EMU at a lower exchange rate than the prevailing market rate.(3) Chart 14 shows that the expected correlation between sterling and the Deutsche Mark (derived from currency option prices) increased in this period.

But the rise in the expected correlation between sterling and the Deutsche Mark unwound during the early part of the fourth quarter. On 18 October, *The Times* reported that the Government was likely to rule out EMU entry during the current parliament. Sterling strengthened from DM 2.86 to DM 2.89 when financial markets reopened on 20 October. It rose further to DM 2.92 after the Chancellor's statement about EMU to the House of Commons on 27 October, which was widely interpreted in the market as ruling out UK membership before 2002. During this period, sterling's attractiveness to investors may also have benefited from the perception that UK interest rates would not be lowered towards the levels in core ERM countries.

Sterling strengthened further following the MPC's decision to increase the Bank's repo rate on 6 November. Chart 15 shows that the announcement took many market participants by surprise, and sterling rose by 1% on its effective exchange rate index, to 103.3. The international background of a strong dollar and a softer Deutsche Mark (see international section) helps to explain sterling's subsequent movements. It weakened against the dollar in relatively illiquid markets toward the end of December. Traders who follow a chartist approach may have been persuaded to take profits on long sterling positions after sterling failed to rise above its January 1997

(1) The theoretical Ecu is derived from the weighted exchange rates of the component currencies. See *Quarterly Bulletin*, June 1979.
(2) See the article 'Implied exchange rate correlations and market perceptions of European Monetary Union' by Creon Butler and Neil Cooper, *Quarterly Bulletin*, November 1997, pages 413–23.
(3) See the *Inflation Report*, November 1997, page 46.

Chart 13
Exchange rates

Chart 14
Twelve-month implied correlation US dollar/Deutsche Mark versus US dollar/sterling

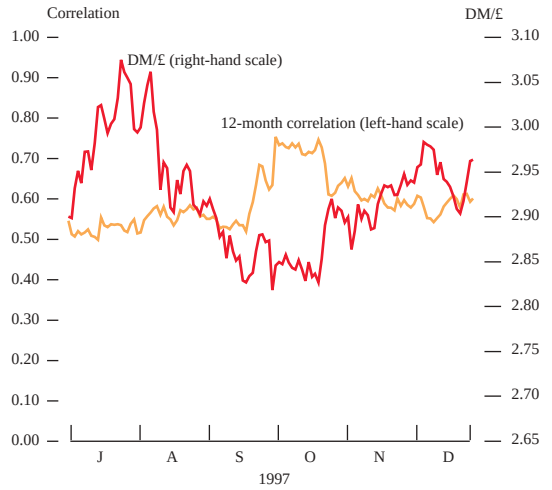
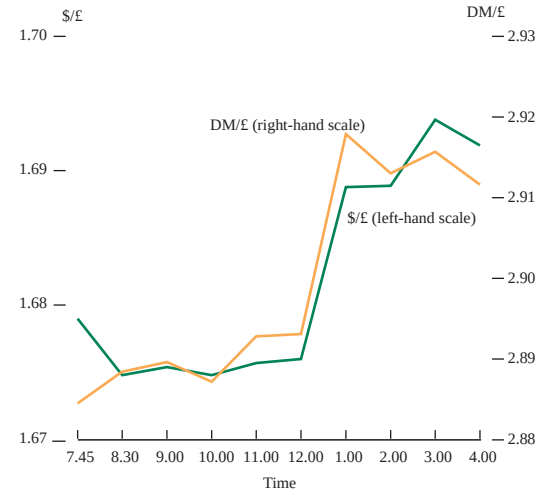


Chart 15
Sterling exchange rates on 6 November 1997



high of $1.72 on 12 November (it reached $1.71 prior to the publication of the *Inflation Report* and closed at $1.70). The failure to establish a new high is often interpreted by chartists as the first indication of a possible trend-reversal. But sterling rose further against the Deutsche Mark in the remainder of the fourth quarter and ended the year at DM 2.96, up 32 pfennigs on a year earlier.

Equities

Much of the quarter was dominated by developments in Asian markets, and the spillover effects to other stock markets. Equity market developments in the major Asian markets are shown in Table C. The steepest fall in the quarter was in South Korea. In the year as a whole, Malaysian and South Korean equity markets fell by 52% and 42% respectively.

Equity indices in the major markets were affected by the falls and volatility in Asian markets, though by the end of December they had regained much of their losses, as Chart 16 shows (Japan was an exception). In the first part of the quarter, major markets fell: between 1 October and 13 November (the date when both the S&P 500 and the FT-SE 100 reached low-points), the S&P 500 index fell by 4.1%, the FT-SE 100 by 11.4% and the German DAX by 13.2%. In the same period the Nikkei 225 fell by 13.6%. During the second part of the quarter, major equity markets regained much of their lost ground. In the quarter as a whole, the S&P 500 index rose by 1.6%, with the FT-SE 100 and the German DAX falling by 3.4% and 0.9% respectively; the Nikkei 225 fell by 14.5%. Chart 17 shows the Nikkei 225 and the yen/dollar exchange rate. The fall in the Nikkei from around mid year was accompanied by a fall in the yen/dollar exchange rate from around ¥110 to ¥130 per dollar.

By the end of the year, the UK and US stock markets were about 20% higher than a year earlier. This suggests that the equity market was not expecting the turmoil in Asia to affect UK and US corporate profitability much. During most of the second half of last year, equity prices were high relative to corporate earnings: by the end of the quarter, the price/earnings ratio for the FT-SE 100 was around 20, its highest for about four years. The price/earnings ratio for the Dow Jones Industrial Average was also at its highest since 1994.

Credit indicators and spreads

The heightened market concern about Asia led to a widening of the spread between Asian countries' bond yields and equivalent US Treasuries. Credit markets in other countries were also affected. Other (non-Asian) emerging market borrowers saw credit spreads widen from around 250 basis points over US Treasuries to about 500 basis points or more. Credit spreads for high-rated borrowers in the industrialised countries also widened. At ten years, typical UK borrowers' bond spreads widened from about 40 basis points over gilts to around 55 basis points.

The interbank market also saw a widening in credit spreads. The gap between (unsecured) interbank three-month rates and (secured) gilt repo rates widened from about 10 basis points to as high as 30–35 basis points, because of the deepening Asian crisis—and especially further concerns about Japan. The spread narrowed a

Table C
Changes in emerging market equity indices

Per cent

	1996	1997	1997 Q4
Hong Kong	+34	-20	-29
Indonesia	+24	-37	-27
Malaysia	+24	-52	-27
Singapore	-2	-31	-22
South Korea	-26	-42	-42
Taiwan	+34	+18	-6

Chart 16
Equity indices

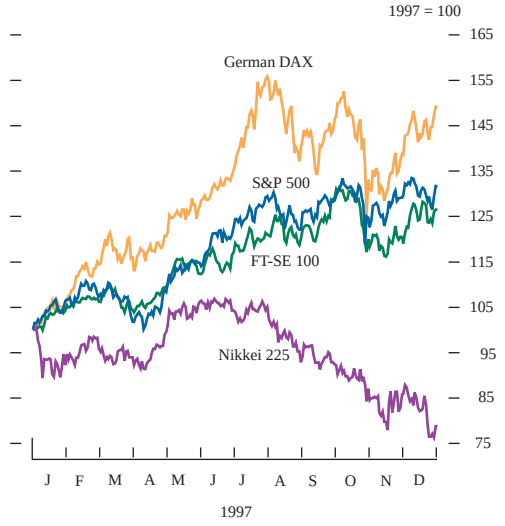


Chart 17
Japanese equity market and yen/dollar exchange rate

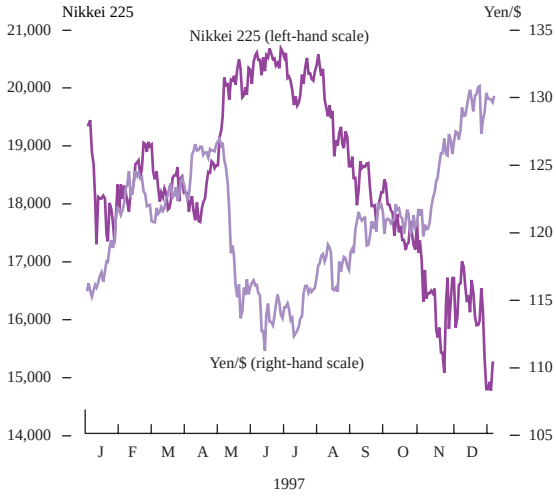


Table D
Average daily money-market shortages

£ millions

1996	Year	900
1997	Year	1200
1997	October	1700
	November	1400
	December	1000

little toward the end of December, as concern about the Asian crisis eased and as Japanese banks had probably completed most of their end-quarter funding. A similar widening in interbank rates relative to government rates occurred in the US dollar and yen markets during the fourth quarter.

Bond market credit spreads generally remained at their wider levels throughout the quarter, suggesting that the bond market continued to be nervous about pricing all types of credit risk. The sterling interbank credit spread was not only affected by credit conditions facing Japanese banks, but also by end-of-year funding pressures affecting a variety of institutions, and technical tightness in the money markets (particularly in October). As some of these factors eased, the spread narrowed.

Open market operations and gilt repo

Operations in the sterling money market

The final quarter of the year was generally smooth for the Bank's sterling open market operations (OMOs), though the daily money-market shortages were volatile. The stock of refinancing was high during October, following the dual gilt auction in September and accompanying seasonal surplus in the CGBR in October. This produced shortages averaging £1.7 billion a day in October, compared with £1.3 billion for the previous six months. In November and December, the shortages fell to £1.2 billion a day (see Tables D and E).

The high stock of refinancing in October put pressure on the short end of the money market. The sterling overnight interest rate average (SONIA) was above the Bank's (two-week) repo rate on 19 days in October, compared with three days in the previous month.(1) At longer maturities, the gap between unsecured interbank and certificate of deposit (CD) rates rose relative to secured gilt repo, as Chart 18 shows. The rise in November and December partly reflected credit conditions in the interbank market (see above). But the spread was also affected by technical money-market conditions. The high stock of refinancing, combined with retail banks' continuing need to hold sterling stock liquidity, meant that gilt collateral was in high demand. That put downward pressure on general collateral (GC) repo rates. Similarly, the need for stock liquidity may have led more clearing banks to issue CDs, pushing up CD rates (CDs may be used to offset some of a bank's retail liabilities in its sterling stock liquidity requirement).

The use of late facilities, through which discount houses and settlement banks may obtain liquidity late in the day from the Bank, was also higher in October than it had been for some months. On average, the use of combined late facilities averaged £115 million a day during October, reverting to the average rate of use in June and July, compared with £40–50 million in August and September.

Chart 19 shows how the Bank's daily refinancing was provided during the quarter. Overall, despite the rise in October, the use of late facilities remained small, at about 5% of the total refinancing. Two-week gilt repo remained the dominant form of refinancing, though there was also an increase in the use of bill repo during the

(1) SONIA is explained in more detail in a box on page 57.

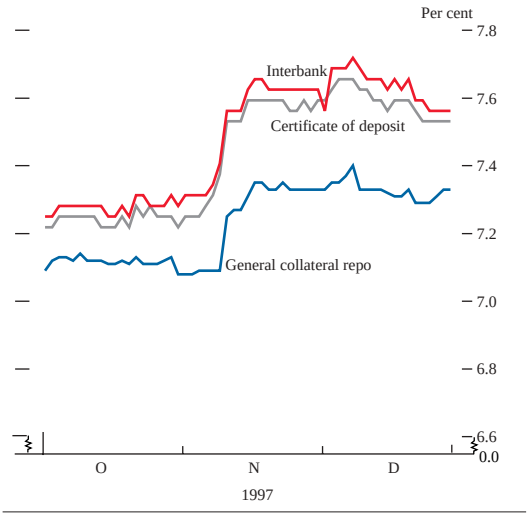
Table E
Influences on the cash position of the money market

£ billions; *not seasonally adjusted*
Increase in settlement banks' operational balances (+)

	1997 Apr.-Sept.	Oct.	Nov.	Dec.
CGBR (+)	10.1	-5.1	3.4	1.0
Net official sales of gilts (-) (a)	-8.6	-1.6	0.3	-2.6
National Savings (-)	-0.7	-0.2	-0.2	-0.1
Currency circulation (-)	1.2	-1.7	-0.5	0.0
Other	-2.4	0.5	1.7	3.9
Total	**-0.4**	**-8.1**	**4.7**	**2.2**
Outright purchases of Treasury bills and Bank bills	-0.5	0.9	-0.3	-0.1
Repos of Treasury bills, Bank bills, and British Government stock and non-sterling debt	-1.1	6.7	-5.3	-2.0
Late facilities (b)	0.3	-0.3	0.4	-0.4
Total refinancing	-1.3	7.3	-5.2	-2.5
Treasury bills: Market issues and redemptions (c)	-1.2	-0.8	-0.4	-0.4
Total offsetting operations	**-0.1**	**8.1**	**-4.8**	**-2.1**
Settlement banks' operational balances at the Bank	-0.5	0.0	0.1	0.0

(a) Excluding repurchase transactions with the Bank.
(b) Since 3 March 1997, when the Bank introduced reforms to its daily money-market operations, discount houses and settlement banks have been eligible to apply to use the late facilities.
(c) Issues at weekly tenders plus redemptions in market hands. Excludes repurchase transactions with the Bank (market holdings include Treasury bills sold to the Bank in repurchase transactions) and tap Treasury bills.

Chart 18
Sterling three-month interest rates



quarter—to 25% from 17% in the previous quarter. Outright bill sales accounted for 27% of refinancing, suggesting that counterparties still value the ability to obtain shorter-maturity money from the Bank through the use of bills. Since the start of the new money-market arrangements, the average maturity of bills sold to the Bank outright has fallen gradually: by the fourth quarter, more than 60% of outrights were of three-days' maturity or less, illustrating their flexibility in providing shorter-maturity money.

Gilt repo market

The Bank's quarterly market survey showed that there was £72 billion gilt repo outstanding at the end of November, about 6% higher than a year earlier. The survey has been carried out every three months since the start of the market in January 1996. The size of the market reached a peak of £79 billion in May 1997 and activity now appears to have stabilised. Similar consolidation has been reached in reverse repo. Average daily repo turnover fell to £13 billion during the three months ended November, compared with £16 billion during the previous three months. This will in part have reflected the increase in the maturity of repo outstanding during the quarter, especially at maturities over three months (see Table F). By end November, 15% of trades outstanding were for three months or more, compared with 5% at the end of the previous month. That may be an indication that the market in term repo is developing, or it could be that volatile market conditions and uncertainty about interest rates led dealers to use repo to take a view on interest rates at a horizon of three to six months.

The main feature of the specials market has been the tightness of 9% Treasury 2008, the cheapest to deliver stock into the March long gilt futures contract.(1) It has at times attracted a specials premium several percentage points below GC repo rates. Elsewhere, 7¼% Treasury 2007 started trading in 1998 at special rates because of its status as the ten-year benchmark. Its benchmark status puts it in demand by eurobond lead-managers wishing to borrow the stock to short-sell it, to hedge against their exposure to ten-year eurobonds that they are underwriting.

Continuing structural topics in the repo market, such as the *Code of Best Practice*, are covered in the article, 'Gilt-edged and sterling money markets: developments in 1997' on pages 55–69.

Gilt financing

Gilt sales to the end of December amounted to £20.9 billion, more than 80% of the slightly increased sales target of £25.4 billion announced following the *Pre-Budget Report* in November (see Table G). About £16.9 billion was raised by conventional gilt sales, with the rest by index-linked sales. Within conventionals, the distribution of sales was skewed towards short and, to a lesser extent, long-dated gilts, which accounted for 42% and 33% respectively of total conventional issues, compared with 25% for mediums, against Remit targets for the financial year as a whole for 35% each for shorts (3–7 years) and longs (over 15 years), and 30% for mediums (7–15 years). This reflects the pattern of auctions held in the first three quarters of the financial year, with

(1) When a stock is particularly difficult to obtain and its repo rate falls below the prevailing GC rate by more than about 5–10 basis points, it is said to be trading 'special'.

Chart 19
OMOs—instrument overview

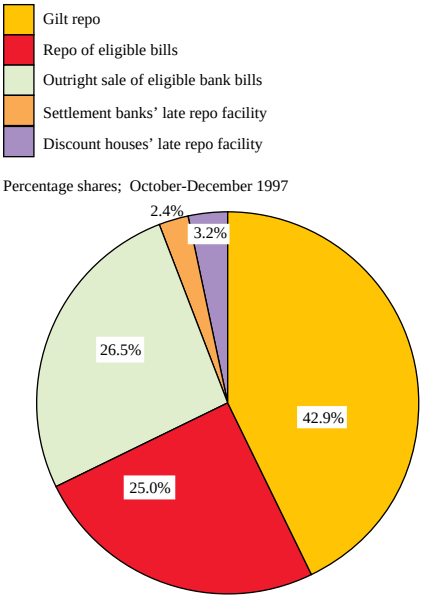


Table F
Maturity breakdown of outstanding repo and reverse repo over time[a]

		On call and next day	2–8 days	9 days to 1 month	1–3 months	3–6 months	Over 6 months	Total Per cent	Total £ billions
Per cent									
Repos									
1996	May	20	34	23	15	7	1	100	35
	Aug.	19	33	33	11	4	1	100	56
	Nov.	19	36	22	19	2	2	100	68
1997	Feb.	20	29	33	15	3	0	100	71
	May	27	23	27	18	4	1	100	79
	Aug.	25	21	24	24	4	1	100	67
	Nov.	22	22	19	22	11	4	100	72
Reverse repos									
1996	May	20	30	20	23	6	2	100	34
	Aug.	22	29	29	14	5	1	100	54
	Nov.	21	34	21	20	3	2	100	60
1997	Feb.	18	32	26	21	3	0	100	67
	May	23	21	30	20	6	1	100	71
	Aug.	17	20	26	26	6	1	100	63
	Nov.	17	25	17	25	11	5	100	71

Note: rows may not sum to total owing to rounding.

(a) From the data reported under the voluntary quarterly arrangements.

four auctions of shorts and three of longs, compared with only two auctions of medium stocks. Taps of conventional stocks are used for market management purposes only, and are now rare; there were none during the quarter. Table H reports gilt issuance by auctions and taps.

Auctions

There were two auctions during the third quarter of the financial year; a medium-maturity in October and a short in December. The December auction was originally scheduled for 26 November, but was postponed to 10 December to avoid a clash with the *Pre-Budget Report*. The auction schedule for the quarter was announced on 30 September, following the usual consultation with market participants.

The auction of £2 billion of 7¼% Treasury Stock 2007 in October reflected strong market demand, expressed at the Bank's quarterly meetings, for a medium stock, in the absence of any medium-dated issuance since June. Market views were divided on whether to reopen 7¼% 2007, or to issue a new ten-year benchmark stock. The prevailing factor in the decision to reissue the existing benchmark was the aim of increasing the amount of the stock outstanding, ahead of the start of the strips market on 8 December. During the unsettled conditions in equity and bond markets immediately before the auction, little attention was focused on the auction itself. In the event, with the GEMMs perhaps taking encouragement from an improvement in equity markets the day before, the auction went well, with cover of 2.39 times, a 1 basis point tail, and an average price of 104–09 (yielding 6.66%), compared with the price of 109–13 in the when-issued market at 10.30 am.

Market participants' views differed on the choice of stock for the November/December auction, with some advocating a further issue of the longest strippable stock (8% Treasury 2021) just ahead of the opening of the strips market. Others, including a majority of GEMMs, preferred a short stock, with many advising the authorities to take the opportunity to open a new five-year benchmark. This view prevailed, and details of the new benchmark, 6½% Treasury 2003, were announced on 2 December, a week ahead of the auction. The maturity date, December 2003, was slightly longer than usual, allowing more time to build up the amount of stock outstanding, in view of the reduced funding requirement forecast for the next two years. Cover was lower (1.77 times) and the tail (2 basis points) longer than usual, given the maturity of stock. The stock yielded 6.53% at the average accepted price, the lowest for a five-year issue since 1993.

On 30 December 1997, following consultation meetings with the GEMMs and representatives of investors in the gilt market, the Bank announced that the auctions to be held in the final quarter of the current financial year would be of a new long stock (maturing in December 2028) on 28 January 1998, and a further issue of 7¼% Treasury 2007, on 25 March 1998 (depending on the date of the Budget). The choice of which two maturity areas to auction was determined by the terms of the Remit issued to the Bank in March 1997. Because the target for shorts had already been reached, the auctions in the final quarter of the financial year had to contain a medium and a long. The decision to auction a new

Table G
Financing arithmetic 1997/98: progress to end December

£ billions

CGBR forecast		11.7
Assumed increase in net official reserves		0.0
Gilt redemptions		19.6
Plus gilt sales residual from 1996/97		-3.9
Financing requirement		**27.4**
Less:	expected net inflow from National Savings	2.0
	expected net sales of Certificates of Tax Deposit (a)	0.0
Gilt sales required		**25.4**
Less:	gilt sales already made (to end-Dec. 1997)	20.9
Further gilt sales required Jan 1998-March 1998		**4.5**

Note: figures may not sum owing to rounding.

(a) Certificates of tax deposit are deposits (CTDs) made by taxpayers with the Inland Revenue in advance of potential tax liabilities. Changes in the level of CTDs act as a financing item for central government.

30-year stock gives investors in gilts the opportunity directly to compare long yields in various government bond markets such as the United States, France and Germany. It also enables investors matching long liabilities the chance to extend the duration of their assets, especially when the new stock becomes strippable (when the amount outstanding reaches £5 billion).(1) The new long stock will also allow fund managers an additional bond to match the over 15 year FT bond index, currently dominated by the £16.5 billion 8% Treasury 2021. The March auction of 7¼% Treasury 2007 will build up the liquidity of the current ten-year benchmark.

The Bank's gilt 'shop window' is on the Bank's information screens and shows the amount of stocks in official portfolios available for resale or switching. There was only a small amount of stock available in the Bank's shop window during the October-December quarter, so turnover in switches remained low, averaging £120 million a month.

Index-linked

Demand for index-linked bonds remained strong for much of the quarter, with real yields approaching 3%.(2) The sector benefited from the strength of conventional bond markets; switching out of equities into bonds, including index-linked, as Asian markets triggered a 'flight to quality'; and limited supply. Weaker equities and a stronger gilt market in October saw index-linked real yields fall significantly below dividend yields for the first time since April. The box on pages 16–17 compares real yields in different countries.

Although the 1997/98 target for index-linked issuance rose slightly to £5.1 billion following the Chancellor's *Pre-Budget Report*, only £2 billion needed to be raised through index-linked sales in the second half of the financial year. The slower pace of funding in the quarter reflected this, with three tap packages issued, two of which were for £150 million of a single stock (see Table H). The £0.9 billion raised in the quarter took cumulative funding to £4.1 billion, more than 80% of the required sales for 1997/98.

Limited supply and a rising market meant that GEMMs tended to be short of stock. Liquidity in the sector was low for much of the period, with institutions having to await supply in order to obtain large amounts of stock. As a result, each of the taps was sold quickly—three of the four stocks were exhausted at the initial tenders—and above their issuance prices, as GEMMs sought to cover their short positions and customer orders.

Sectoral investment activity

The latest ONS data, covering the period from July to September, show total net institutional investment in gilts at £3.7 billion, £1.9 billion lower than the previous quarter. The net fall in investment reflects the effect of the two large redemptions during the period, totalling around £7 billion. Otherwise, underlying investment in gilts remained strong, probably driven by the effect

(1) The Bank decided to delay the strippability of the new long-dated stock, in response to market feedback. If it were immediately strippable, the longest-dated coupon strips would have very small amounts outstanding in cash terms and so might be illiquid, making it difficult for GEMMs to make markets in them.
(2) Because of the indexation lag of eight months on index-linked gilts, we need to make an assumption about the rate of inflation over the remainder of the life of the bond in order to calculate its real yield. The data referred to here uses a 3% assumed inflation rate. Real yields dipped below 3% on a 5% assumed inflation rate.

Table H
Gilt issuance

Date	Stock	Amount issued (£ millions)	Price at issue (per £100 stock) (a)	Yield at non-competitive allotment price (b)	Yield at issue	Yield when exhausted (c)	Average yield (d)	Cover (e) at auctions	Tail (f) at auctions (basis points on yield)	Date exhausted
Auctions of conventional stock: Apr.-Dec.										
23.4.97	7% Treasury Stock 2002	2,000	98.9688	7.24	n.a.	n.a.	n.a.	3.49	1	23.4.97
20.5.97	7% Treasury Stock 2002	1,500	100.2500	6.94	n.a.	n.a.	n.a.	3.03	0	20.5.97
22.5.97	8% Treasury Stock 2021	1,500	108.6250	7.24	n.a.	n.a.	n.a.	1.29	4	22.5.97
25.6.97	7¼% Treasury Stock 2007	2,000	100.8125	7.13	n.a.	n.a.	n.a.	2.71	1	25.6.97
23.7.97	8% Treasury Stock 2021	2,000	113.2813	6.86	n.a.	n.a.	n.a.	2.32	1	23.7.97
23.9.97	7% Treasury Stock 2002	1,500	101.1250	6.71	n.a.	n.a.	n.a.	2.30	1	23.9.97
25.9.97	8% Treasury Stock 2021	1,500	117.0313	6.57	n.a.	n.a.	n.a.	2.33	1	25.9.97
29.10.97	7¼% Treasury Stock 2007	2,000	104.2813	6.66	n.a.	n.a.	n.a.	2.39	1	29.10.97
10.12.97	6½% Treasury Stock 2003	2,000	99.8438	6.53	n.a.	n.a.	n.a.	1.77	2	10.12.97
Tap issues of index-linked stock: Oct.-Dec.										
2.10.97	2% Index-linked 2006	150	201.4688	n.a.	3.22	3.22	3.22	n.a.	n.a.	3.10.97
28.11.97	2½% Index-linked 2016	150	173.3750	n.a.	3.12	3.11	3.11	n.a.	n.a.	28.11.97
12.12.97	2½% Index-linked 2020	100	172.0000	n.a.	2.98	2.97	2.97	n.a.	n.a.	12.12.97
12.12.97	2½% Index-linked 2003	100	192.1250	n.a.	2.99	2.99	2.99	n.a.	n.a.	12.12.97

n.a. = not applicable.

(a) Non-competitive allotment price.
(b) Gross redemption yield per cent based on the weighted average price of successful competitive bids.
(c) Gross redemption yield or real rate of return (assuming 5% inflation) based on the price when the issue ceased to operate as a tap.
(d) Weighted average gross redemption yield or real rate of return (assuming 5% inflation), based on actual price at which issues were made.
(e) Total of bids divided by the amount on offer.
(f) Difference in gross redemption yield between the weighted average of successful competitive bids and the lowest accepted competitive bid.

Table I
Official transactions in gilt-edged stocks

£ billions; *not seasonally adjusted*

	1997 Apr.-Sept.	Oct.	Nov.	Dec.
Gross official sales (+) (a)	16.0	2.4	0.0	2.7
Redemptions and net official purchases of stock within a year of maturity (-)	-7.4	-0.8	-0.3	-0.1
Net official sales (b)	8.6	1.6	-0.3	2.6
of which net purchases by:				
Banks (b)	1.2	-1.2	0.9	0.0
Building societies (b)	0.2	0.2	0.1	0.0
M4 Private sector (b)	5.2	-0.8	-2.3	0.8
Overseas sector	1.6	3.3	0.9	1.8
LAs & PCs (c)	0.3	0.0	0.0	0.0

(a) Gross official sales of gilt-edged stocks are defined as official sales of stock with over one year to maturity net of official purchases of stock with over one year to maturity, excluding transactions under purchase and resale agreements.
(b) Excluding repurchase transactions with the Bank.
(c) Local Authorities and Public Corporations.

of the Minimum Funding Requirement introduced under the *Pension Act* in April, and perhaps also the effect of the Budget changes to ACT tax credits in July. Net investment in gilts by pension funds fell from an unusually high level of £2.8 billion the previous quarter, to £1.5 billion; net investment by long-term insurers also fell.

Data compiled by the Bank for the fourth quarter show that net official gilt sales were £3.8 billion (see Table I). The domestic non-monetary sector—which includes pension funds and life assurance companies—reduced its holdings by around £2 billion, and the overseas sector increased its holdings by £6 billion during the quarter.

Technical developments

Central Gilts Office (CGO) upgrade

The Bank announced in November 1995 that the CGO system was to be upgraded to provide easier handling of gilt repo and strips. The upgraded CGO system was launched on 10 November 1997. The new CGO system has been developed over the past two years; it has retained most of the features of the CREST software on which it is based, but also includes some new features. The new settlement system is discussed in the articles on pages 55–69 and 70–78.

Strips

Successful introduction of the upgrade to CGO allowed the new gilt strips facility to be launched on 8 December 1997. Stripping a coupon-bearing bond involves separating it into its constituent interest and principal payments, which can then trade as zero-coupon instruments. Conversely, assembling coupon and principal strips enables reconstitution of a coupon-bearing gilt. This new facility is available as part of the upgraded CGO system. Gilts held in CGO can be stripped or reconstituted through gilt-edged market makers (GEMMS).(1)

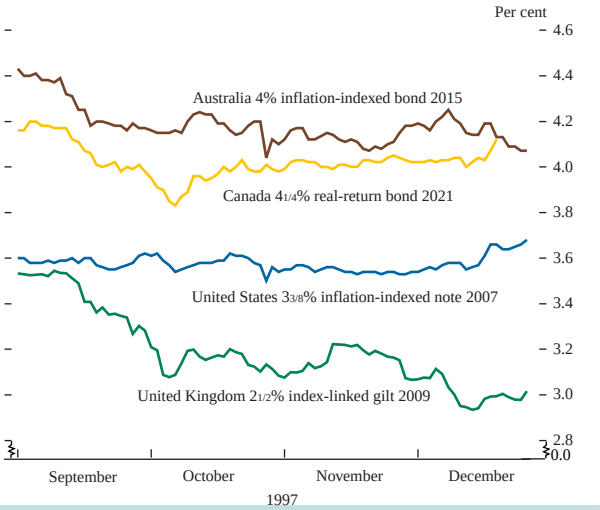
(1) More information on gilt strips is given in the article on page 55–69, in particular pages 58–9.

International real yields

Index-linked bond markets enable us to compare real returns between countries. A box in the November 1997 *Quarterly Bulletin* illustrated the divergence between UK real yields (which had fallen) and US real yields (which had not). The chart below shows that this trend continued in the final quarter of 1997. The chart also shows real yields derived from index-linked bonds in Australia and Canada. These have also remained broadly unchanged recently, in contrast with the UK market. Institutional factors may help to explain the fall in UK yields, particularly the influence of the Minimum Funding Requirement, which became effective in April.

The rest of this box looks at reasons why levels of real yields might differ between countries, concentrating on structural differences—tax, indexation, liquidity and instrument design—between the UK and US markets as an illustration. (There are other reasons why levels of real yields might differ—if, for example, the relative price of the baskets of goods to which different bonds are indexed was expected to change over the life of the bonds.)

Real yields on index-linked securities



Tax treatment

In both the UK and the US markets, nominal coupons (ie coupons uplifted by inflation) on government bonds are taxed. The inflation uplift on the principal is not taxable in the United Kingdom. In the United States it is taxable on an annual basis, though in practice many taxpaying US investors are likely to hold indexed bonds in tax-deferred accounts. With a tax-deferred account, payment of income tax is deferred until the income is withdrawn from the account.

To assess the potential significance of this difference in tax regimes, imagine two hypothetical ten-year index-linked bonds with $3^3/_8$% (gross) real coupons—one subject to the US tax system (but with tax deferral) and the other subject to the UK tax system.(1) Suppose that the after-tax real return on these two bonds is equal. It is then possible to compute corresponding gross real yields. The less favourable US tax regime will tend to make US gross real yields higher than in the United Kingdom. The extent of the difference depends on the 'marginal' investor in each market (who determines the price). If non-taxpayers are driving prices in both markets, tax differences are unlikely to be important.

Table 1
Impact of tax rates on gross real yield differentials

US tax rate (per cent)	UK tax rate (per cent)	Difference in gross yields (basis points)
39.6	40.0	70
28.0	24.0	60
15.0	20.0	6

Note: Calculations assume that future inflation remains constant at 3%.

But if taxpayers are driving prices, tax effects could be large relative to the apparent difference in real yields (see Table 1). For ease, these calculations assume that the marginal investor in both markets has a similar tax status—the differences would be larger if this assumption were to be relaxed.

(1) $3_{3/8}$% is the coupon rate on the first US ten-year indexed note.

UK strips market activity was relatively quiet during December. By 2 January 1998, a little under 1% of the £82 billion of strippable stock was held in stripped form. In the first four weeks of the strips market, turnover in coupon and principal strips was equivalent to 1% of turnover in the rest of the gilts market.

The new strips market provides direct observations of zero-coupon bond yields for the first time. Because coupon strips mature every 7 June and 7 December, there is a wide spread of observations across the yield curve. Zero-coupon curves can be used as an indicator of the market's expectations of future interest rates. Until now, it has only been possible to obtain a theoretical zero-coupon yield curve for the UK gilt market from the prices of

Taxpaying investors are present in both markets. For instance, in April 1995 there were estimated to be more than 50,000 personal investors (ie taxpayers) in UK index-linked gilts, while more recent analysis of the stock register suggests that higher-rate individual taxpayers continue to be important holders up to around the ten-year maturity. But non-taxpayers (such as pension funds) are large investors in both markets, and are likely to be dominant. This view is supported by the UK corporate index-linked market. The inflation uplift on UK corporate index-linked bonds is taxed. Taxpayers would require compensation for this in the gross yield on such debt. But actual differentials between comparable corporate and government index-linked and conventional bonds suggest that in practice there is no such tax effect.

Index problems

The Boskin Commission suggested that the US consumer price index (CPI), to which US bonds are indexed, on average overstates inflation by 1.1%. This could have two effects. First, if the inflation uplift over-compensates for actual inflation, the apparent real return on the bonds will understate the actual real return. Second, bond-holders may demand a premium in the yield, because they are uncertain whether the CPI will be changed and if so, how any change will affect them.

Liquidity

One of the factors most likely to lead to a difference in real rates between the United Kingdom and the United States is a relative liquidity premium. Though the ten-year US bond is much larger than the biggest index-linked gilt, there is still very little secondary-market trading taking place in the US instruments relative to the UK bonds.

Instrument design

There are three key areas where the design of the US bonds differs from that of UK IGs. The US bonds employ a shorter indexation lag (three months, as opposed to eight months for IGs), are strippable and employ an inflation 'floor' on the value of the inflation-adjusted principal (the final repayment will never be less than the price at which the bonds were originally issued). Each of these factors might, in principle, make the US bonds more attractive than IGs. But it seems unlikely that investors would believe that these US design features would currently be worth more than a small price premium relative to the UK bonds. Given the low, stable inflationary environments in both the United Kingdom and the United States, it is unlikely that the shorter US lag will provide the American instrument with significantly better inflation protection than the comparable UK bond. Also, the clause protecting the value of the principal of US bonds is unlikely to have much value. And given that no one has yet stripped the three US indexed bonds, it is unlikely that strippability attracts a significant premium.

Method for computing real rates

Comparisons of real rates are also affected by conventions in the computation of real rates. Because of lags in indexation, real yields are sensitive to the rate of inflation assumed in their calculation. The longer the lag and the shorter the residual maturity, the more impact this inflation assumption will have on the bond's computed yield. Table 2 shows the yields for two index-linked gilts with very different residual maturities under different inflation assumptions. While the UK real yields illustrated in the chart were based on a 3% inflation assumption (the current UK market convention), the figures for the United States are based on the US Treasury's settlement price formula, which ignores the indexation lag altogether. Because of the shortness of the US lag, the difference between 'true' real yields based on 3% inflation and those calculated using the Treasury formula will, however, be small.

Table 2
Computed real yields on index-linked gilts under different inflation assumptions (as at 30 June 1997)

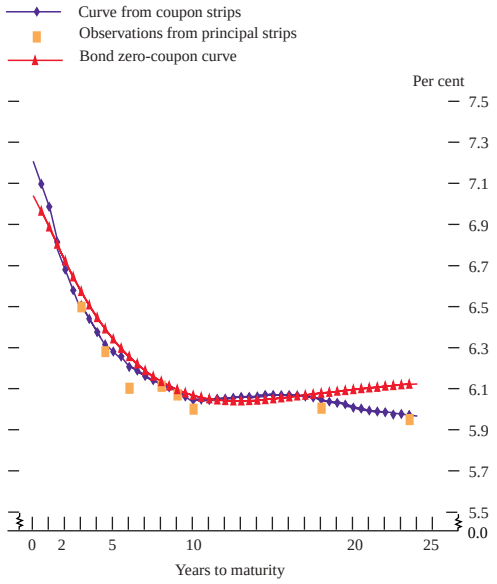
Per cent

Bond (per cent)	Real yield assuming 3% inflation	Real yield assuming 5% inflation
4 5/8% 1998	4.11	2.94
4 1/8% 2030	3.69	3.63

coupon-bearing gilts. The launch of gilt strips means that traded zero-coupon rates can be used as a measure of interest rate expectations. So far, because of the low levels of strip activity and trading, it would be misleading to read much into the interest rate expectations derived from strips prices. As the market develops, the information content should increase.

As zero-coupon instruments, strips bring only one payment. So their duration, the weighted average of their cash flows over time, is much longer than that of coupon-bearing gilts of the same maturity. Given this difference in duration, strips and bonds of the same maturity have different yields: strips' yields will usually be closer to the yields of much longer coupon-bearing gilts than to

Chart 20
UK nominal interest rate spot curves using strip and bond prices on 26 January 1998



those of coupon-bearing bonds of similar maturities. So when the bond yield curve is downward-sloping, strips' yields lie below those of coupon-bearing gilts of the same maturity. Similarly, when the bond yield curve is upward-sloping, the strip curve will lie above it. Currently, the bond yield curve is downward-sloping. So it is possible that the current shape of the yield curve has deterred some strip activity: at equivalent maturities, strip yields lie below bond yields, making strips appear expensive (see Chart 20).

The long duration that investors may obtain through strips can be attractive, depending on their interest rate view. If investors were bullish about the interest rate outlook, believing that rates were likely to fall sharply and bond prices to rise, then long-duration assets would be attractive: they would provide a larger capital gain for the same change in interest rates. So activity in strips may increase as more market participants look for leveraged ways of taking a bullish view on interest rates.

Other issues

HM Government Ecu issues

The United Kingdom continued to hold regular monthly tenders of ECU 1 billion of Ecu Treasury bills during the fourth quarter, comprising ECU 200 million of one-month, ECU 500 million of three-month and ECU 300 million of six-month bills each month. The tenders continued to be oversubscribed, with issues being covered by an average of 4.0 times the amount on offer in the fourth quarter of 1997, compared with the average cover of slightly under 3.0 times during 1996 and the first three quarters of 1997. During the fourth quarter, bids were accepted at average yields of 4–10 basis points below the Ecu Libid rate of the appropriate maturity. There are currently ECU 3.5 billion of UK Government Treasury bills outstanding. Secondary market turnover in the fourth quarter averaged ECU 1.2 billion a month, slightly lower than in the first three quarters of 1997.

On 21 October, at the regular quarterly auction under the UK Government's three-year Ecu note programme, the Bank reopened the Ecu Treasury note maturing in January 2000 with a further tender for ECU 500 million, raising the amount outstanding with the public of this note to ECU 2.0 billion. There was strong cover at the auction of 4.7 times the amount on offer and accepted bids were in a tight range of 5.01%–5.03%. The total of notes outstanding with the public under the UK note programme thus rose from ECU 5.5 billion to ECU 6.0 billion.

Sterling issues

Speculation that the United Kingdom might join EMU at an early stage, suggesting convergence between UK and European interest rates, boosted demand for sterling assets at the beginning of the quarter. Lower yields, an inverted yield curve, and narrowing eurosterling yield spreads over gilts, also encouraged a number of UK companies to lock into cheap long-term funding levels. But investor demand fell in late October, after the Chancellor's statement on EMU quelled speculation. With the turmoil in Asia adding to volatility in bond markets and leading to switches from lower to higher quality credits, spreads began to widen and issuance slowed markedly, resulting in a few planned issues being postponed or cancelled. Nevertheless, towards the end of the

quarter, with issuance and secondary market activity slowing to a trickle ahead of the Christmas holiday period, spreads began to narrow again.

Though the difficult trading conditions for much of the fourth quarter led to fewer issues, total issuance of fixed-rate bonds and floating-rate notes (FRNs) remained high, boosted by large, heavily pre-marketed securitised deals. These included Annington Finance, which raised a further £3.1 billion against rentals on ex-MOD residential properties; Rose II, which securitised a further £1.4 billion of National Westminster Bank corporate loans; Aire Valley Finance, which raised just over £1 billion secured against Mortgage Express mortgage receivables; and Canary Wharf, which raised over £500 million against rental incomes.

Fixed-rate issues in the quarter totalled £5.6 billion, taking total fixed-rate issuance for 1997 to a record £32 billion, compared with £22 billion in 1996 and the previous peak of £26 billion in 1993. Narrower swap spreads reduced arbitrage issuance from its levels earlier in the year and only £0.7 billion of sub-seven year bonds were issued. (Swap spreads allow borrowers to swap fixed-rate borrowing into floating-rate.) UK corporate issues were focused at ten years and were a large share of the £1.1 billion issued within the 7–15 year maturity band. Though there was some corporate funding at longer maturities, including a £300 million 25-year bond for Railtrack, nearly 80% of the £3.8 billion longer-dated issues were part of the securitised deals described above.

Securitisations also boosted floating-rate issuance, with five deals accounting for over 85% of the £4.2 billion issued in the quarter. The EIB's £500 million five-year note was the only other major FRN issue.

The international environment

This article discusses developments in the international environment since the November 1997 Quarterly Bulletin. *The financial and economic crisis in Asia has widened and deepened during 1997 and into 1998. There have been signs of contagion in other emerging markets. These developments are discussed separately in the note on page 26. The other main news*[1] *is:*

- *Growth in the United States remained strong in the third quarter of 1997, but the Japanese economy has continued to slow.*
- *The recoveries in Germany and France have strengthened. Activity in Germany remained dependent on net exports, while domestic demand strengthened in France.*
- *By December 1997, most major equity indices had recovered from the correction in October 1997. In Japan, equity prices fell steadily in the second half of 1997, but have strengthened in January 1998.*
- *Measured inflation remains low throughout the major six (M6)*[2] *overseas economies.*
- *A majority of EU countries are expected to have fiscal deficits of 3% of GDP or less for 1997.*
- *Official interest rates were stable in most industrial countries, but bond yields have fallen.*

GDP[3] *in the M6 overseas economies grew by 0.8% in the third quarter, up from 0.1% in the second quarter. Growth in the United States remains strong, but activity in Japan has slowed.*

Table A
Quarterly contributions to US GDP growth[a]

Percentage points

	1996	1997		
	Q4	Q1	Q2	Q3
Domestic demand	**0.6**	**1.5**	**1.0**	**1.1**
Private consumption	0.6	0.9	0.2	1.0
Investment	0.1	0.2	0.5	0.5
Government consumption	0.0	0.0	0.1	0.0
Stockbuilding	-0.1	0.4	0.2	-0.4
Net exports	**0.5**	**-0.3**	**-0.1**	**-0.4**
GDP	**1.1**	**1.2**	**0.8**	**0.8**

(a) Contributions may not sum because of rounding.

US GDP rose by 0.8% in the third quarter of 1997, to a level 3.9% higher than a year earlier. This followed growth of 1.2% and 0.8% in the first and second quarters respectively (see Table A). Growth in the third quarter was driven mainly by private consumption. As in the previous two quarters, net exports fell, reflecting the continued rise in the dollar effective exchange rate and the strength of US domestic demand relative to its major trading partners.

In Q4, nominal retail sales were 3.9% higher than a year earlier. This was slower than in Q3, but consumer confidence remains at historic highs. Consumption was also supported by strong growth in both nominal and real income. Industrial production remained strong, rising by an average annual growth rate of 5.8% in Q4.

The US labour market tightened in the fourth quarter; non-farm payrolls, the main measure of employment, rose by a monthly average of 358,000. For 1997 as a whole, payrolls grew at a monthly average of 267,000, up from 212,000 in the year before. The US unemployment rate fell to a historic low (see Chart 1), averaging 4.7% in Q4, its lowest quarterly average since 1970 Q1.

(1) Based on data up to 28 January 1998.
(2) The M6 comprises the G7 countries minus the United Kingdom, ie the United States, Japan, Germany, France, Italy and Canada.
(3) UK trade-weighted.

Chart 1
US labour market

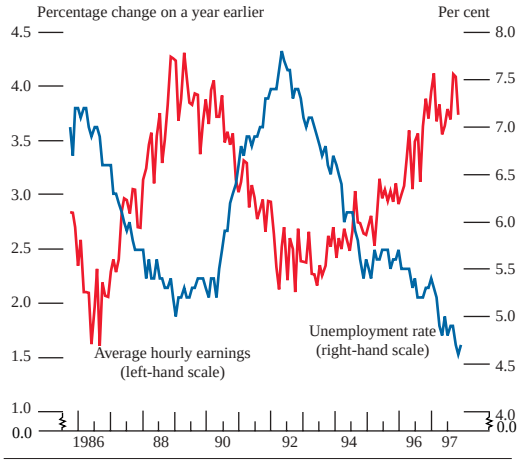


Table B
Quarterly contributions to Japanese GDP growth[a]

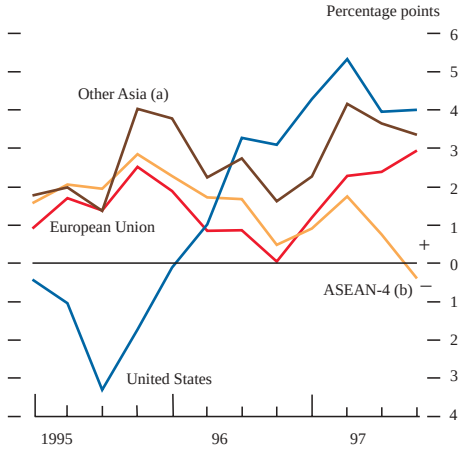
Percentage points

	1996	1997		
	Q4	Q1	Q2	Q3
Domestic demand	**0.7**	**1.9**	**-3.8**	**0.9**
Private consumption	0.6	2.3	-3.2	0.9
Investment	0.1	-0.4	-0.8	-0.1
Government consumption	0.1	0.1	-0.1	0.1
Stockbuilding	-0.1	0.0	0.3	0.0
Net exports	**0.4**	**0.1**	**1.0**	**-0.1**
GDP	**1.1**	**2.0**	**-2.8**	**0.8**

Source: Economic Planning Agency.

(a) Contributions may not sum because of rounding.

Chart 2
Japan: contributions to annual export growth[a]



(a) Nominal terms. Not seasonally adjusted.
(b) Other Asia includes: South Korea, People's Republic of China, Taiwan, Hong Kong and Singapore.
(c) The ASEAN-4 are: Thailand, Malaysia, the Philippines and Indonesia.

Wage pressures appear to be building; average hourly earnings rose by 4.3% annualised in the fourth quarter, up from 4% in Q3. The Employment Cost Index, a more comprehensive measure of labour costs, has also been accelerating. It rose by 1% in Q4, compared with 0.8% in the previous quarter.

By contrast with the United States, the Japanese economy has slowed. Preliminary data indicate that Japanese GDP rose by 0.8% in the third quarter of 1997, so that the level of output was barely higher than a year earlier. The main contributor to Q3 growth was private consumption (see Table B), suggesting some recovery from the effects of the April tax rise. The prospects for consumption in Q4, however, are subdued. Retail sales fell in the fourth quarter, car sales have been weak and activity in the housing sector has been lacklustre.

Net exports, which have been the main engine for growth in the current cycle, may be losing momentum—they fell in the third quarter. And data for the fourth quarter released so far show evidence of some adverse impact from the financial crisis elsewhere in Asia. Exports to Indonesia, the Philippines, Thailand and Malaysia (the ASEAN-4), which accounted for just over 10% of Japan's exports during 1997, fell by 6.9% in Q4 relative to Q3. By contrast, exports to the European Union (18% share) and the United States (28% share) rose by 16.9% and 7.6% in the same period, more than offsetting the deterioration with the ASEAN-4 (see Chart 2).

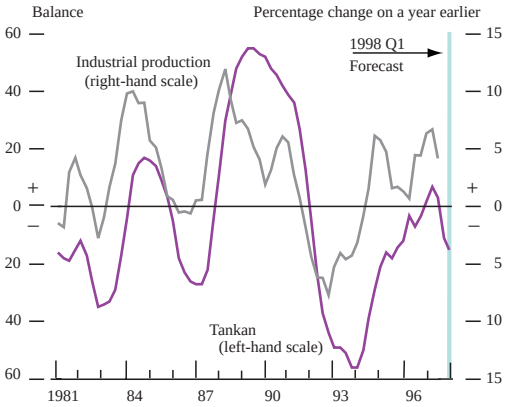
Industrial production weakened as manufacturers reduced unwanted inventories. Business sentiment also deteriorated, according to the Bank of Japan's Tankan Survey for the fourth quarter (see Chart 3). The business conditions diffusion index for major manufacturers, which had been +3 in September, fell to -11, its first negative value for a year. Confidence in other business sectors, which has been significantly weaker than in large-scale manufacturing, also deteriorated in the December quarter, as did the lending attitude of financial institutions.

The signs of increasing financial fragility, with the closure of Yamaichi Securities and Hokkaido Takushoku Bank in the fourth quarter, together with weakening economic prospects, led the authorities to loosen fiscal policy. A supplementary budget was announced, comprising tax cuts and a one-off income tax rebate, as well as a programme of public works. The total ¥5 trillion package (1% of GDP) partly reverses the consumption and income tax increases in April 1997. The Japanese government also announced measures to stabilise the financial system, involving a ¥30 trillion guarantee (equivalent to 6% of GDP) to the Deposit Insurance Corporation. The funds are to be used for recapitalising the banking sector and depositor protection.

Since the November *Quarterly Bulletin*, considerable attention has focused on the prospects for countries in East Asia, and the potential spillover of the financial crisis to other countries. The note on page 26 describes recent developments. The *Inflation Report* analyses their likely effect on the world economy and on the UK economy in particular.[1]

(1) Financial market developments are also analysed in the 'Markets and operations' article on pages 5–19.

Chart 3
Japan: Tankan Survey[a] and industrial production



(a) Major manufacturers' view of business conditions.

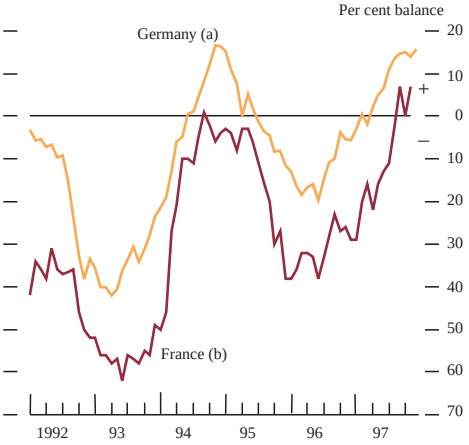
Table C
Quarterly contributions to German GDP growth[a]

Percentage points

	1996	1997		
	Q4	Q1	Q2	Q3
Domestic demand	**0.3**	**0.3**	**0.2**	**0.1**
Private consumption	-0.2	-0.1	0.7	-0.6
Investment	0.1	-0.5	0.1	0.1
Government consumption	-0.4	0.3	0.1	0.1
Stockbuilding	0.9	0.6	-0.6	0.5
Net exports	**-0.1**	**0.0**	**0.8**	**0.7**
GDP	**0.2**	**0.3**	**1.0**	**0.8**

(a) Contributions may not sum because of rounding.

Chart 4
Industrial confidence



(a) IFO: manufacturing climate.
(b) INSEE: industrialists' opinion on total demand.

Table D
Quarterly contributions to French GDP growth[a]

Percentage points

	1996	1997		
	Q4	Q1	Q2	Q3
Domestic demand	**0.1**	**-0.4**	**0.5**	**1.2**
Private consumption	-0.3	0.1	0.1	0.7
Investment	0.0	-0.3	0.1	0.3
Government consumption	0.1	0.1	0.1	0.1
Stockbuilding	0.3	-0.3	0.3	0.2
Net exports	**0.3**	**0.7**	**0.7**	**-0.3**
GDP	**0.3**	**0.3**	**1.1**	**0.9**

(a) Contributions may not sum because of rounding.

Growth in the large continental European economies moderated in the third quarter. The recovery in Germany continues to be export-dependent, whereas domestic demand in France has recently strengthened.

German GDP grew by 0.8% in the third quarter, to a level 2.3% higher than a year earlier. The strongest contribution came from net exports, as in the previous quarter (see Table C). Investment rose by 0.4%, reflecting a marked recovery in machinery and equipment expenditure, which outweighed the contraction of the construction sector. In Q4, business confidence in western Germany was little changed from its level in the previous quarter, though it remained stronger than a year previously (see Chart 4). Sentiment about the current economic situation reached its most positive since early 1992 in December. But expectations of business conditions deteriorated slightly during Q4, albeit from a high level, which may indicate concerns about the impact on net exports of the Asian slowdown.

Private consumption was weak in the third quarter, partly reflecting the high level of unemployment and its effect on disposable income. The unemployment rate in Germany overall reached 11.9% in December, up from 11.6% in August. Unemployment in western Germany remained broadly stable in the three months to December, but continued to increase quickly in eastern Germany. The unemployment rate is now almost twice as high in eastern Germany (19.8%) as in western Germany. But consumer confidence, though volatile from month to month, has been steadily increasing. Consumers' expenditure in 1998 is expected by the OECD and IMF to grow at close to its trend rate, which has been around 2.3% during the past decade (after adjusting for the effects of reunification).

The manufacturing sector continued its recent strength in the third quarter, spurred by extremely strong export orders. But industrial production data released so far for the fourth quarter suggest that the growth rate of manufacturing has slowed slightly.

In France, GDP grew by 0.9% in Q3, to a level 2.6% higher than a year earlier (see Table D). Growth in the third quarter was a little lower than in the previous quarter, which had been slightly inflated by a working-day effect. Whereas in previous quarters the main stimulus to demand had been net exports, growth in the third quarter was driven mainly by stronger private consumption. Net exports fell for the first time since 1996 Q2.

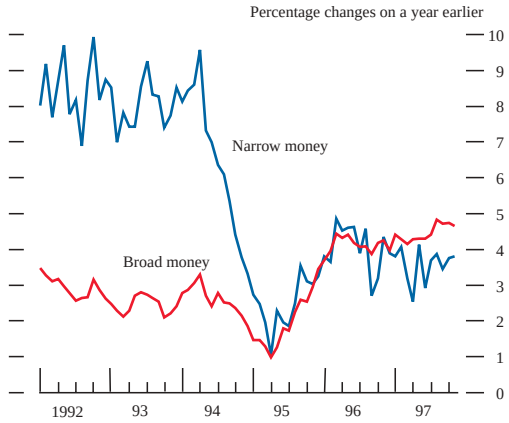
The prospects for consumption have improved, with strengthening consumer confidence and a pick-up in labour demand. Employment rose by 0.7% in the year to Q3, nudging the unemployment rate down to 12.4% in November, its lowest since August 1996. The number of vacancies has also begun to grow more rapidly. Investment has strengthened recently and, together with stronger consumption, offset the fall in net exports in the third quarter. The outlook for net exports in coming quarters has been dimmed by the impact of the Asian crisis, and by the prospects for import growth as consumption strengthens.

In Italy, the recovery appears to be strengthening gradually. Output rose by 0.4% in the third quarter of 1997, and by 2.1% on a year earlier. The quarterly pattern of output growth has been distorted

both by working-day effects, as in France, and by a car-purchase incentive scheme. GDP growth for 1997 as a whole is now widely expected slightly to exceed the Government's forecast of 1.2%, partly because of downward revisions to GDP in 1996. But this better-than-expected growth rate for 1997 is still substantially below trend. Unemployment remained high, at 11.7%, in the third quarter.

Elsewhere in Europe, growth has been strong in the Netherlands, Finland, Denmark and Ireland. Growth in 1997 strengthened in Spain and Portugal. The OECD estimates that output in the European Union rose by some $2^{1}/_{2}$% in 1997, compared with $1^{3}/_{4}$% in 1996.

Chart 5
Average narrow and broad money growth in the M6 economies



Narrow and broad money growth in the M6

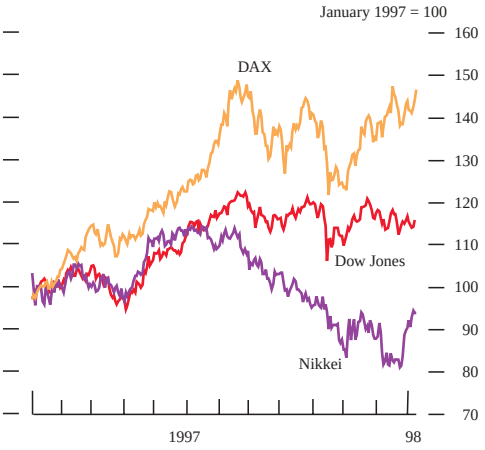
On a GDP-weighted basis, the average growth of narrow and broad money in the M6 economies rose slightly in the third quarter of 1997 (see Chart 5). The annual growth rate of narrow money in the M6 was 3.8% in November, up from 2.7% at the end of Q2. In real terms, narrow money grew by 1.4% in September. In November, annual narrow money growth rose in the United States and France, but fell sharply in Germany and Canada in Q3. In contrast, Canadian M1 continued to grow strongly. In Japan, the annual growth rate of M1 rose from 8% in Q3 to 8.7% in Q4. This may partly reflect a shift in individuals' preferences towards holding cash at a time of financial fragility.

Nominal broad money in the M6 economies has grown by more than 4% annually during the past two years, and by 4.5% in October. Real broad money growth in the M6 has been strong, rising by 2.3% in the year to September.

US M2 growth rose almost continuously in 1997, to an annual growth rate of 5.2% in December, above its monitoring range of 1%–5%. But broad money in Germany slowed throughout the year, and M3 growth has been within its target range of 3.5%–6.5% since June. M3 rose at an annualised rate of 4.7% in November (relative to its average level in 1996 Q4); October's rise in the repo rate appears to have brought monetary growth below the 5% midpoint of the Bundesbank's target range for the first time this year. The new target range for 1998 was lowered to 3%–6%, to take into account the existing large supply of liquidity in the economy.

The weakness of the Japanese economy was reflected in continued broad money growth rates of around 3% in Q3, which picked up to 3.8% in December, reflecting monetary operations by the Bank of Japan to improve liquidity. Italian broad money remained strong, at an annual growth rate of 9.4% in November. French annual broad money growth, which had been negative since July 1996, turned positive again, and was 1% in November.

Chart 6
Equity markets[(a)]



(a) In local currencies.

Most major equity markets were buoyant in 1997, quickly recovering from losses when prices fell in October last year. In Japan, equity prices fell steadily in the second half of 1997, but have recovered some of their losses in recent weeks.

Equity markets proved buoyant in 1997 in most industrialised countries, with the major exception of Japan (see Chart 6). Prices were more volatile in the second half of 1997 than in the first half,

Chart 7
US consumer and producer price inflation

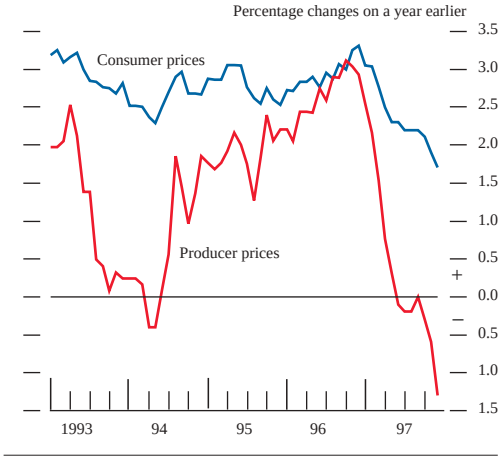


Chart 8
EU3 consumer price inflation

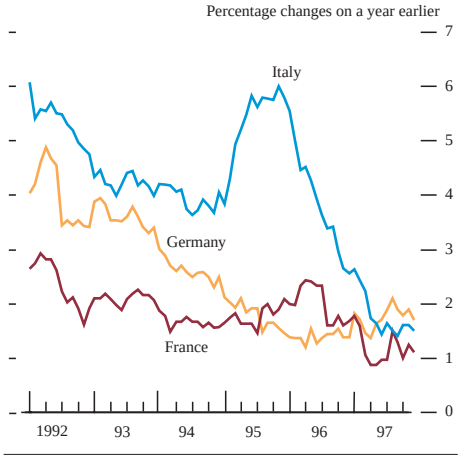


Table E
Harmonised index of consumer prices (HICP)

Percentage changes on a year earlier

	1997			
	Aug.	Sept.	Oct.	Nov.
Austria	1.3	1.1	1.1	1.1
Belgium	1.7	1.6	1.2	1.3
Denmark	2.0	1.9	1.6	1.4
Finland	1.6	1.6	1.6	1.7
France	1.6	1.5	1.1	1.4
Germany	1.7	1.6	1.4	1.4
Greece	5.6	4.9	4.8	5.0
Netherlands	2.5	2.6	2.4	2.6
Ireland	0.6	0.6	0.8	1.1
Italy	1.6	1.6	1.9	1.8
Luxembourg	1.4	1.7	1.7	1.5
Portugal	1.6	1.5	1.6	1.9
Spain	1.7	1.9	1.8	1.9
Sweden	2.1	2.6	2.7	2.7
United Kingdom	2.0	1.8	1.9	2.0

with sharp corrections in a number of markets. In the industrialised countries, the falls in October were quickly reversed, with most of the losses recouped by early December.

US equity prices were about 25% higher at the end of 1997 than a year earlier. In Japan, equity prices fell by around 25% between their most recent peak at the end of July 1997 and the end of December 1997. This reflects the considerable slowdown in activity, the expected negative impact of the Asian currency turmoil, and continuing concerns about the general health of the financial system. In January, Japanese equity prices have strengthened, rising by around 12% since the end of December. In Germany, the DAX rose by around 50% during 1997.

Inflationary pressures remain subdued in all major economies.

In the United States, the pick-up in wages growth has not fed through to either wholesale or retail prices. US producer prices fell by 0.2% in December to a level 1.2% lower than a year earlier, while consumer prices rose by 1.7% during the same period (see Chart 7). 'Core' measures of consumer and producer prices have also been subdued. Price pressures have been reduced not only by a stronger dollar, but also by weakening commodity prices in the second half of 1997.

After allowing for the impact of the consumption tax rise in April, Japanese inflation rates also remain low. Annual consumer price inflation has been around 2% since the tax rise, which largely reflects the one-off tax-induced change to the price level, the effect of which should drop out after a year. Wholesale prices have increased even less quickly, rising by 1.5% in November on a year earlier. Annual import price inflation fell from rates above 15% in the first few months of 1997 to around 5% in the third quarter.

Weak domestic demand has helped to moderate inflation in the EU3 (see Chart 8). In Germany, annual consumer price inflation was 1.8% in December, down from its recent peak of 2.1% in August. In France, annual consumer price inflation was 1.1% in December. In both countries, producer price inflation was similarly muted. In Italy, annual consumer price inflation was 1.5% in December. There appears to be considerable consumer resistance to price rises: inflation did not pick up substantially in response to the increase in VAT in October. If passed on fully, this would have added 0.7 percentage points to annual inflation for a year.

In the European Union, inflation rates based on harmonised indices of consumer prices converged during the year (see Table E). The range between the highest and narrowest rates was 3.9 percentage points in November, the lowest since 1996, when these data were first available for all countries. The unweighted average inflation rate (excluding Greece) was 1.7% in November.

A majority of EU countries are expected to have fiscal deficits of 3% of GDP or less for 1997.

The latest European Commission (EC), OECD and IMF forecasts indicate that a majority of the EU countries are expected to have fiscal budget deficits at or below 3% of GDP in 1997 (see Table F). In particular, the OECD forecasts, which are the most recent, indicate that only France and Greece will exceed that level—

Table F
Forecasts of 1997 fiscal deficits[a][b]

	EC [c]	IMF [c]	OECD [d]
Austria	-2.8	-2.5	-2.9
Belgium	-2.6	-2.8	-2.5
Denmark	1.3	0.5	0.5
Finland	-1.4	-1.9	-1.3
France	-3.1	-3.2	-3.1
Germany	-3.0	-3.1	-3.0
Greece	-4.2	-4.7	-5.0
Ireland	0.6	-0.8	-0.2
Italy	-3.0	-3.2	-3.0
Luxembourg	1.6	-0.1	n.a.
Netherlands	-2.1	-2.1	-2.0
Portugal	-2.7	-2.9	-2.9
Spain	-2.9	-3.0	-2.9
Sweden	-1.9	-2.1	-1.5
United Kingdom	-2.0	-2.0	-2.3

n.a. = not available.

(a) Percentage of GDP; negative indicates a deficit.
(b) General government (Maastricht definition).
(c) October 1997.
(d) December 1997.

France by just 0.1 percentage point. The EC forecasts tell a similar story. But the IMF forecasts suggest that four countries will have deficits that exceed 3% of GDP.

Most EU countries will have had public debt ratios in excess of 60% of GDP in 1997. According to IMF and OECD forecasts there will be only four exceptions—France, Luxembourg, Finland and the United Kingdom—but the EC forecast that Germany and Portugal will also have debt ratios of 60% or less in 1997. All three organisations expect the debt positions of most EU countries to improve in 1998. In particular, the OECD and EC forecast that the debt/GDP ratios of all EU countries except France will rise (the IMF also projects a rise in the German ratio); all three organisations expect debt/GDP ratios in Belgium, Greece and Italy to remain above 100% in 1998.

Official interest rates have remained stable in most industrialised economies.

US official interest rates were unchanged by the Federal Open Market Committee in Q4, as they have been since March 1997. The long end of the US yield curve has fallen progressively during the past five months, partly reflecting the growing perception that domestic inflationary pressures have subsided. Official short-term rates within the European Exchange Rate Mechanism countries have converged. Official rates were raised by 30 basis points in Germany in October, followed by increases in rates in Belgium, France and the Netherlands; official rates were cut in Italy, Spain and Portugal. Official interest rates were increased in Canada in November and December.[1]

(1) More details of interest rate changes are given in the 'Markets and operations' article on pages 5–19.

Developments in East Asia

Global economic developments in the second half of 1997 were dominated by the financial crisis in East Asia, initially concentrated in Thailand, Malaysia, Indonesia and the Philippines (the ASEAN-4). These countries were forced to abandon their exchange rate pegs to the US dollar and have seen substantial falls in their stock markets. The crisis affected a number of other emerging markets, and Korea was seriously affected towards the end of 1997.

Background

Although the precise economic situation differed among the ASEAN-4 countries, there were a number of broad similarities (see Table 1). All had experienced rapid, investment-dominated growth in recent years. Though this was accompanied by generally moderate inflation, there were increasing signs of overheating, particularly evident in widening current account deficits. There were also large foreign capital inflows, attracted by the higher returns available at a time when yields in industrial countries were falling. In 1996, net private capital inflows to the ASEAN-4 were between 6%–10% of GDP, exceeding the size of their current account deficits. Since exchange rates were not allowed to adjust, there was a build-up of foreign exchange reserves. These reserve increases were not fully sterilised, resulting in rapid increases in the money supply.

Table 1
Selected economic indicators

1996 levels as a percentage of GDP unless otherwise stated

	ASEAN-4				
	Indonesia	Malaysia	Philippines	Thailand	Korea
GDP growth (a)	7.9	9.0	4.9	7.9	8.2
Inflation (b)	8.6	3.5	8.5	5.6	5.2
Domestic saving	28.8	36.7	19.7	33.1	33.3
Fixed capital formation	28.1	42.2	23.2	40.8	36.8
General government balance	1.4	4.2	-0.4	1.6	0.0
Current account balance	-3.3	-4.9	-4.7	-7.9	-4.9
Net private capital inflows	6.3	9.6	9.8	9.3	4.9
External debt	53.4	43.9	67.8	53.2	29.3

Sources: IMF *World Economic Outlook* and Institute of International Finance.

(a) Average annual growth for 1993–96.

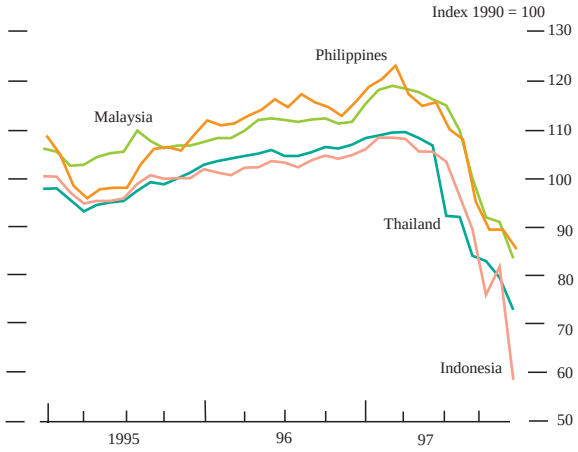
A problem facing all these countries was weak financial infrastructure. The limited experience of their financial institutions in the pricing of risk, combined with underdeveloped banking supervision systems, lax controls on lending criteria and political interference, all contributed towards imprudent lending. This left the banking systems vulnerable to adverse economic developments.

Private sector credit growth rose in the ASEAN-4 to rates in excess of 20% in 1995. In Malaysia, the credit growth was primarily domestic, fuelling a property price bubble, though there was also a large amount of net direct investment from overseas. Elsewhere, the capital inflows included large volumes of foreign currency borrowing by the corporate sector, both from domestic and foreign banks (particularly Japanese banks), encouraged by foreign interest rates that tended to be lower than domestic ones. These funds supported high levels of investment. In some countries, notably Thailand and to a lesser extent Indonesia, the investment was increasingly in real estate, where there were property price bubbles.

The foreign currency borrowings were predominately short term and typically unhedged, in the expectation that exchange rate pegs would be maintained. According to statistics from the Bank for International Settlements on foreign bank lending to these regions, the share of short-term loans outstanding by June 1997 was highest in Korea (68%), followed by Thailand (66%), Indonesia (59%) and Malaysia (56%).(1) This compares with a share of 52% in Latin America and 51% in Eastern Europe. The reliance on short-term, private sector capital left the Asian countries vulnerable to changes in investor sentiment.

A combination of factors led up to the crisis itself. The export performance of the ASEAN-4 weakened in 1995–96, as their trading partners' activity slowed, and excess supply in the electronics market led to sharp falls in revenue from electronics exports. These developments were exacerbated by a loss of competitiveness in the ASEAN-4 countries: their real effective exchange rates appreciated steadily during 1995–96 (see Chart A). This partly reflected higher rates of inflation relative to their trading partners. But it was also

Chart A
ASEAN-4: real effective exchange rates

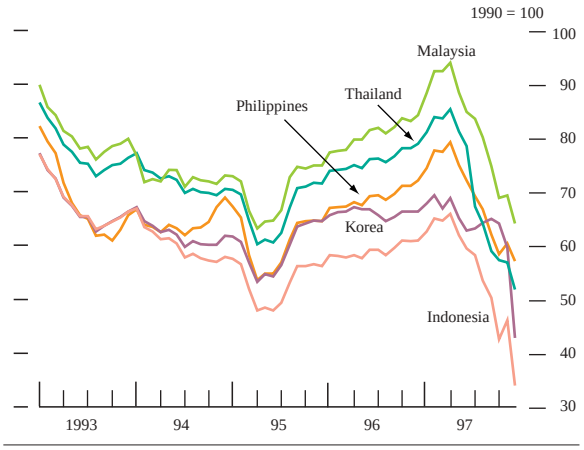


Source: J P Morgan.

(1) Short-term is defined as 'up to and including one year'. These data cover lending from banks in the G10 countries plus Austria, Denmark, Finland, Ireland, Luxembourg, Norway and Spain, and foreign affiliates of these banks. For precise definitions see *The maturity, sectoral and nationality distribution of international bank lending*, BIS, January 1998.

caused by the appreciation of the US dollar in this period, particularly against the yen, making the ASEAN-4 less competitive against Japan, their largest or second-largest trading partner (see Chart B).(1)

Chart B
Bilateral yen exchange rates



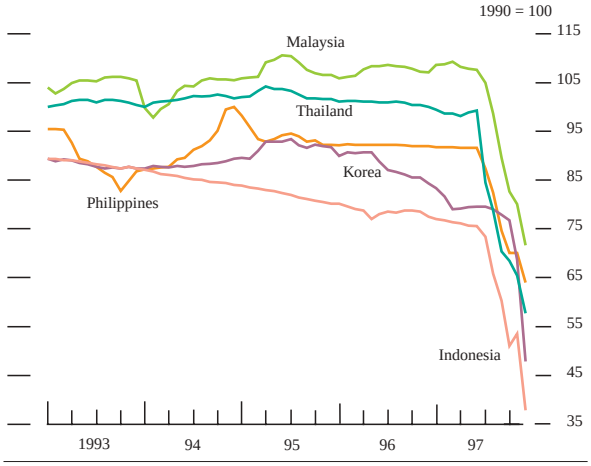
Domestic developments—most notably asset price falls and rising corporate bankruptcies—clearly warranted lower interest rates, but these were maintained at high levels to offset pressures on the exchange rate, as international investors were increasingly questioning the sustainability of the exchange rate pegs.

The ASEAN-4

There were periodic attacks on the Thai baht during 1996, which became more persistent and aggressive from May 1997. Having raised interest rates and intervened extensively on the foreign exchange market, the Thai authorities allowed the exchange rate to float on 2 July, in the face of large capital outflows. The Thai baht depreciated by about 20% against the US dollar in the first month, and by about 40% by the end of October (see Chart C). From July, the currency turbulence spread to the Philippines, Malaysia and Indonesia, as investors became concerned about the sustainability of their exchange rate arrangements. In the Philippines, the authorities abandoned the *de facto* peg of the peso to the US dollar on 11 July; the peso depreciated by 10% against the dollar in the first month of floating. The Malaysian ringgit also came under pressure, and the authorities allowed the currency to depreciate—by around 10% against the dollar between the end of July and the end of August. Pressures on the Indonesian rupiah caused the authorities to widen the intervention band to 12% on 11 July, having widened it on three occasions during 1996, but after further exchange rate pressures, the authorities decided to float the currency on 14 August.

China remained relatively unscathed by the crisis in the surrounding region. Chinese competitiveness improved after the unification of its official and swap exchange rates

Chart C
Bilateral US dollar exchange rates



in 1994, when the yuan depreciated.(2) Since then, China has had a current account surplus, which reached an estimated 2.5% of GDP in 1997; its reserves have risen to a level far higher than in any other emerging country in the region (around US$140 billion at the end of 1997), its external debt is lower than most other countries in the region (14.3% of GDP in 1996), and it maintains controls on international capital flows.

But other Asian currencies came under pressure, such as the Hong Kong dollar, which is pegged against the US dollar in a currency board arrangement. The Hong Kong authorities' commitment to maintain the current peg necessitated sharp increases in interest rates (three-month rates peaked at more than 40% on 23 October). The Singapore dollar and New Taiwan dollar also came under pressure in July. There were sharp falls in most equity markets in Asia (see Table 2 and Chart D).

Table 2
Currency and stock market movements in Asia

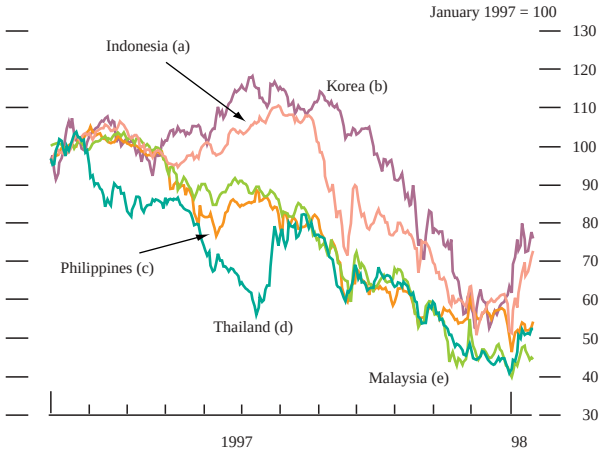
	Percentage change between start January 1997 and end October 1997		Percentage change between end October 1997 and end January 1998	
	Equity market (a)	Exchange rate (b)	Equity market (a)	Exchange rate (b)
Japan	-15	-4	+3	-4
Hong Kong	-19	0	-12	0
Korea	-28	-13	+10	-38
Singapore	-29	-11	-19	-8
Taiwan	+12	-11	+6	-9
Thailand	-44	-37	-3	-24
Malaysia	-46	-24	-14	-24
Philippines	-43	-25	-2	-16
Indonesia	-22	-35	-3	-71

(a) Major indices expressed in local currencies: Nikkei 225; Hang Seng; Korean composite; Straits Times Industrial; Taiwan Stock Exchange; Thai Set; Malaysian Kuala Lumpur composite; Philippines composite; Jakarta composite.
(b) Nominal rate against US dollar.

Two rescue packages were announced by the IMF: US$17 billion for Thailand on 11 August, and US$23 billion for Indonesia on 31 October. Both stipulated conditions for structural economic changes and financial reform. Having seemingly stabilised, the situation worsened, particularly in Korea.

(1) The dollar appreciated against the yen by 37% between April 1995 and June 1997.
(2) While the yuan depreciated by some 50% against the US dollar from the previous official rate, the effective depreciation was less than this, because a large proportion of transactions were conducted at the swap rate. For more details, see IMF *World Economic Outlook*, Interim Assessment, December 1997.

Chart D
Asian stock exchange indices



In local currencies:
(a) Jakarta composite.
(b) Korean composite.
(c) Philippines composite.
(d) Thai Set index.
(e) Malaysian Kuala Lumpur composite.

Korea

Until the end of October, Korea appeared to be avoiding contagion effects, partly because it already had a more flexible exchange rate. The won had depreciated against the US dollar by around 10% during 1996, insulating it to some extent from the loss of competitiveness against the yen experienced by the ASEAN-4 (see Chart C).

The economic problems in Korea were rather different in nature from those experienced in the other Asian countries, and were more closely linked with a loss of confidence in the banking system. In Korea, the banking sector is heavily dependent on the fortunes of *chaebol* (large conglomerates), which dominate the industrial structure. The *chaebol* tended to concentrate on market share rather than profitability, resulting in overinvestment in some sectors, notably steel and automobiles. Weaknesses in the domestic financial system exacerbated these problems, with lending decisions, especially to firms in financial difficulty, often politically influenced. These firms had become highly leveraged, borrowing increasing amounts of foreign currency, predominantly at short maturity. Because this debt was typically unhedged, it left the Korean economy vulnerable to shifts in international investor sentiment.

It should be recognised, however, that all banking systems are vulnerable to changes in sentiment. This is why governments have tended to support banks with liquidity problems, reinforcing the view that lending to banks carries low risks. At the international level, this 'moral hazard' has increased the size of capital flows, reduced the monitoring of the profitability of the borrowers by lenders, and encouraged speculative investment by borrowers. If further crises are to be avoided in future, ways must be found to reduce the extent of moral hazard in international capital flows.

A record number of bankruptcies during 1997 among the *chaebol* severely weakened the financial sector.(1) Initially, the extent of the difficulties was not clear because of a lack of reliable data. The trigger for the crisis occurred when several commercial banks admitted having difficulties in meeting their short-term debt obligations. The stock market fell by 17% in the last week of October, and by a further 19% by 3 December. The won also came under pressure, falling against the US dollar by an average of 1% a day between the end of October and the start of December.

An IMF-supported rescue package of US$57 billion was announced on 3 December, initially meeting with a positive market reaction. In the first couple of days after the announcement, the Korean stock market rose by 15% and the won appreciated by around 5%. But the improvement in sentiment was short-lived. During the following week, concerns increased about Korea's ability to repay its short-term debt, amid doubts about the government's commitment to structural reform, concerns about the impact of higher interest rates on the corporate sector, and increasing evidence that the problems were more serious than previously thought.(2)

Since then, the Korean authorities have received part of the rescue funding ahead of schedule, and they have accelerated and reaffirmed their commitment to the IMF reforms. Various steps have been undertaken to help instil confidence, including suspending 19 insolvent merchant banks, taking measures to liberalise the capital account, raising the ceiling on interest rates and removing the exchange rate band.

Spillovers to emerging markets

There were spillovers to currency and equity markets in a number of emerging markets throughout 1997. At about the same time as the attacks on the Thai baht, the Czech Republic was becoming vulnerable because of its widening current account deficit. The authorities abandoned their target band for the koruna in late May 1997, after trying to defend the currency with higher interest rates and intervention in foreign exchange markets. The Slovak koruna came under similar pressure at this time.

Most of the pressures on exchange rates in emerging markets occurred in late October. In Brazil, pressure on the real prompted the authorities to double interest rates and tighten fiscal policy. The Argentinian and Mexican pesos also came under pressure, as did the currencies in Greece, Russia and the Ukraine. Interest rates were increased sharply in these countries.

There were falls in a number of equity markets. In Brazil, the Bovespa Stock index fell by around 40% between the last week in October and mid November; though the index was still more than 40% higher in domestic currency terms (around 30% in US dollar terms) at the end of 1997 than at the start of the year. There were also corrections in Russia and Hungary.

(1) By 6 December, seven of the top 30 *chaebol* had failed. More than 15,000 companies filed for bankruptcy in 1997.
(2) Money-market interest rates were increased from 15%–19% at the beginning of December to 25% on 13 December.

The outlook

Assessing the impact of the Asian crisis on world growth is made more difficult by the rapidly changing economic and financial situations of many of these countries. It is also unclear how far the effects may be mitigated by policy adjustments in other countries. Between October and December 1997, the IMF revised down its forecasts for world growth in 1998 from 4.3% to 3.5%.(1) This compares with world growth of around 4% in 1996 and 1997, but is considerably stronger than the global slowdown in 1990–93, when world output was rising at an annual rate of around 1¾%–2¾%.

Growth projections by the IMF have been revised down for all regions, but mainly for Asia. Forecasts of growth in 1998 in the newly industrialised Asian economies (Korea, Taiwan, Hong Kong and Singapore) have been reduced most—from 6% to 3½%—with the largest adjustment for Korea. The 1998 forecast for Japan has also been revised down, from around 2% to 1%. Revisions to forecasts elsewhere—notably for the United States and European Union—are fairly minor, reflecting smaller shares of trade with Asia and the recent stronger-than-expected growth in these countries. Though considerable uncertainty surrounds these estimates, the risks are predominantly on the downside, especially given that the crisis has deepened since December.

The OECD also revised its forecasts, but these were concluded in November 1997, before the more recent deterioration in Korea and worsening prospects in Japan. Moreover, they forecast OECD, rather than world, growth, and so do not include the ASEAN-4 countries. They expect GDP growth for the OECD region to be 2.9% in 1998. This is higher than their forecast in June of 2.7%, and principally reflects faster growth expected in the United States. Given the events in Korea and Japan that have occurred since the publication of these forecasts, growth in the OECD region in 1998 is likely to be lower than their initial estimate.

(1) The new forecasts, included in the IMF *op cit*, were based on developments up to mid December 1997. The OECD's new forecasts in the *Economic Outlook*, December 1997, were based on information available up to 10 November 1997.

The *Inflation Report* projections: understanding the fan chart

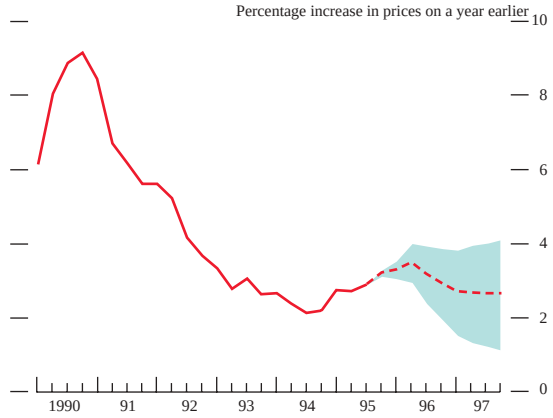
By Erik Britton, Paul Fisher and John Whitley of the Bank's Conjunctural Assessment and Projections Division.

Since February 1996, the Bank's inflation forecast has been published in the form of a probability distribution—presented in what is now known as 'the fan chart'. This article discusses the motivation for the change, describes how the chart is produced and explains how it reflects the forecast process.

Introduction

The introduction of an inflation-targeting regime for UK monetary policy in 1992 has placed more emphasis on taking a forward view of inflationary pressure.(1) That forward view is inevitably best described by producing and presenting an explicit forecast for inflation. Between February 1993 (when the *Inflation Report* was first published) and February 1996, the Bank of England published a two years ahead forecast for the inflation rate in the form of a chart (see Chart 1) showing a path for the central projection of inflation. That chart also gave a measure of the range of uncertainty, as indicated by a blue shaded area around the central projection. The range of uncertainty was based on forecast errors from the previous ten years. The edges of this shaded area were derived by adding to (and subtracting from) the central projection the average absolute value of past forecast errors. Normally, one would have expected the outturn for inflation to lie within the blue area just over half of the time.

Chart 1
November 1995 RPIX inflation projection, showing symmetric error bands(a)



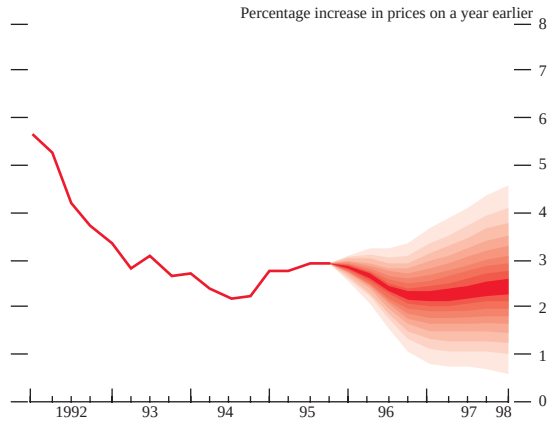
(a) The range of the error bands is defined as the central projection plus or minus the average absolute error on RPIX inflation projections since 1985.

That chart was not completely satisfactory. It gave no weight to the discussion of risks to the forecast (or alternative scenarios) and encouraged the reader to concentrate on an apparently precise central projection, ignoring the very wide degree of uncertainty surrounding it. Hence, small changes in the projection were given too much prominence relative to the risk assessment. Internal discussions at the Bank have typically spent at least as much time discussing the ways in which the central projection might be wrong as in fine-tuning that central case. In addition, the shaded area itself was often misread as indicating upper and lower bounds for the forecast, rather than the representation of probabilities that it actually showed.

Since February 1996, the Bank's inflation forecast has been published explicitly in the form of a probability distribution—presented in what is now known as 'the fan chart'. The aim of the fan chart has been to convey to the reader a more accurate representation of the Bank's subjective assessment of medium-term inflationary pressures, without suggesting a degree of precision that would be spurious.

Chart 2 shows the first fan chart, published in February 1996. The rest of this article explains the derivation of the chart, how it should be read, and the forecast process that underlies it. The article also discusses the new chart for GDP growth introduced in the November 1997 *Report*.

Chart 2
RPIX inflation projection in February 1996



Sources: CSO and Bank of England.

(1) See the Governor's 1996 speech at Loughborough University, reprinted in the *Quarterly Bulletin*, February 1997, pages 98–103.

Judgment has always been key to the forecast process in the Bank. But whose judgment and whose forecast? A distinctive feature of the *Report* process prior to May 1997 was the involvement of the Governors and Directors of the Bank in agreeing key assumptions and risks, on the basis of advice from Bank staff.(1) With the advent of the Monetary Policy Committee (MPC), the *Report* and the forecast represent the views of the MPC members, again aided by advice from Bank staff. Since the MPC has adopted and adapted the forecast process, this article describes that process as the MPC's, without prejudice to further changes that the MPC might wish to make in future.

The MPC builds up its assessment of risks by discussing in detail the major economic issues affecting the forecast. The multiple models approach to forecasting(2) allows the Bank to develop and use the appropriate models for each issue. This eclectic approach means that a wide variety of views can be explored and no school of thought is automatically excluded.

The forecast process

The February 1998 *Report* is the third complete forecast round undertaken by the MPC. The process will inevitably develop further over time. This brief snapshot describes how the forecasts have been prepared to date.

There is a series of meetings between the MPC and the Bank staff. At the first meeting, roughly a month before *Report* publication, the key assumptions, the main issues and the starting-point for the risk assessment are discussed. At this stage, no forecast is presented. Following this meeting, the forecast team map the decisions of the MPC onto a central projection and risk distribution. A second meeting with the MPC considers this draft forecast. The quantification of the mapping from each assumption and risk assessment is reviewed, new data are incorporated and changes are requested. A third meeting gives the MPC an opportunity to fine-tune the revised forecast distribution and bring it up to date. The final forecast, published in the *Report*, includes adjustment in response to the advent of market-related data in the period up to the relevant monthly MPC meeting, and reflects any change in interest rates made by the Committee in that meeting.

It is important to note that the Bank's published forecasts have assumed unchanged UK short-term interest rates during the forecast period, and that the fan chart does not reflect any uncertainty about UK interest rates. The MPC's forecast distribution is not easily comparable with forecasts that allow interest rates to vary, such as those surveyed in the *Report*.

The forecast distribution

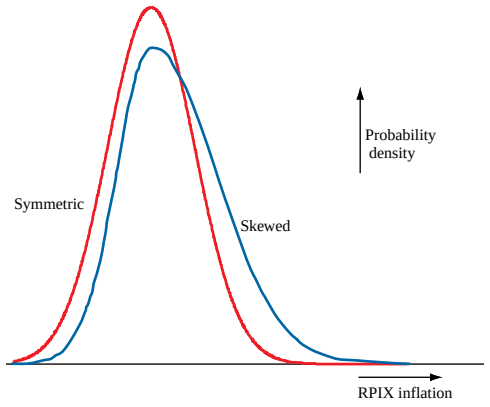
The fan chart portrays a probability distribution that approximates to the MPC's subjective assessment of inflationary pressures evolving through time, based on a central view and the risks surrounding it. Whatever the mix of judgment and statistics used in this assessment, the process needs to be as rigorous as possible: the MPC needs to be able to explain exactly why the chart looks as it does and why it changes between *Reports*. This is vitally important both for the consistency of policy-making and for the presentation of the analysis.

For any particular forecast, one can think of the projection as being based on a model that maps choices about economic assumptions onto an inflation forecast. To generate the probability distribution, one would ideally like to evaluate all the possible alternative assumptions numerically using this model. In practice, this process is approximated by assuming a known functional form for the distribution and evaluating a limited number of alternative assumptions. These alternatives are sufficient to calibrate the key parameters of the distribution.

The choice of distribution

One might perceive the possible outcomes for inflation as being roughly symmetrically dispersed around a central, most probable value, with the values closer to the centre being more likely than those further away. That would suggest that the forecast distribution should be based on the normal 'bell-shaped' distribution widely used in statistical analysis. But the assessment of likely alternative outcomes sometimes suggests that forecast error is more likely to be in one direction than the other. This has led to the choice of a particular form of statistical distribution (a 'two-piece' normal) which has a degree of asymmetry in the form of a variable skew. The chosen form of distribution is given in full in the Appendix. A graphical representation of the distribution for a single point in time is shown in Chart 3 for both a symmetric (when it is equivalent to a normal distribution) and a skewed case. The distribution allows for the possibility of negative inflation rates.

Chart 3
RPIX inflation symmetric and skewed probability distributions



(1) See the Governor's 1996 speech to Loughborough University, reprinted in the February 1997 *Quarterly Bulletin*, especially page 101, and the article 'Economic models and policy-making' by John Whitley in the May 1997 *Quarterly Bulletin*, pages 163–73.
(2) Outlined in the article by John Whitley in the May 1997 *Quarterly Bulletin*, *op cit.*

Choosing a particular form for the distribution does not rule out the possibility of changing that choice between *Reports*. For example, suppose that two quite distinct scenarios, which are nearly equally likely, are considered. A bi-modal distribution could then be chosen so as to show two 'humps' instead of the usual one.

To derive the MPC's forecast distribution, three parameters need to be evaluated. First, a measure of the central tendency for inflation—usually expressed as a particular projected path. Second, a view on the degree of uncertainty (the variance). Third, a view on the balance of the risks, to get a measure of the skew. We discuss these three aspects of the forecast in turn.

The central view

No single projection of inflation at a future date has much chance of matching the subsequent outcome. Policy discussions need to take account of the full range of possibilities. The Bank's preference has been to start with a set of key assumptions consistent with the most likely view of developments in the economy. The central projection of inflation is then interpreted as being the 'mode' of the statistical distribution—it is the single most likely outcome based on current knowledge and judgment, even if the actual chance of it matching the eventual outcome is small. This central projection is based on a consistent set of assumptions about economic behaviour that provides the foundations for subsequent assessment of how the economy is evolving relative to the forecast.

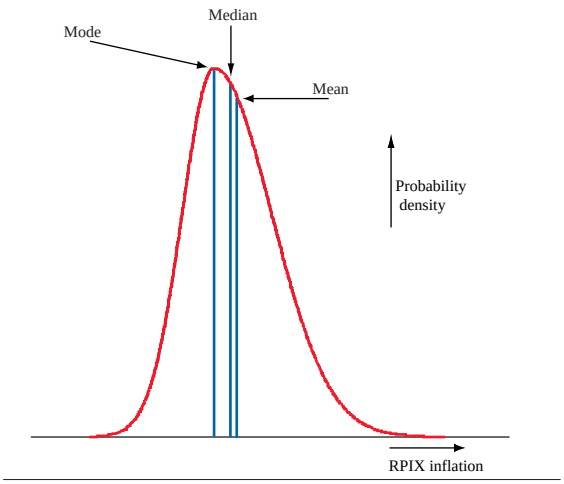
If the risks are symmetrically distributed around the central view, this will also provide a view of the average outcome (or mean forecast). But when the risks are unbalanced, the average of all the alternatives is unlikely to be the same as the single most likely case, and the mean forecast will differ from the mode. We return to this with an example when discussing the balance of risks (the skew of the distribution).

Neither the most likely nor the average view will necessarily split the forecast distribution in half. The point in the distribution that has 50% probability on either side is known as the median. The relationship between the mode, median and mean is important in interpreting the fan chart. Chart 4 shows how the three measures relate to each other when the distribution is skewed. When the balance of risks is on the upside, the mean inflation forecast will be higher than the median, which will be higher than the mode.

The degree of uncertainty

The uncertainty in the subjective assessment of inflation relates to how likely it is that the future events will differ from the central view. It is therefore a forward-looking view of the risks to the forecast, not a mechanical extrapolation of past uncertainty. Nevertheless, the initial calibration of uncertainty is based on the experience of

Chart 4
Central tendencies of a skewed distribution



forecast errors from the previous ten years (as in the shaded area shown in Chart 1). So the fan chart approach then requires the MPC to form a view as to whether or not uncertainty looking forward is greater or less than in the past.

The degree of uncertainty (the degree of dispersion in the distribution) can be measured by a variety of statistics such as variance, mean absolute error or inter-quartile range. The Bank uses a variance measure.

It is always tempting when forecasting to assume that the current degree of uncertainty is greater than usual. Knowledge of the current state of the economy is strictly limited, unusual shocks are always occurring, and statistical models based on the past are always likely to break down in the face of new developments. In practice, it has been shown that, though forecasting is indeed notoriously uncertain in an absolute sense, the track record of forecasts is rather better than one would suppose from simply evaluating the uncertainty inherent in statistical models.(1) And since 1994, inflation has been much less volatile than previously, helping to improve forecast accuracy. When evaluating the risks, the MPC may decide to vary the degree of forecast uncertainty to reflect the prospective or recent variability of economic developments.

The balance of risks

In deciding upon central assumptions and risks across key components of the forecast, it may become clear that the risks are unbalanced. A good example of this is the effect of 'windfall' gains to consumers from the conversion of several building societies to banks in 1997.(2) Uncertainty about the pace at which the windfalls would be spent represented a risk to the forecast of consumer spending. The Bank's theoretical analysis suggested that only a small proportion of these gains would be spent in the first year, and correspondingly took this as a central view. In the Bank's judgment, the risks were much greater that actual

(1) Not just the Bank's own—see Wallis, K F and Whitley, J D, 1991, 'Sources of Error in Forecasts and Expectations: UK Economic Models 1984–88', *Journal of Forecasting* 10, pages 231–53.
(2) See the *Inflation Report*, February 1997, page 22.

expenditure would be in excess of the central forecast assumption than that it would be less. This was an upside risk to the forecast during most of 1997.

In order to produce the fan chart, only one number is needed to summarise the degree of skewness (the balance of risks). Just as with the central view and the degree of uncertainty, there is more than one possible choice of parameter. The Bank's analysis focuses on the difference between the mean and the mode of the forecast distribution to be presented in the *Report*. This difference is of interest as a summary statistic of the balance of risks, and it provides a practical way of calibrating the distribution.

The Bank has concentrated on systematically building up a forecast distribution of inflation in a manner that reflects its subjective judgment, and now that of the MPC. What matters is that the MPC should be content with both the fan chart and the recorded mapping from its discussions of the issues. Because the current procedure is an approximation, evaluating a limited number of alternative scenarios, a certain amount of iteration in the discussions between the MPC and the forecasting team is needed until the fan chart is agreed.

The mapping

To evaluate the complete forecast distribution, one would ideally want to assess a potentially unlimited number of shocks that might affect the inflation forecast. But to keep the process tractable, one has to focus on the major issues of the day, while ensuring a comprehensive review of the economic situation as a whole. The first MPC meeting confirms the selection of major issues and provides the economic analysis to form the basis of the forecast. For each observed shock, the MPC forms a central view of its size and consequences, and considers how that view might be wrong. The degree of uncertainty and the balance of risks for each shock are then calibrated. In most cases this is done by examining various alternative models to assess what the consequences might be if the central view is mistaken. Eventually, a judgment has to be made about whether the risks are skewed and by how much, and whether the uncertainty about the relevant relationships is more or less than in the past.

The central projection represents a mapping of the central assumptions onto an inflation projection, using an economic model. In order to understand the issues of particular relevance in any one forecast round, the MPC considers several different ways of looking at the economy before selecting the set of relationships—or model—that represent its view for that forecast round. Hence, the econometric model used to ensure consistency of variables in the forecast is not set in stone, but changes from one forecast to the next.

The variance of inflation can be derived from the underlying variances of the basic shocks, using the mapping provided by the economic model. To make this tractable, simulations are used to identify the contribution of the relevant basic variances to the variance of the inflation forecast. For independent shocks, the inflation forecast variance could be obtained by a weighted sum of the individual variances.(1) But rather than add up all the variances, the past inflation forecast error variance is taken as a starting point and then adjusted upwards or downwards, based on changes to a limited number of variance assumptions.(2) By adjusting the basic variances, the forecast variance of inflation is thus changed to match the degree of uncertainty as viewed by the MPC.

Wherever discussions suggest that there might be an unbalanced risk, a plausible alternative assumption is made for the relevant parameter or shock in the direction of the identified skew, and a model (or models) is simulated to show how the forecast for inflation at different horizons would change under that assumption, allowing for all relevant feedbacks. The MPC attaches a probability weight to that alternative, which scales up or down the effect of the alternative assumption on the inflation forecast distribution. The MPC must make a judgment about that probability weight, which they can do by reference to the underlying analysis, or by reviewing the impact on the inflation forecast. Attaching probability weights in this way approximates the task of simulating all possible forecast variants with a limited number.

Once the individual risks are evaluated, they must be aggregated to give an overall balance of risks. In practice, this means adding together the individual simulations of the alternative assumptions, each weighted by their probability. This gives an overall balance of risks, expressed in terms of an effect on the inflation forecast.

The balance of risks is interpreted as giving the difference between the mean and the mode of the forecast. Why is that? If we take a probability-weighted average across a range of alternative forecasts, then we have implicitly estimated the mean of the forecast distribution.(3) Hence, the balance of risks estimated in this way is used to calibrate the forecast distribution.

The MPC judges not only the individual components of the forecast, but whether the final result for the inflation distribution is felt to be consistent with its analysis of the issues. If not, then the forecast team will be asked to change the nature of the assumptions or the probability of alternative assumptions, or to reassess the simulation responses of the models used. In this way, the fan chart is made consistent with the MPC's judgments—both 'bottom up' and 'top down'.

(1) The risks are identified as independent shocks that have zero covariance, though this assumption can be relaxed if necessary.
(2) Technically, the assumptions about the degree of uncertainty and its skew, as expressed by the difference between the mode and mean, may not be independent. In practice, it is possible to alter the distribution so as to preserve one while adjusting the other, if that is appropriate.
(3) This can be thought of as a partial numerical integration of the distribution.

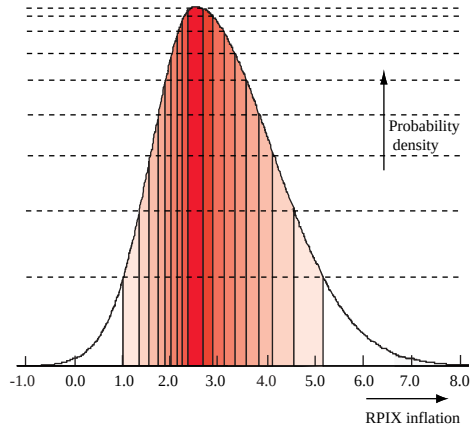
Drawing the fan chart

The distribution to be plotted is generated by an iterative procedure, given the central projection as a mode, the variance and balance of risks. The chosen distribution is adjusted until the required variance and the required difference between mean and mode are obtained, and appropriately adjusted to ensure that the probability area is equal to one, as required by a probability distribution. The skew and variances are evaluated for one year ahead and two years ahead projections and then interpolated for the quarterly fan chart. This gives the distribution to plot.

Having obtained the forecast distribution for inflation at each point in a nine quarter ahead forecast, its graphical representation remains a matter of choice. The fan chart was chosen to meet the criterion that it should give information on the whole of the forecast distribution, without claiming a spuriously high degree of precision.

The fan chart itself is best understood by looking at Charts 5 and 6. A vertical section of the chart at any time period (for example as shown by the thick black line in Chart 6) corresponds to a bird's-eye view of the underlying probability density function (pdf) for that period. This pdf is shown conventionally in Chart 5. The height of the pdf is proportional to the probability of inflation being a particular value in that time period. Hence, the central projection corresponds to the peak of the distribution, as it is associated with the mode.

Chart 5
Cross-sectional probability distribution of RPIX inflation with 10% confidence bands(a)

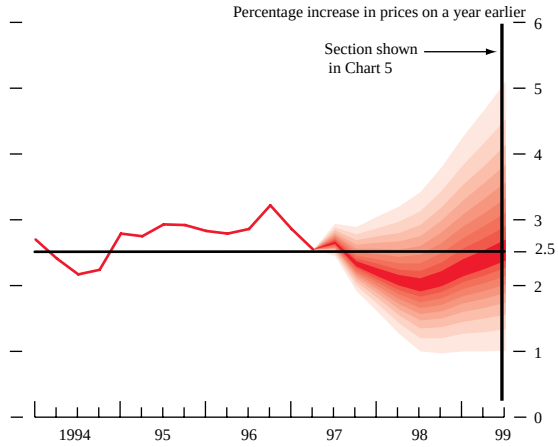


The dashed lines show how the edges of the bands are drawn—see text.

(a) Taken from the August 1997 *Inflation Report* fan chart.

The style of the chart is to make the shade of red reflect the relative probability of inflation lying in a particular band. To draw the bands, the following rule is used.(1) Two points of equal probability density are shown, one on either side of the mode. The two points are then moved away from the centre simultaneously, keeping the values of the probability density the same, until there is 10% of the distribution in a single central band, with these two points marking the outside edges. That band is coloured the deepest shade of red. The two points are moved outwards again on either side of the first band (still keeping equal probability density) until another 10% of the distribution has been added, this time marking a pair of bands, one on either side of the centre. These two bands are shaded the same colour as each other, but are lighter than the central band. Pairs of bands continue to be added until 90% of the distribution is covered.

Chart 6
RPIX inflation projection in August 1997



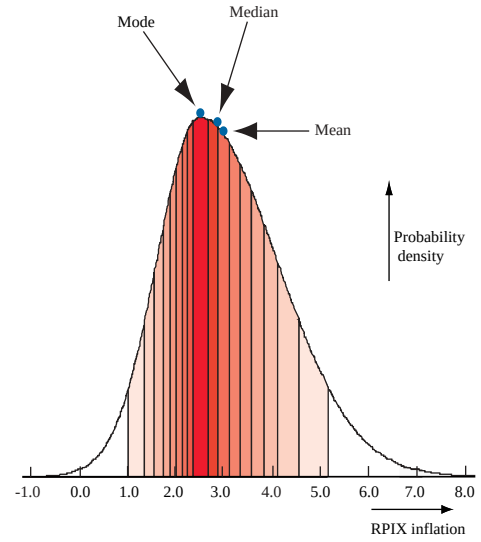
The chart shows the relative likelihood of possible outcomes. The central band, coloured deep red, includes the central projection: there is judged to be a 10% chance that inflation will be within that central band at any date. The next deepest shade, on both sides of the central band, takes the distribution out to 20%; and so on, in steps of 10 percentage points. Of course, it is impossible to assess the probabilities with any precision, but this represents the MPC's best estimate. The more uncertainty there is about the inflation outcome at any particular time horizon, the wider the bands, and the more gradually the colour fades. And if the risks are more on one side than the other, then the remaining bands will be wider on that side of the central band.

The fan chart always has the following features. There is an equal number of red bands on either side of the central band (eight). Each pair of bands covers 10% of the distribution but, if the risks are unbalanced, the same colour bands are not of equal width (representing unequal probability intervals). The distribution is truncated, so that there is an implicit ninth and final pair of bands, occupying the white space outside the 90% covered. The central projection is, by construction, always in the deepest red band since it is associated with the mode. For heavily unbalanced risks, the mean and median may not be in the deepest red band, as shown in Chart 7.

At any particular date in the forecast period, the shading gets lighter as the probability of inflation lying in bands further away from the central projection diminishes. But as uncertainty increases with the forecast horizon (compare the example distributions for years one and two in Chart 8), we could also vary the shading over time. This is done explicitly in Chart 9 with a three-dimensional chart, which includes the probability on a vertical axis. The shading of this chart emphasises that there is much less certainty about the outcome two years ahead than about the outcome one quarter ahead. In the two-dimensional chart, this increased uncertainty is shown by the widening of the bands.

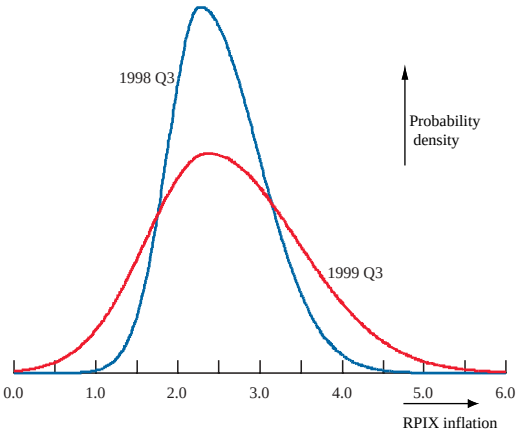
(1) The rule might need to change if the distribution changed shape (eg if it were bi-modal).

Chart 7
Central tendencies of the forecast probability distributions(a)



(a) Taken from the August 1997 *Inflation Report* fan chart.

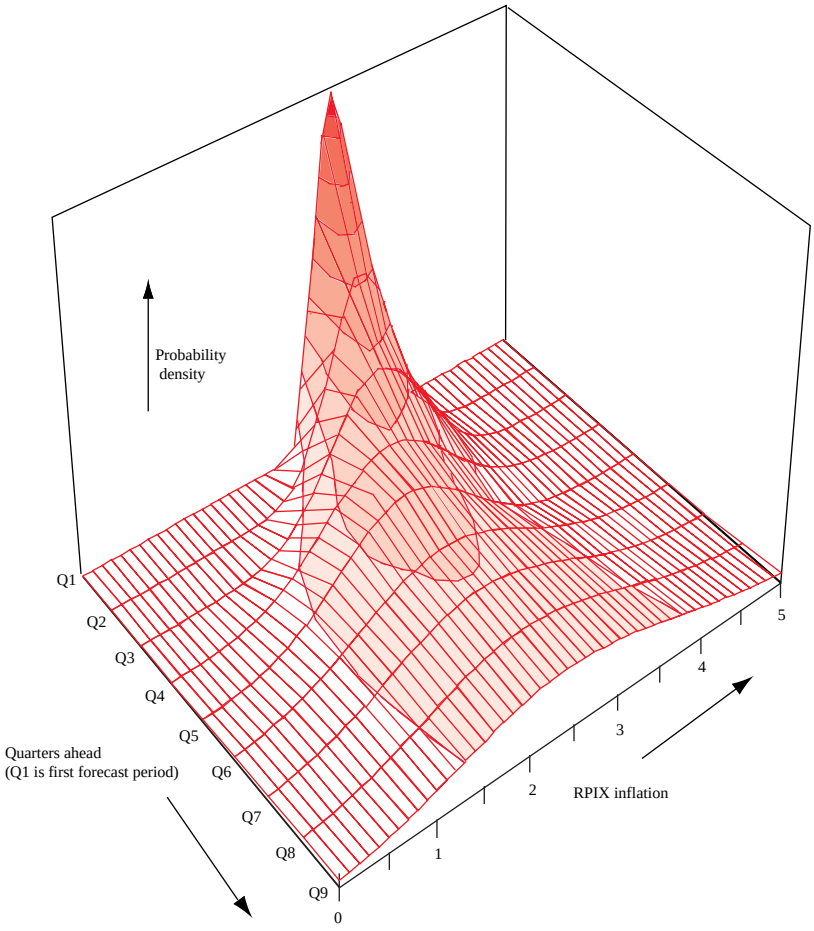
Chart 8
Cross section of the fan chart (August 1997)—one and two year ahead forecast distributions(a)



(a) Illustrating increasing uncertainty as projection horizon becomes more distant.

There are some common misconceptions about the chart. First, as explained above, the 'fan' does not cover 100% of the probability. Second, the central projection (the mode) is not necessarily the centre of the deepest red band—although it is always within it and is usually close to the centre. Third, though the fan chart could be used to represent a forecast distribution generated by purely statistical methods such as stochastic simulation of a model,(1) the Bank's approach is to represent a subjective distribution for its inflation projection based on economic analysis and the judgment of the MPC.

Chart 9
Three-dimensional plot of RPIX inflation forecast distributions(a)



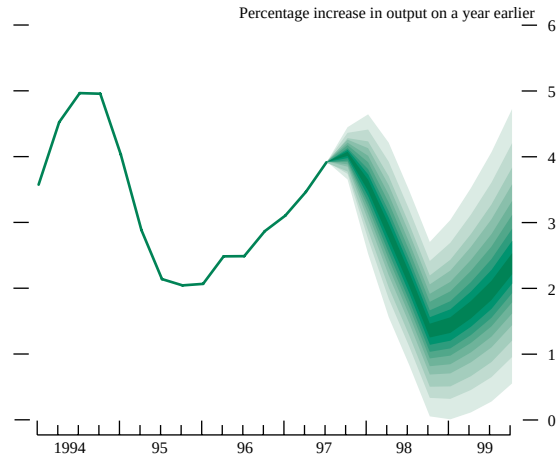
(a) Based on the August 1997 *Inflation Report* fan chart.

(1) See Blake, 'Forecast Error Bands by Stochastic Simulation', *National Institute Economic Review*, May 1986, pages 72–9.

The GDP fan chart

In principle, the process used above could be used to derive a fan chart for any forecast variable, as long as all the relevant risks are considered. The November 1997 *Report* presented a fan chart for GDP growth for the first time, shown in Chart 10.

Chart 10
November 1997 GDP projection



The chart shows the relative likelihood of possible outcomes. The central band, coloured deep green, includes the central projection: there is judged to be a 10% chance that output growth will be within that central band at any date. The next deepest shade, on both sides of the central band, takes the distribution out to 20%; and so on, in steps of 10 percentage points. Of course, it is impossible to assess the probabilities with any precision, but this represents the MPC's best estimate. The more uncertainty there is about the output growth at any particular time horizon, the wider the bands, and the more gradually the colour fades. And if the risks are more on one side than the other, then the remaining bands will be wider on that side of the central band.

The process of producing a GDP fan chart is exactly the same as the inflation fan chart: they are part of the same forecast. Consistency of the distributions is ensured by using the same models and judgments when mapping from alternative assumptions onto the projections for both output and inflation. In general, one cannot alter the variance or skewness of one chart without altering the other. But except for the mean and the mode, positions on one chart cannot necessarily be associated with particular points on the other, without knowing the specific risks leading to these outcomes.

A shock to demand will usually result in a positive co-movement in inflation and output. Hence, if the assessment is that there is an unbalanced risk arising from a demand shock, both distributions will be skewed upwards. But a supply shock (eg a sudden rise in world oil prices) will usually generate a negative co-movement in output and inflation. If the assessment is that the risks are unbalanced because of supply-side factors, then the charts will be skewed in opposite directions.

What has been gained from the fan chart?

The original objectives set for the fan chart were principally to improve presentation: to focus attention on the whole of the forecast distribution, rather than on small changes to the central projection. It was hoped that this would promote discussion of the risks to the economic outlook, and thus contribute to a wider debate about economic policy. The fan chart helps to make it clear that monetary policy is about making decisions in an uncertain world, and that the MPC does not pretend to know with certainty the exact rate of inflation in two years' time.

The process used to produce the fan chart has also had a major impact on the Bank's approach to forecasting. The process forces the MPC to consider not just a single possible outcome for the economy, but a range of possibilities in areas where the central view is most likely to be wrong. In turn, this should promote better economic analysis of the underlying issues, and a necessary focus on the shocks hitting the economy.

The process also gives a rigorous accounting framework for essentially judgmental decisions. For each forecast, there is an explicit account of every discussion and decision that generated a component of the forecast for the central view, the degree of uncertainty and the balance of risks. These discussions and decisions are reflected in the text of the *Report*, and one can move from *Report* to *Report* to trace developments in the MPC's assessment of risks. In due course, one should be able to draw on all this information to judge how successful this assessment has been in identifying and calibrating the relevant shocks and their effects on UK inflation at a two-year forecasting horizon.

Appendix

The functional form for a normal distribution is as follows:

$$pdf = \frac{1}{\sqrt{2\Pi\sigma^2}} e^{\left[\frac{-(x-\mu)^2}{2\sigma^2}\right]}$$

where μ is the mean of the distribution, σ^2 its variance and x is the normally distributed random variable. The fan chart distribution incorporates an extra parameter γ, to measure its skewness (where γ lies between 1 and -1). The parameter γ is incorporated into the normal distribution as follows:

$$S = \frac{1}{\sqrt{2\Pi\sigma^2}} e^{\left[\frac{-1}{2\sigma^2}\left\{(x-\mu)^2 + \gamma\left(\frac{x-\mu}{|x-\mu|}\right)(x-\mu)^2\right\}\right]}$$

But with non-zero skewness, the integral of this function is not equal to one. So the distribution also requires a multiplicative area correction to ensure that, whatever the value of γ, the integral equals one:

$$A = \frac{2}{\left(\left(1/\sqrt{1-\gamma}\right) + \left(1/\sqrt{1+\gamma}\right)\right)}$$

So the *pdf* for the fan chart is equal to:

$$pdf = \mathrm{AS} = \frac{2}{\left(\left(1/\sqrt{1-\gamma}\right) + \left(1/\sqrt{1+\gamma}\right)\right)} \frac{1}{\sqrt{2\Pi\sigma^2}} e^{\left[\frac{-1}{2\sigma^2}\left\{(x-\mu)^2 + \gamma\left(\frac{x-\mu}{|x-\mu|}\right)(x-\mu)^2\right\}\right]}$$

This distribution is known as a 'two-piece' normal and is briefly discussed in Johnson, Kotz and Balakrishnan (1994), *Continuous Univariate Distributions*, Vol 1, page 173.

Investment in this recovery: an assessment

By Simon Whitaker of the Bank's Structural Economic Analysis Division.

Investment has grown less rapidly in this recovery than during the previous one, despite a relatively low user cost of capital, high levels of profitability and high stock market valuations of capital. Part of the reason may have been that firms were correcting for over-optimistic forecasts of demand in the late 1980s. Another possibility is that conventional measures of investment do not capture additions to the productive potential of the economy as accurately as they once did.

Introduction

Trends in investment are important for two reasons. First, investment adds to the capital stock, and helps to determine how the supply potential of the economy grows over time. This rate of growth in turn determines the rate at which demand can grow on a sustainable basis without inducing inflationary pressure. Second, investment is itself a component of demand (accounting for about 17% of GDP).

This article explores why investment has contributed less to this recovery than to the previous one, and has fallen as a share of GDP. It considers various economic variables that theory suggests should affect investment, and uses these to try to account for recent trends. The article distinguishes between two sets of arguments: those that relate to how the desired capital stock has grown during this recovery compared with the previous one, and those that explain how firms may have begun this recovery at a different point relative to that desired capital stock. Finally, it discusses problems in measuring investment that complicate the analysis of published data.

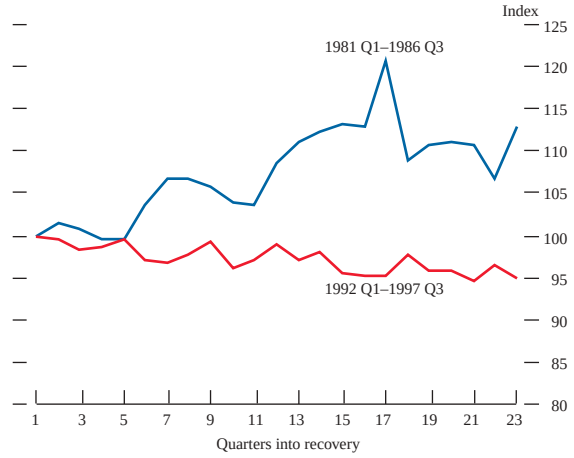
Recent trends in investment

Since the current recovery began in 1992 Q1, whole-economy investment has declined as a share of GDP, unlike in the previous recovery, ie from 1981 Q1 to 1986 Q3 (see Chart 1). This recent weaker growth in investment cannot be attributed solely to weak government or private housing investment: business investment has also grown less than it did in the previous recovery (see Chart 2).

Table A decomposes the growth in investment during each of the recoveries, by sector and by asset. This simple comparison shows that the growth in investment during this recovery has been slower than in the previous one in every sector except manufacturing, and for all types of asset. Table A also shows in particular that:

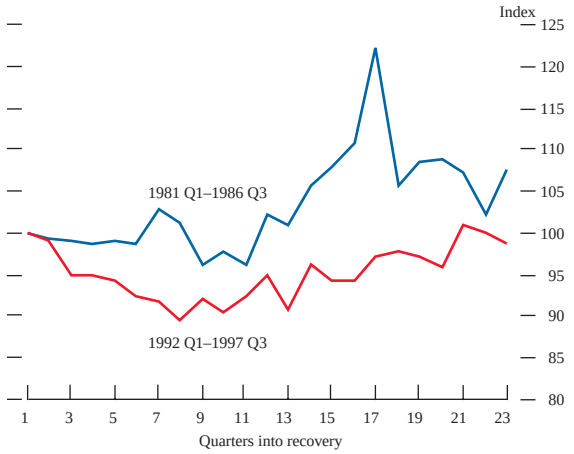
- Around one third of the relative weakness has been due to low general government investment. This is not because of privatisations, since private sector investment is defined here to include public corporations. But there has been a policy of shifting investment expenditure from the government to the private sector via the Private Finance Initiative (PFI).

Chart 1
Whole-economy investment/GDP in recoveries (at constant prices)



Ratio = 100 at start of recoveries.

Chart 2
Business investment/GDP in recoveries (at constant prices)



Ratio = 100 at start of recoveries.

Table A
Contribution to cumulative growth of annual investment in recoveries

Percentage points (a)

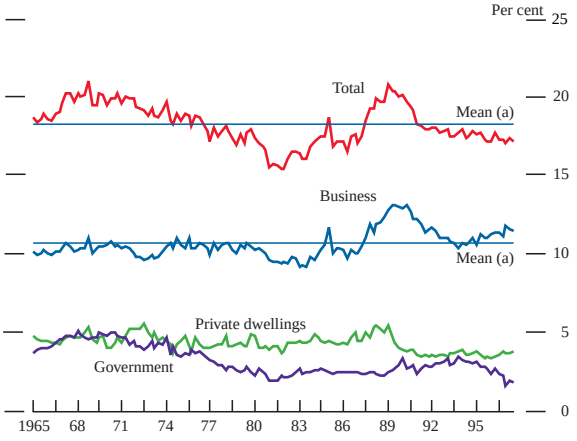
	1996 weights in total (per cent)	1981–85 (1)	1992–96 (2)	Difference (2) – (1)
By sector				
Total		**26**	**8**	**-17**
of which:				
Government (b)	12	4	-2	-6
Private (b)(c)	88	22	11	-11
of which:				
Private dwellings (b)	23	6	3	-3
Business (d)	65	15	7	-8
of which:				
Services	45	16	11	-5
Manufacturing	12	0	1	0
Mining/oil	4	-1	-2	-1
Utilities	4	0	-3	-3
By asset				
Vehicles, ships and aircraft	9	4	2	-1
Plant and machinery	36	10	5	-5
Dwellings	19	4	2	-2
of which:				
Private	17	4	2	-1
Public	2	1	0	-1
Other buildings and infrastructure	36	7	0	-8

(a) Columns may not sum exactly because of rounding.
(b) Includes net purchases of land and existing buildings.
(c) Includes public corporations (except NHS trusts).
(d) Private sector and public corporations' (except NHS) non-residential investment (including investment under the PFI).

- Most of the two-thirds difference accounted for by the private sector has been due to the relative weakness of business sector investment.
- The service sector has accounted for around half of the relative weakness in business sector investment; the rest has been because of mining/oil and utilities, even though these are much smaller sectors.
- Across different types of asset, non-residential construction investment contributed most to the relative weakness.

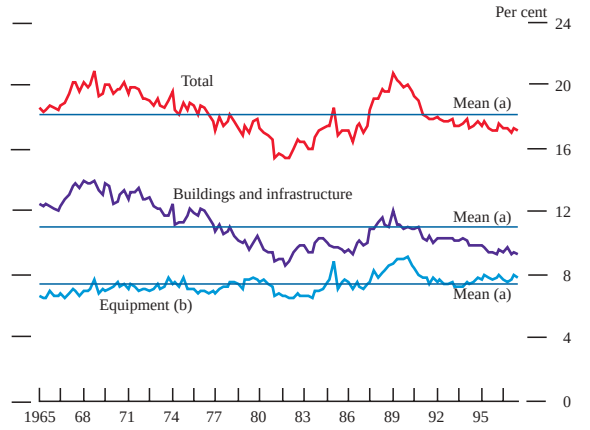
It is important to maintain a broader historical perspective, and in particular to consider levels of investment as well as growth rates. In purely accounting terms, Chart 3 indicates that the whole-economy investment/GDP ratio is low relative to its historical average because of low government investment. Though business investment has grown relatively slowly during this recovery, it began the recovery at a relatively high level and has been rising as a share of GDP since 1994; this share is now above its historical average. By asset, Chart 4 indicates that the low investment/GDP ratio is accounted for by low investment in buildings and infrastructure.(1)

Chart 3
Investment by sector/GDP (at constant prices)



(a) For period shown in the chart.

Chart 4
Investment by asset/GDP (at constant prices)



(a) For period shown in the chart.
(b) Equipment comprises plant and machinery, vehicles, ships and aircraft.

These historical comparisons can help to account for movements in investment, but to explain them we need to understand the economic factors affecting investment, which may have differed greatly in the two recent recoveries. We focus on business investment, which accounts for two thirds of total investment.

How can we explain the behaviour of business investment?

Investment is the means by which firms adjust their capital stock to its desired level. Therefore, investment is determined by how this desired capital stock grows over time. So one reason why investment may have been weaker in this recovery is that the desired capital stock to which firms are adjusting may not have risen as much as during the previous recovery. However, since it is costly for a firm to adjust the size of its capital stock, and because firms make errors in forecasting future market conditions, they may at any time be some way from their desired capital stock. If firms began the respective recoveries at different positions relative to their desired capital stock, this would also affect the subsequent rate of investment. What follows therefore considers factors that may have affected the growth of the desired capital stock, and then examines whether firms might have begun this recovery with 'too much' (or the previous recovery with 'too little') capital.

(1) All investment shares in this article are expressed in constant prices. The current price investment/GDP ratio is lower than the constant price ratio because there has been a decline in the reference price of capital goods.

Factors affecting the desired capital stock

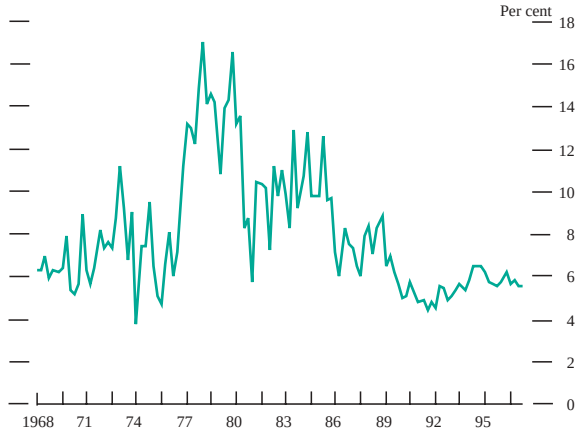
(i) The real user cost of capital

A simple way of looking at investment behaviour is to assume that firms maximise the expected present value of future profits, and hence the value of the firm to shareholders. When there are no adjustment costs, firms maximise profits by ensuring that the capital stock in each period is at a level where its marginal product—the return from the most recently acquired unit of capital—is just equal to the marginal cost of using that last unit. This cost is known as the 'real user cost of capital' and can be thought of as the amount the firm would pay to rent a capital good for each period. Many factors affect the real user cost of capital: the real purchase price of capital goods; the rate at which they depreciate through use; the real opportunity cost of investing in fixed capital rather than a financial asset with similar risk characteristics (usually called the real cost of finance); and taxes on the purchase price and on the flow of profits from the investment.(1) Each of these is discussed below.

The real cost of finance

It is difficult to measure the real cost of finance precisely. One simple measure would be a long-term interest rate adjusted for the rate of inflation. But this would need to be the expected average rate of inflation for the whole period of the investment project, rather than the prevailing inflation rate. Prevailing inflation rates may imply a very low real interest rate (as occurred for example during the 1970s), but uncertainty about future inflation rates may still discourage investment. And an interest rate is unlikely to represent the return that shareholders require from an investment project, because equity is more risky than debt. What we require is a measure of the overall real cost of finance. This is the rate at which a company's future real earnings are discounted by the capital market in valuing the securities upon which those earnings will accrue, whether in the form of interest, dividends, or retentions. Future real earnings are not observable, but if we assume that real earnings in future years are equal to earnings in the current year, then the ratio of current real earnings to the market value of a firm's liabilities (its debt and equity) gives a measure of the real cost of finance.(2) Chart 5 shows such a measure for the UK non-financial corporate sector.(3) The real cost of finance during this recovery has been well below its level during much of the 1970s and 1980s. This is consistent with a reduction in the risk premium—the premium that investors require to compensate them for macroeconomic uncertainty.

Chart 5
Real cost of finance(a)

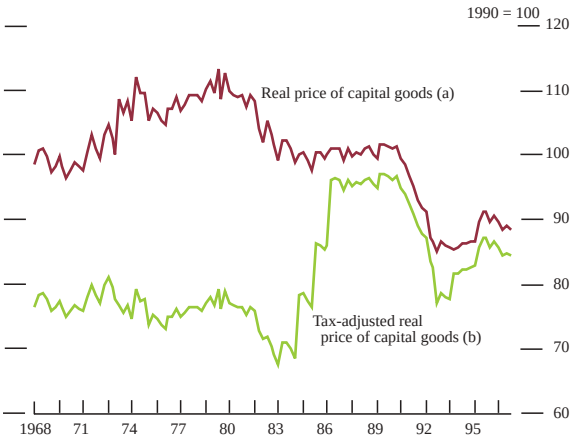


(a) Defined as ICCs' post-tax net operating surplus divided by the market value of their net financial liabilities, expressed as a percentage.

Tax

The tax regime also affects the user cost of capital. In the United Kingdom, the tax system affects the user cost of capital in two ways: capital allowances reduce the effective real purchase price of capital goods; and corporation tax raises the pre-tax revenue that investment projects must generate to be profitable. The real price of capital goods has been lower than in the previous recovery (see Chart 6). But this is before tax. The 1984 corporate tax reforms reduced tax allowances for investment. Because the changes were phased in over two years, investment rose sharply in 1984 and 1985 (as shown in Chart 2) in anticipation of what was effectively an increase in the tax-adjusted price of capital goods. The real tax-adjusted price of capital has been higher than during the equivalent phase of the previous

Chart 6
Real price of capital goods



(a) Business investment deflator relative to GDP deflator.
(b) Defined as the real price of capital goods multiplied by one minus the present value of capital allowances.

(1) Formally, the measure is calculated as:

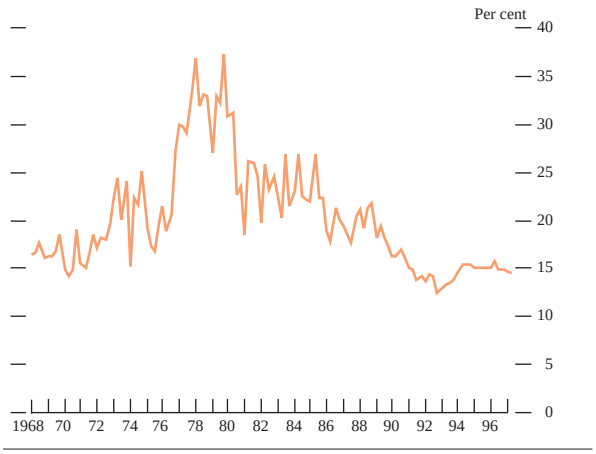
$$\text{real user cost of capital} = \frac{(1-A)}{(1-t)} P\,(r+d)$$

where A is the present value of capital allowances, t is the rate of corporation tax, P is the real price of capital goods (the price of capital goods divided by the GDP deflator), r is the real cost of finance, and d is the rate of depreciation.
(2) This approach was taken by Fleming *et al* (1976).
(3) This is calculated as the ratio of its post-tax net operating surplus to the market value of its net financial liabilities. The post-tax net operating surplus is defined as gross trading profits plus rent minus stock appreciation (that part of accounting profits attributable to the effect of price changes on stock values) and minus capital consumption (depreciation).

recovery. The decline in capital allowances has been partly offset by reductions in the corporate tax rate from 52% to 35% in 1986, to 33% in 1991, and to 31% in the most recent Budget.(1) This has reduced the minimum pre-tax return necessary for investment projects to be profitable.

Taking all these factors into account, the estimated real user cost of capital has been lower in this recovery (see Chart 7). By raising the desired capital stock, this, other things being equal, would lead us to expect stronger investment growth than in the previous recovery, counter to the evidence presented earlier. So if we are trying to explain this apparent puzzle, we could conclude one of two things: either that we should place more emphasis on factors that might have driven firms away from their desired capital stock, or, alternatively, that some or all of the assumptions behind our measure of the user cost of capital do not hold.

Chart 7
Real user cost of capital

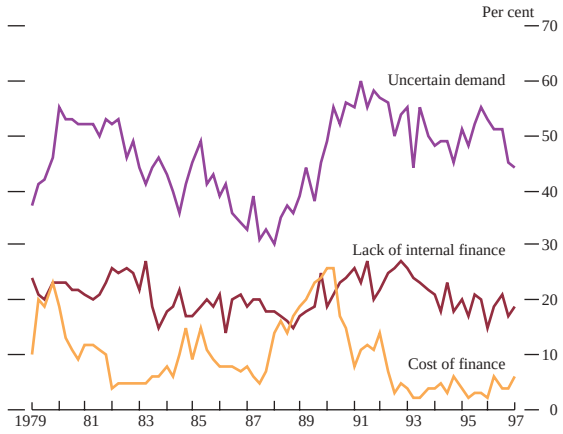


To calculate the user cost of capital, we have to make several assumptions. First, we have assumed that there has been no change in the rate of depreciation of capital goods (in other words, that there has been no change in the average useful life of a capital good). In reality, average asset lives may have fallen (or depreciation may have increased). For example, the fact that IT equipment has accounted for a growing share of the capital stock would imply a fall in average asset lives as IT equipment becomes obsolete more quickly. This would imply that the true cost of capital is higher than is shown in Chart 7. The second uncertainty is about the price of capital goods: if measured prices do not take account of improvements in quality (or productivity), then our measure could overstate the true cost of capital (this also affects the measured volume of investment and is explored later in the article). Correct price measurement is a particular problem with IT equipment, where quality—particularly computing power—has increased rapidly. Finally, our estimate of the real cost of finance is very approximate. In deriving an implicit discount rate from the market valuation of the ICCs sector, we have assumed that the market expects future profitability to be equal to current profitability. In reality, expectations about the future will vary as the market receives news about the economy. All of these factors could distort our measure of the user cost of capital, and their net effect is not clear.

(ii) Uncertainty

The riskiness of an investment project should be reflected in the cost of finance. But in some circumstances, uncertainty may have an additional effect. Because of the lack of liquid, efficient, second-hand markets in capital goods, most investment is to some extent irreversible. So expansion today may leave the firm with too high a capital stock over a prolonged period, if future conditions turn out to be less favourable than expected. In contrast, not investing now leaves the firm with an option to invest later, if uncertainty is reduced and expansion proves warranted. Investing today eliminates the value of this option, so it should be included as one of the costs of the project—in effect raising the required rate of return. The value of this option increases with the level of uncertainty. This may be one factor explaining the high required rates of return (relative to estimates of the cost of finance) quoted by firms in surveys.(2) And according to the CBI Industrial Trends Survey, uncertainty about demand is a far more important constraint on investment than either internal finance or the cost of finance (see Chart 8).(3) The level of uncertainty—at least for manufacturers—has remained high during this recovery. We do not have an equivalent measure of uncertainty for the rest of the business sector. It is possible that the previous recession is still affecting perceptions of risk, and holding back investment.(4) But we would expect

Chart 8
Factors constraining investment(a)



(a) Based on CBI Industrial Trends Survey; percentage of manufacturing firms citing each factor.

(1) A further planned reduction to 30% was announced in the November 1997 Pre-Budget Report.
(2) For example see Wardlow (1994), who reports an average required real rate of return (before depreciation) of around 15%, much higher than the 6% shown in Chart 5.
(3) Although there is some doubt about whether CBI respondents interpret the questions on uncertainty correctly.
(4) The theoretical literature shows that the long-run effect of uncertainty on investment is ambiguous, but that investment will become more lumpy when uncertainty is higher. However, Price (1996) does find that aggregate uncertainty has a negative effect on the level of manufacturing investment.

firms to be more certain about the future macroeconomic environment in the new monetary framework.

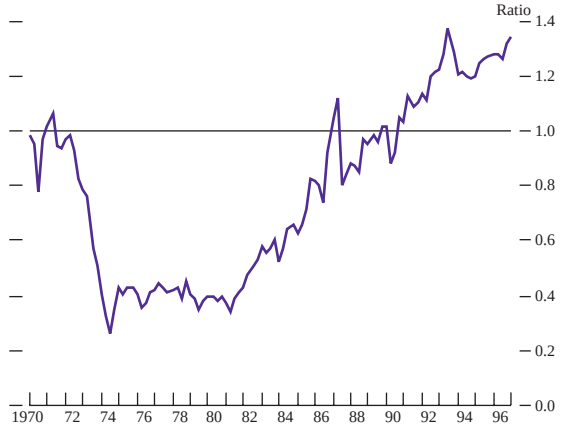
(iii) Tobin's q

It is clearly too simplistic to assert that investment depends only on the prevailing marginal product and/or user cost of capital. Most firms purchase rather than rent capital goods, so they cannot costlessly alter their capital stock each period, both because of adjustment costs and because there is often no well-functioning second-hand market in capital goods.(1) Because firms cannot costlessly adjust the capital stock in each period when capital productivity and/or its user cost changes, they must look at the expected present value of all revenues generated by an investment project over its whole life. Firms will invest only if this exceeds the purchase price of the capital goods by more than the adjustment costs. Since adjustment costs are likely to be increasing with the amount of investment, investment ought to be related positively to the difference between the value an additional unit of capital adds to the firm and its purchase price. Under certain conditions, the value of an additional unit of capital can be measured by looking at the stock market's valuation of existing capital.

The ratio of the market value of a firm to the replacement cost of its capital stock is termed 'Tobin's *q*' (Tobin and Brainard (1969)). Firms' investment should be positively related to the divergence of Tobin's *q* from one. The Bank's measure of Tobin's *q* for the ICCs sector has risen significantly in this recovery, and is at a historically high level (see Chart 9). This implies that the incentive to invest in new capital has been higher than in the previous recovery. But the empirical relationship between Tobin's *q* and investment in fixed capital has not been at all precise in the past. One reason might be that the stock market does not always accurately reflect the 'fundamentals'—expected future streams of profits—upon which investment decisions are based. For example, the information available to those who buy and sell shares may be different from the information used by those who control the day-to-day investment decisions of firms. And the stock market may be subject to 'fads' and 'bubbles' (Blanchard *et al* (1993)).

Another reason why a Tobin's *q* in excess of one might not imply a large incentive to invest in fixed capital is that as the economy becomes more service-oriented, a higher proportion of the market value of the corporate sector relates to intangible assets such as intellectual and human capital and brand image, which are not captured in the denominator (fixed capital). This gives an upward bias to measured *q*. For example, companies such as Microsoft have a Tobin's *q* far in excess of one (see the *Inflation Report*, November 1997).(2) There are also many reasons why the stock market valuation of existing capital may not be the same as their

Chart 9
Tobin's *q*(a)



(a) Defined as the ratio of the market value of ICCs' net financial liabilities to the replacement cost of their capital stock.

valuation of an additional unit of capital; it is this marginal value relative to costs (marginal *q)* that should determine investment.(3)

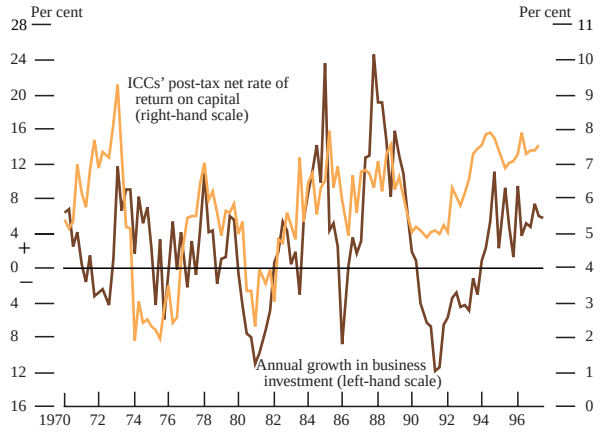
(iv) Profitability

Approaches based on the user cost of capital and Tobin's *q* assume that the source of finance is irrelevant for the optimal path of investment. In fact, the cost of external finance (or the stock market's valuation of investment opportunities) may be a relatively unimportant determinant of investment at the margin, if capital markets are imperfect. Capital markets may be imperfect because, for example, the providers of finance know less than the firms themselves about the quality of investment projects (and those managing them). In this case, finance providers have an incentive to ration by quantity rather than price, since those firms willing to borrow at high interest rates are more likely to be risk-loving, and therefore high-risk firms. If firms are constrained in the amount they can borrow to finance investment, they will have to raise extra funds internally. In this case, investment will be determined partly by the amount of profits available for investment. Also, if managers prefer to retain control of the firm, then they will value the streams of profit accruing from internally financed projects more highly than those from externally financed ones. Their cost of finance is therefore reduced when profitability increases. In the CBI Industrial Trends Survey, firms consistently quote lack of internal finance as a bigger constraint on investment than the cost of finance (see Chart 8). And there is a good deal of other evidence that firms are financially constrained at times, so that investment is related to internal cashflows.(4) But investment may also be affected by current profitability, even if firms are not financially constrained, if current profitability is used as an indication of future profitability.(5)

(1) For example, according to the Finance and Leasing Association, only around 20% of non-residential investment is leased.
(2) In aggregate, the brand image effect alone on *q* should cancel out—an increase in the brand image and hence market value of one firm in an industry is likely to be at the expense of other firms in that industry.
(3) When there are no adjustment costs, the firm will maintain its capital stock at the level where marginal *q* is one. Note that this is an alternative way of expressing the condition that the marginal product of capital is equal to its real user cost (as defined earlier).
(4) Formally, firms are defined as financially constrained if a windfall increase in profits, ie an increase not associated with any change in expectations about future profits, would lead to an increase in investment. For a survey of the growing literature in this field, see Schiantarelli (1996).
(5) This assumption was made earlier in deriving the cost-of-finance measure.

As Chart 10 shows, there has traditionally been a close relationship between the growth rate of business investment and profitability. The rate of return on capital is currently at near-record levels and hence, on the basis of the historical relationship, we would expect business investment growth to be higher. So movements in profitability cannot explain the weakness in investment relative to the previous recovery—though we would expect the relationship between profits and investment to have weakened, given the financial liberalisation that has taken place.

Chart 10
Growth in business investment and profitability



Factors that may have pushed firms away from their desired capital stock

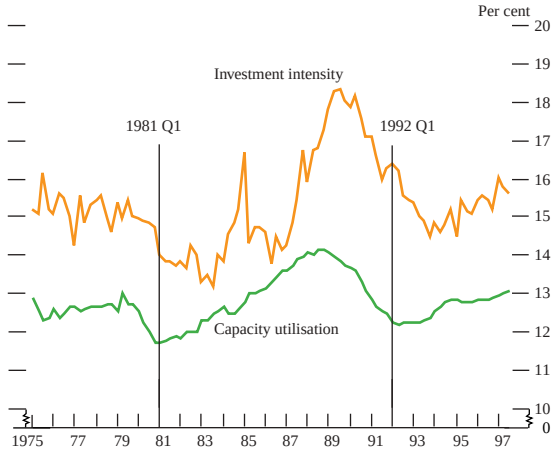
The factors we have considered so far are those that may affect the desired capital stock, and hence the flow of investment needed to reach it. Other things being equal, a low user cost of capital, high stock market valuations and high profitability would suggest that the desired capital stock had risen and that investment should be buoyant. But firms may have begun the respective recoveries at different positions relative to their desired capital stock, which would also have affected the subsequent rate of investment.

(i) Capacity utilisation

One way of assessing whether firms began this recovery with too much capital is to look at measures of capacity utilisation. Firms may choose to maintain spare capacity because it is costly to adjust the capital stock to match every fluctuation in demand. But if firms' previous forecasts of demand turn out to have been over-optimistic, then they may find themselves with more spare capacity than they need. In this case, any subsequent increase in demand, even if it is expected to be permanent, may not lead to firms choosing to acquire as much extra capital as they would in the absence of these forecast errors.

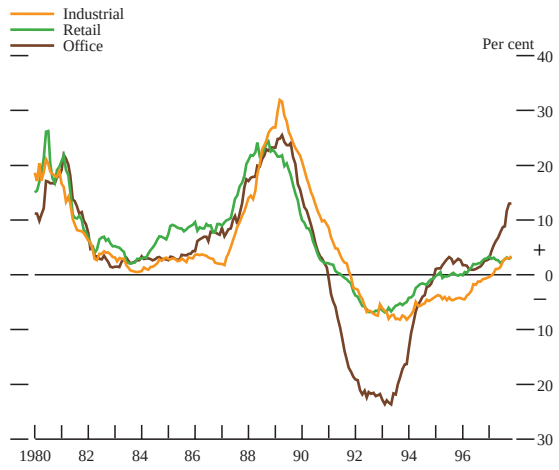
We do not have a direct, survey-based, measure of the level of capacity utilisation in the business sector. But we can estimate it by using ONS data for business sector output and its capital stock to compute the volume of output per unit of capital.(1) Chart 11 shows that historically there has been a positive relationship between business investment intensity (the ratio of investment to output) and this measure of capacity utilisation. It appears from ONS data that capacity utilisation at the beginning of the present recovery (1992 Q1) was not significantly different from its level at the beginning of the previous recovery (1981 Q1). But firms were investing a much greater share of their output, so it was understandable that investment grew less rapidly than output during the early part of the latest recovery, as firms sought to increase utilisation of existing capacity. Business is now investing a relatively high share of its output. Other indicators suggest that for some assets the degree of excess capacity was greater at the beginning of the present recovery. In the commercial and industrial property sector, rental values were declining until 1995 (see Chart 12) and, as shown earlier (Chart 4), investment in buildings and infrastructure has been particularly weak.

Chart 11
Business investment intensity and capacity utilisation(a)



(a) Capacity utilisation is defined as the volume of output divided by the net capital stock, expressed as a percentage.

Chart 12
Annual rental value growth



Source: Richard Ellis.

(1) The drawback of this approach is that the difficulties of correctly allowing for depreciation and scrapping mean that capital stock estimates are imprecise.

(ii) Indebtedness

We can also look for evidence of firms having inherited 'too much' capital by looking at firms' financial liabilities. Other things being equal (particularly the supply of finance), capital accumulation should have been reflected in additional borrowing.

Chart 13 shows that the corporate sector began this recovery with an unprecedently high debt burden. During the early part of the recovery, firms used higher profits to repay bank debt. So this may be one reason why investment did not rise in line with profitability during the early part of the recovery. How can we interpret this pattern of events? Smith *et al* (1994) show that firms that were highly indebted in 1992 had been among the most profitable in the second half of the 1980s; their profitability then fell rapidly to a trough in 1992. This profile is consistent with firms borrowing in the second half of the 1980s to invest in projects that they and the banks expected, based on current profitability, would generate profits more than sufficient to repay the debt. During the recession, firms found themselves with excess fixed capital, and hence excess debt used to purchase the capital. In the early part of the recovery, firms were still correcting for that previous expectational error. This contrasts with the previous recession, when the decline in profitability had not been preceded by an increase in indebtedness, so that the rate of subsequent insolvencies was lower.

Chart 13
ICCs' outstanding bank borrowing/profits(a)

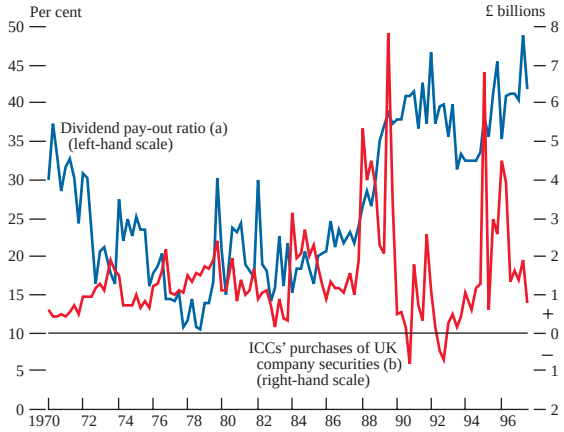
(a) Defined as the ratio of the stock of M4 lending to ICCs' gross trading profits, expressed as a percentage.

Of course, the supply of finance may not have remained 'equal', as we have assumed. It could be that the repayment of debt reflected the fact that financial intermediaries corrected for their own errors in expectations, not only about the future demand for their borrowers' goods and services, but also about the level of financing that is consistent with profit maximisation in the newly liberalised financial market.

(iii) Mergers and acquisitions (M&A) activity and dividend payments

Another reason why investment may not have risen in line with increases in the desired capital stock—and, in particular, why it may not have risen in line with profitability (as we saw in Chart 10)—is that firms have been expanding via acquisition and, as a result, a large proportion of profits has been paid out to shareholders as dividends. The market for corporate control can lead to defensive dividend payments by firms at times of high M&A activity: a high dividend may boost the share price and make takeover more expensive for the predator firm.(1) But until the most recent Budget, there has also been a bias in the UK tax system towards dividend payments rather than retained earnings—pension funds received a refund on Advance Corporation Tax paid on dividends on their behalf—which became more severe when lower capital allowances reduced the attraction of investing retained earnings. Chart 14 shows that the dividend payout ratio is much higher than during the previous recovery, and has been rising during the period of the recent M&A boom. The higher the share of profits absorbed by dividends, the more likely firms are to face a binding constraint on investment spending. Against this it is argued that dividends can be recycled as external finance, so this dividends-based explanation relies on there being some rationing of (or preference against) external finance.

Chart 14
The dividend payout ratio and M&A expenditure



(a) Defined as the ratio of dividend payments to ICCs' total income after tax and interest payments, expressed as a percentage.
(b) Deflated by the FT All-share Index (1990 = 100).

There are other problems with this explanation. First, it is not clear why there has been an M&A boom: theory says that when Tobin's *q* is above one, firms should be expanding via investment rather than acquisition. Second, work by Thomas (1996) explains how an increase in M&A activity could eventually lead to an increase in fixed capital investment. This work argues that firms use 'excess' money holdings to acquire financial assets via, for example, mergers and acquisitions. Financial asset prices are bid up

(1) In order for this to be an effective strategy, shareholders must interpret a high current dividend payment as a signal that future dividend payments will be higher than they would be under the management bidding for control.

and this drives down the cost of finance, which in turn increases investment in fixed capital in the long run.

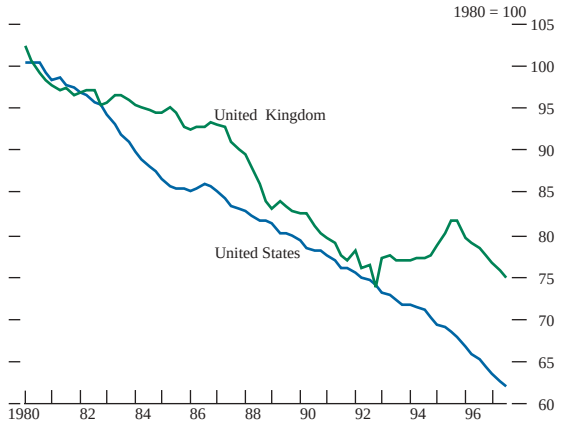
Measurement problems

We have identified some economic factors that could explain why business investment has grown more slowly in this recovery than in the previous one, but part of the explanation may lie with measurement error. This section looks at various ways in which investment may have been underrecorded during this recovery.

(i) Prices

Our measure of the real quantity of investment depends on our having an accurate measure of the price of capital goods. But prices need to be adjusted for (the now rapid) improvements to the quality of capital goods. If prices are overstated, we may underestimate investment volumes. This could account for some of the relative weakness of measured investment in this recovery. Methodological differences mean that UK statisticians may make less allowance for quality than their US counterparts. The fact that, relative to the overall price level, the price of equipment in the United States has declined more rapidly than in the United Kingdom is indicative of this (see Chart 15).

Chart 15
Real price of equipment in the United States and United Kingdom(a)

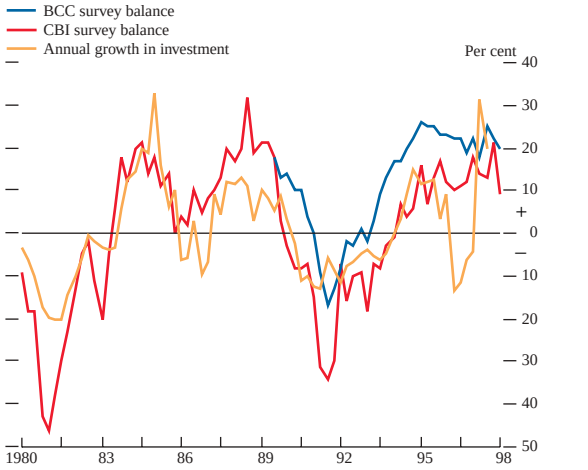


(a) Defined as the price of equipment divided by the GDP deflator.

(ii) Expenditure

There is also some evidence from survey data that suggests that investment expenditure may be under-recorded. Chart 16 shows that during 1996, a substantial gap opened between recorded growth in manufacturing investment and investment intentions expressed in surveys. There have been gaps between these series in the past, but they occurred at peaks and troughs in the cycle. Under-recording of investment is more likely in the service sector, because ONS survey coverage is less comprehensive (and perhaps less likely to cover new firms, who are more likely to be investing). A gap has emerged between service sector investment growth and BCC survey intentions (see Chart 17). And there is some anecdotal evidence from the Bank's regional Agents that IT equipment may, because of its short economic life, be recorded as current rather than capital expenditure. Against this, it is important to note that gauging the quantitative significance of a change in a qualitative survey balance is not straightforward (Cunningham (1997)).

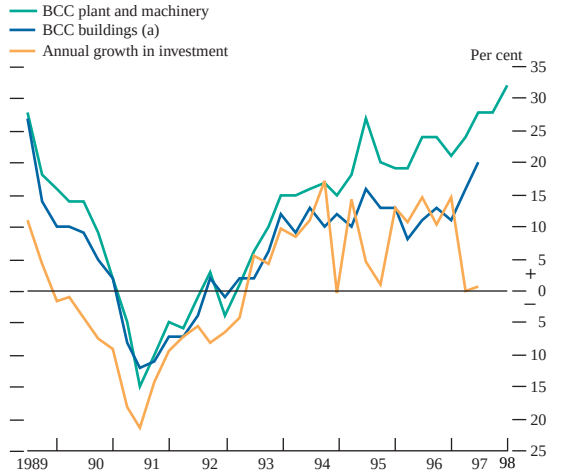
Chart 16
Manufacturing investment intentions



Note: Survey balances are determined by subtracting the percentage of companies reporting decreases from the percentage of companies reporting increases. The survey balance has been moved forward two quarters, as it relates to intentions.

Sources: British Chambers of Commerce, CBI and ONS.

Chart 17
Services investment intentions



Note: Survey balances are determined by subtracting the percentage of companies reporting deceases from the percentage of companies reporting increases. The survey balance has been moved forward two quarters, as it relates to intentions.

Sources: British Chambers of Commerce and ONS.

(a) This series has been discontinued.

The ONS has analysed revisions to the expenditure components of GDP between initial release and the final estimate published three years later. Over a ten-year period, revisions to investment showed a significant upward bias. On average, four-quarter growth rates were revised up by 2.6 percentage points between the initial and final estimate (see Table B). Using a longer data period, the ONS also

looked at the effect of the economic cycle. The mean revision in the expansion phase was higher than in the contraction phase, but its standard error was also higher, so that it is more difficult to say whether it was significantly different from zero.

Table B
Revisions to investment (whole-economy)

Revisions to four-quarter growth rates of constant price investment (1986–95) (a)

Mean revision	Standard deviation	t-value (b)	Percentage of revision	
			+	-
2.6	0.8	3.2	83	17

Revisions to four-quarter growth rates of constant price investment (1991–95)

Mean revision	Standard deviation	*t*-value	Percentage of revision	
			+	-
2.3	1.2	1.9	75	25

Tests for cyclical variation (1982–95)

Expansion phase		Contraction phase	
Mean	*t*-value	Mean	*t*-value
3.9	1.8	1.2	2.2

Source: Rizki (1996).

(a) Dating refers to publication of revisions.
(b) *t* value > 1.96 indicates that the mean revision is significantly different from zero at the 95% level.

Overall, the survey data and ONS research suggest that one reason why investment growth has been weaker in this recovery is that investment in recent years may have been under-recorded.

It is also important to realise that investment, as currently defined, is now a less useful guide to increases in productive capacity, because of the growing importance of computer software. The definition of investment will change in 1998 when the United Kingdom, along with other European countries, moves onto the new European System of Accounting: software expenditure will be recorded as investment, even when it is developed in-house. This should help to align measured investment more closely with changes in the economy's productive potential.(1)

Summary

Investment has grown more slowly in this recovery than in the previous recovery, and this is not restricted to particular sectors or types of asset. But though growth in business investment has been weaker than in the previous recovery, its level at the start of the recovery was relatively high and at present accounts for a relatively high share of GDP. The decline in investment as a share of GDP during this recovery can be attributed to weak government investment, or by asset, to weak investment in buildings and infrastructure.

How can we explain the behaviour of business investment during this recovery, compared with the previous one? Part of the answer lies in how economic factors may have changed the desired capital stock. Other things being equal, a low user cost of capital, high stock market valuations and high profitability would suggest that the desired capital stock had risen and that investment would be buoyant. But this is not the case. This points us towards explanations for why firms may be away from their desired capital stock, and how they might be adjusting towards it. In the early part of the recovery, the corporate sector may have had to correct for excessive levels of debt and capital stock, which slowed investment relative to the previous recovery. The unusual increase in debt and investment during the second half of the 1980s could well have been, in retrospect, based on unrealistic expectations about future profitability. A more recent feature of corporate behaviour—the M&A boom and associated high dividend payouts—may also have diverted funds away from investment in fixed capital. Finally, there may be statistical as well as economic reasons for the observed sluggish growth in investment. Some of the apparent weakness may be due to measurement errors, both of the price of investment goods and of the amount of expenditure. But it is also true that investment, as currently defined, is now a less useful guide to increases in productive capacity, because of the growing importance of computer software.

(1) Revisions will be made to the National Accounts for previous years.

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Macroeconomic policy and economic performance in developing countries

By Maxwell Fry, Director of the Bank's Centre for Central Banking Studies.

In this article,[1] Maxwell Fry, who became Director of the Bank's Centre for Central Banking Studies (CCBS) in September 1997, examines the relationship between monetary and fiscal policies for a sample of 70 developing countries. He finds that the size of the government's deficit and the methods by which it is financed determine monetary policy reactions to increases in both government credit and net foreign assets. In particular, Maxwell Fry finds that larger deficits and greater reliance by governments on the domestic banking system are associated with more accommodating monetary policies. In turn, such inflationary macroeconomic policies are associated not only with higher inflation, but also with lower economic growth.

Introduction

In many developing countries where I have worked, the fiscal situation dominates other areas of macroeconomic policy, including exchange rate and monetary policies. Specifically, large and sustained government deficits are typically accompanied by inflationary monetary expansion and exchange rate depreciation. In this paper, I put forward the hypothesis that this is systematically the case: a country's monetary policy stance amplifies rather than offsets its fiscal stance, as defined by both the size of its deficit and how it is financed. I further suggest that the reason for this relationship between fiscal and monetary policy is that both are determined by the government's competence in macroeconomic policy-making.

A government can finance its deficit in various ways. For example, the typical OECD country finances about 50% of its deficit from non-bank domestic sources, whereas the typical developing country finances only about 8% from this source (Fry (1997, page 4)). Here, I predict that the larger its deficit and the more a government finances it by borrowing from the domestic banking system, the less monetary policy will counteract the consequent inflationary pressures. So the size of the deficit and the methods by which it is financed together affect the stance of monetary policy.

To examine the relationship between fiscal and monetary policies, I estimate monetary policy reaction functions for groups of countries selected on their fiscal characteristics, drawn from a sample of 70 developing countries. The results support my hypothesis: they suggest that, far from offsetting expansionary fiscal policy, monetary policy tends to compound any inflationary fiscal stance in these countries. Larger deficits and greater reliance by governments on the domestic banking system are associated not only with less monetary policy neutralisation (that is, changes in government borrowing from the domestic banking system are not countered by equal and opposite changes in credit to the private sector), but also with less sterilisation of increases in foreign exchange reserves. In other words, more inflationary fiscal policies are accompanied by more accommodating and so more inflationary monetary policies.[2]

Monetary policy reaction functions

To pursue a monetary target, monetary policy in any open economy acts to control domestic credit expansion. If the government's demands would otherwise produce inflationary domestic credit expansion, monetary policy can react by reducing credit to the private sector.[3]

To examine whether monetary policy in developing countries has neutralised government credit expansion by reducing private sector credit, I estimate monetary policy reaction functions for a variety of countries. This builds on earlier work on monetary policy reaction functions (eg Reuber (1964) and Froyen (1974)), where central bank objectives have typically been modelled to include a balance of payments target, an inflation target, and possibly a response to exogenous shocks such as changes in the terms of trade.

Initially, I specify the monetary policy reaction function in terms of the change in domestic credit scaled by GDP,

(1) The author thanks Bill Allen, Spencer Dale, Charles Goodhart, Andrew Haldane, Neal Hatch, Charles Nolan, and Eric Schaling for comments and suggestions on earlier drafts of this paper.

(2) An accommodating monetary policy responds to exogenous shocks such as an oil price increase or extra government borrowing by expanding the money stock to finance and so validate the higher price or increased aggregate demand. The 'real bills' doctrine advocates one form of accommodating monetary policy. Adam Smith (1776) argued that, provided banks confined themselves to lending short on the security of good commercial paper ('real bills' financing trade in real commodities), and provided they were legally obliged to redeem their notes on demand at a fixed price in terms of gold, overissue (and hence inflation) was impossible. Smith's second condition was subsequently ignored during the period 1797–1821, when the Bank of England's obligation to redeem its notes in gold was suspended; advocates of the doctrine still invoked Smith to defend their view that adherence to the policy of lending only against real bills would prevent overissue and so inflation. History has demonstrated the fallacy of this doctrine, at least for currencies not redeemable on demand into gold (Laidler (1992, page 104)).

(3) In the industrialised countries, this is achieved by raising interest rates to influence the demand for credit. In many developing countries, monetary policy is implemented by setting credit ceilings to affect the supply directly.

DDCY, a potential intermediate target of monetary policy in an open economy. The first explanatory variable, *DNFAY*, is the change in net foreign assets of the banking system adjusted for exchange rate changes and scaled by GDP, included to detect any systematic sterilisation of the effects of such asset acquisition on the money supply. Complete sterilisation implies a coefficient of -1 for the variable *DNFAY*. (Because domestic credit plus net foreign assets constitutes the assets backing the money stock, an increase in the latter must be offset by a decrease in the former to prevent any change in money.)

An alternative reaction to an increase in net foreign assets is to increase domestic credit. Porzecanski (1979) finds that higher net foreign assets led to more rapid domestic credit expansion in Mexico and Venezuela. I discover the same phenomenon in Sri Lanka (Fry (1990)) and Turkey (Fry (1988)). Indeed, Turkey's two bouts of double-digit inflation in the 1950s and 1970s originated in rapid increases in foreign exchange receipts. Rather than sterilising the effect of higher net foreign assets on the money supply, Turkish monetary policy responded by expanding domestic credit to finance a greater volume of imports of capital equipment and raw materials. Although this reduced rapidly the level of net foreign assets, it sustained the expansionary monetary impulse. Turkey then followed its own version of the 'real bills' doctrine towards domestic credit expansion, accommodating with a lag demand pressures generated by the accelerating rise in nominal GNP.

Other possible explanatory variables are the gap between domestic inflation and inflation in the industrial countries, the gap between actual and potential output as a proxy for unemployment, economic growth, and the rate of change in international oil prices. Fry, Lilien, and Wadhwa (1988) find that monetary policy in their sample of developing countries outside the Pacific Basin accommodated domestically generated inflationary pressures, the government's credit requirements, and the increase in oil prices. Porzecanski (1979) also finds that Argentina and Chile accommodated domestically generated inflation either to supplement government revenue through monetary expansion or to maintain a certain level of real liquidity in the economy.

The monetary policy reaction function estimated here takes the form:

$$DDCY = f(DNFAY, X_i) \qquad \textbf{(1)}$$

where X_i represents all the explanatory variables other than *DNFAY*.

Equation **(1)** implicitly assumes a zero coefficient for the change in net domestic credit to the government scaled by GDP, *DDCGY* (since any increase in the government borrowing requirements is completely neutralised). In this case, the expansion of domestic credit is wholly unaffected by any changes in the government's borrowing needs.

I now subtract *DDCGY* from both sides of equation **(1)** to produce the monetary policy reaction function that I estimate for various country groups:

$$DDCPY = f(DNFAY, X_i) - DDCGY \qquad \textbf{(2)}$$

where *DDCPY* is the change in domestic credit to the private sector deflated by GDP. Note that $DDCY \equiv DDCPY + DDCGY$. Complete neutralisation of the government's extra borrowing requirements implies a coefficient of -1 for *DDCGY*. Partial neutralisation, however, produces a coefficient less than zero but greater than -1, and no neutralisation entails a coefficient of zero.

While monetary control dictates complete neutralisation of increased government borrowing from the banking system, the factors influencing the government's credit requirements may affect the private sector's credit demands in a similar way. A passive or accommodating monetary policy would then sanction increases in private sector domestic credit along with increased government borrowing. In this case, the estimated neutralisation coefficient would be positive.

The neutralisation and sterilisation coefficients, together with the monetary policy reaction to inflation itself, measure the extent to which monetary policy is accommodating or used systematically for monetary control.

Estimates of monetary policy reaction functions

To examine the relationship between deficit finance and monetary policy, I obtained data for 70 developing countries for the period 1972–95.(1) This sample includes all developing countries with a reasonable number of observations for the relevant fiscal variables. Even so, the relatively small number of observations per country necessitated parsimonious specifications of the monetary policy reaction function. I therefore include only current and lagged *DNFAY* and *DDCGY*, and the gap between domestic inflation and inflation in the industrial countries, *INFGAP*, measured as the continuously compounded rate of change in the GDP deflator minus the continuously compounded consumer price index for industrial countries.(2)

To select the countries for each estimate, I first ranked them on the basis of various potential discriminating variables. I

(1) Details of the country sample and the data definitions are contained in Fry (1997).
(2) The variable *INFGAP* is defined as $\Delta\log(P_D) - \Delta\log(P_{OECD})$, where P_D is the domestic GDP deflator (nominal GDP divided by GDP at constant prices) and P_{OECD} is the average level of consumer prices in industrial countries. If monetary authorities squeeze domestic credit in response to a widening gap, the coefficient of *INFGAP* would be negative. The choice of GDP deflator rather than consumer price index was dictated by the fact that CPI data for a number of countries were available for only a short time period. Though a traded-goods price index would have been preferable to consumer prices in industrial countries, no alternative average price index for industrial countries is available in *International Financial Statistics* CD-ROM, the main data source used here. I treat the variables *DNFAY*, *DDCGY* and *INFGAP* as endogenous; the instruments I use are the remaining explanatory variables, lagged *INFGAP*, lagged money and economic growth rates, the rate of change in oil prices, the OECD growth rate, and the world real interest rate. In fact, treating the government borrowing requirement *DDCGY* as exogenous to the monetary policy process produces virtually identical results.

then selected the ten countries with the highest average values of the discriminating variable and the ten countries with the lowest average values of this variable during the period 1972–95. Finally, I estimated a system of 20 monetary policy reaction functions with appropriate cross-equation restrictions.(1)

To distinguish effects between 'low' and 'high' country groups, I estimate shift parameters for countries in the 'low' country group, ie the countries scoring low values on the particular discriminating variable. So I assign countries in the 'low' group a value of 1 for the dummy variable *L*; countries in the 'high' group take a value of 0 for *L*. The monetary policy function I estimate is therefore:

$$DDCPY = b_1\, DNFAY + b_2\, DNFAY_{t-1} + b_3\, DDCGY + b_4\, DDCGY_{t-1} + b_5\, INFGAP + b_6\, L.DNFAY + b_7\, L.DNFAY_{t-1} + b_8\, L.DDCGY + b_9\, L.DDCGY_{t-1} + b_{10}\, L.INFGAP \quad \textbf{(3)}$$

The coefficient of *DDCGY* for the 'low' country group is $b_3 + b_8$; it is simply b_3 for the 'high' country group. Full neutralisation of additional government borrowing implies $b_3 + b_4\ (+\ b_8 + b_9) = -1$, while full sterilisation of changes in net foreign assets requires $b_1 + b_2\ (+\ b_6 + b_7) = -1$.

Size of deficits

Table A presents summary results of the monetary policy reaction functions estimated using fiscal variables to select the countries in each estimate; Table 1 in the Appendix reports the complete estimates. For the estimate in the column labelled 'Government deficit/GDP', I select 20 countries using the average government deficit in the period 1972–95. The ten countries in the 'high' group had the largest average deficit ratios, while the ten countries in the 'low' group had the smallest average deficit ratios during this period. This estimate indicates that sterilisation (of external flows) and neutralisation (of budget deficits) coefficients in low-deficit countries are both significantly higher than they are in high-deficit countries. Indeed, this result suggests that, far from counteracting increases in net foreign assets and expansionary fiscal policy, monetary policy in high-deficit countries compounds the inflationary effects of both net inflows of foreign assets and large government deficits. In low-deficit countries, however, monetary policy exhibits some systematic monetary control: in any two-year period, monetary policy in low-deficit countries sterilises 17% of increases in net foreign assets and 41% of increases in domestic credit to the government.

Table A
Summary results of monetary policy reaction function *DDCPY* estimates by fiscal indicators, 1972–95

Explanatory variable	Coefficients (equation **(3)**)	Fiscal indicator: Government deficit/GDP	Δ Reserve money/GDP	Reserve/deposit ratio
		Coefficients for 'high' country group		
DNFAY	$b_1 + b_2$	0.051	0.173	0.003
DDCGY	$b_3 + b_4$	0.176	-0.137	0.218
		Implied coefficients for 'low' country group		
DNFAY	$b_1 + b_2 + b_6 + b_7$	-0.169	-0.198	-0.239
DDCGY	$b_3 + b_4 + b_8 + b_9$	-0.410	-0.392	-1.007

Methods of financing deficits

For the remaining estimates in Table A, I select countries based on the method by which governments finance their deficits. The estimate in the column labelled 'Δ Reserve money/GDP' uses the average change in reserve money expressed as a proportion of GDP to choose 20 countries that finance their deficits to a greater or lesser extent from seigniorage revenue. The estimated equation is similar to that in the previous column: no sterilisation and very little neutralisation in high-seigniorage countries, but 20% sterilisation and 39% neutralisation in the low-seigniorage country group.

One method of financial repression that extracts revenue for the government is to impose high reserve requirements on the commercial banks. On average, the required reserve ratio in developing countries is three times higher than in industrial countries. Substantial use of inflationary monetary expansion tends to be accompanied by high required reserve ratios. In contrast to the textbook discussion of higher required reserve ratios as a monetary policy instrument to restrict monetary growth, a comparison across developing countries indicates that monetary growth or inflation and the ratio of bank reserves to deposits are positively correlated (Agénor and Montiel (1996, pages 154–57), Brock (1989), and Fry (1995, pages 5–6)). Evidently, countries using inflationary monetary expansion tend to combine higher tax rates with a larger tax base in the form of higher required reserve ratios.

The final column in Table A, labelled 'Reserve/deposit ratio', selects countries using the average ratio of bank reserves to bank deposits. Although the estimated equation produces results similar to the other two, the difference between monetary policy reactions in 'high' and 'low' country groups in this equation is most substantial. In countries with high reserve/deposit ratios, monetary policy does not sterilise and actually accentuates credit expansion to the government. In low reserve/deposit ratios countries, however, monetary policy sterilises 24% of increases in net foreign assets and neutralises 101% of any increase in net domestic credit to the government. In other words, monetary policy in low reserve/deposit countries exhibits complete monetary control when government borrowing from the banking system changes.

Monetary policy, inflation, and growth

The results in Table A suggest that lax fiscal discipline in developing countries tends not to be accompanied by

(1) Each regression estimate reported here consists of country equations estimated simultaneously using iterative three-stage least squares (3SLS) with cross-equation restrictions on all slope coefficients, but with shift parameters for the lowest-scoring group; country intercepts are not constrained. The 3SLS estimation procedure is, asymptotically, full-information maximum likelihood. This estimation technique requires that the minimum number of observations exceeds the number of equations, which is why I include only 20 countries in each system of equations.

Table B
Summary results of monetary policy reaction function *DDCPY* estimates by alternative indicators, 1972–95

Explanatory variable	Coefficients (equation **(3)**)	Alternative indicator: Inflation	Alternative indicator: Growth
		Coefficients for 'high' country group	
DNFAY	$b_1 + b_2$	0.273	-0.674
DDCGY	$b_3 + b_4$	0.498	-0.868
		Implied coefficients for 'low' country group	
DNFAY	$b_1 + b_2 + b_6 + b_7$	-0.096	-0.116
DDCGY	$b_3 + b_4 + b_8 + b_9$	-0.673	-0.025

monetary policy aimed at controlling monetary expansion. The two additional estimates of equation **(3)** in Table B show that such accommodating monetary policy is associated with high inflation, and monetary control with high growth.(1) For the estimate in the 'inflation' column, I chose the 20 countries on the basis of lowest and highest inflation rates. The monetary policy behaviour of these two groups is quite different. Monetary policy in high-inflation developing countries neither sterilises increases in net foreign assets nor neutralises increased government borrowing. Indeed, increases in both net foreign assets and net domestic credit to the government are associated with greater expansion in domestic credit to the private sector. In contrast, monetary policy in low-inflation countries sterilises 10% of any increase in net foreign assets and neutralises 67% of any increase in government borrowing.

The 'growth' column in Table B displays the largest difference in monetary policy behaviour between country groups. For this estimate, I selected the ten fastest-growing and the ten slowest-growing developing countries. In the high-growth countries, monetary policy sterilises 67% of any increase in net foreign assets and neutralises 87% of any increase in government borrowing, while monetary policy in low-growth countries sterilises 12% of any increase in net foreign assets and neutralises only 3% of any increase in government borrowing.

The results in Table B support the view that the discriminating fiscal variables used in Table A are capturing competence among the country's macroeconomic policy-makers: competent macroeconomic policy-makers eschew the inflation tax and financial repression to finance government deficits, and understand the concepts of monetary control. The monetary control exhibited in the highest-growth country group tends to be associated with all-round competent economic policy-making.(2) Moreover, growth is closely related to the fiscal variables. Table C compares the mean values of the fiscal variables when countries are selected on growth rates with their mean values when countries are selected on the fiscal variables themselves. The numbers represent means of all annual values for the country group. So the annual government deficit in the ten highest-growth countries averaged 1.4%, compared with 9.5% in the ten lowest-growth countries. The ten lowest-deficit countries averaged surpluses of 1.6% (ie deficits of -1.6%), compared with an average deficit of 12.8% in the ten highest-deficit countries.

Table C
Fiscal attributes in high and low-growth countries

Average annual percentages, 1972–95

Fiscal attribute	Low fiscal	High fiscal	Low growth	High growth
Government deficit/GDP	-1.6	12.8	9.5	1.4
Reserve money/GDP	0.7	6.6	4.1	1.4
Reserves/deposits	6.6	46.9	29.2	12.5

All the differences between high and low-growth countries are highly significant. In all cases, high-growth countries exhibit low averages for fiscal variables, ie low deficits, low reserve-money growth, and low reserve/deposit ratios. In other words, countries with good fiscal characteristics perform better economically than those with poor fiscal characteristics. After conducting formal causality tests, Fischer (1993, page 510) concludes that 'small deficits are good for growth'. So the fact that growth is the best discriminating variable for detecting monetary control is quite consistent with the policy competence hypothesis.

Conclusion

I detect clear differences in monetary policy reaction functions based on fiscal, inflation, and growth attributes of 70 developing countries. The estimated monetary policy reaction functions reported here show that larger deficits and greater reliance by governments on the inflation tax and financial repression are associated both with less sterilisation of increased net foreign assets and with less neutralisation of increased government borrowing requirements. Furthermore, monetary policy exhibiting greatest monetary control occurs in high-growth countries. My interpretation of all this is that competent macroeconomic policy-making, ie both fiscal and monetary policy, fosters both low inflation and high growth.

(1) The full estimates are reported in Table E of the Appendix.
(2) That policy rather than behavioural differences are more important in explaining differences in economic performance in developing countries is also suggested in Fry (1995, pages 229–54), Fry (1998), Fry and Lilien (1986), and Fry, Lilien, and Wadhwa (1988).

Appendix

Table 1
Iterative 3SLS monetary policy reaction function *DDCPY* estimates by fiscal indicators, 1972–95

Explanatory variable	Coefficients (equation **(3)**)	Fiscal indicator		
		Government deficit/GDP	Δ Reserve money/GDP	Reserve/deposit ratio
$\widehat{DNFAY}$	b_1	0.025 (1.725)	0.153 (7.184)	0.003 (0.255)
$DNFAY_{t-1}$	b_2	0.026 (3.050)	0.020 (1.516)	-0.000 (-0.010)
$\widehat{DDCGY}$	b_3	0.087 (3.026)	-0.060 (-1.739)	0.248 (9.206)
$DDCGY_{t-1}$	b_4	0.089 (3.722)	-0.077 (-4.404)	-0.031 (-1.234)
$\widehat{INFGAP}$	b_5	-0.005 (-3.014)	0.062 (16.482)	0.015 (7.609)
			‘Low’ shift parameters	
$\widehat{DNFAY}$	b_6	-0.221 (-8.530)	-0.538 (-19.501)	-0.352 (-10.092)
$DNFAY_{t-1}$	b_7	0.001 (0.069)	0.167 (7.541)	0.110 (4.056)
$\widehat{DDCGY}$	b_8	-0.266 (-5.722)	-0.419 (-8.319)	-1.067 (-18.365)
$DDCGY_{t-1}$	b_9	-0.320 (-8.471)	0.164 (6.019)	-0.158 (-3.777)
$\widehat{INFGAP}$	b_{10}	-0.057 (-4.988)	-0.017 (-3.644)	-0.041 (-2.319)
$\bar{R}^2$		0.393	0.465	0.644

Table 2
Iterative 3SLS monetary policy reaction function *DDCPY* estimates by alternative indicators, 1972–95

Explanatory variable	Coefficients (equation **(3)**)	Alternative indicator	
		Inflation	Growth
$\widehat{DNFAY}$	b_1	0.154	-0.512
		(5.971)	(-16.589)
$DNFAY_{t-1}$	b_2	0.119	-0.162
		(7.605)	(-7.359)
$\widehat{DDCGY}$	b_3	0.535	-0.550
		(19.438)	(-16.381)
$DDCGY_{t-1}$	b_4	-0.037	-0.318
		(-1.559)	(-13.130)
$\widehat{INFGAP}$	b_5	-0.002	0.035
		(-1.407)	(6.877)
		‘Low’ shift parameters	
$\widehat{DNFAY}$	b_6	-0.489	0.408
		(-13.319)	(12.120)
$DNFAY_{t-1}$	b_7	0.121	0.150
		(4.720)	(6.485)
$\widehat{DDCGY}$	b_8	-1.077	0.542
		(-23.594)	(13.918)
$DDCGY_{t-1}$	b_9	-0.093	0.301
		(-2.481)	(10.222)
$\widehat{INFGAP}$	b_{10}	0.019	-0.021
		(0.657)	(-3.706)
$\bar{R}^2$		0.395	0.500

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Gilt-edged and sterling money markets: developments in 1997

This article reviews developments in the gilt-edged and sterling money markets during 1997. There have been significant changes in these markets, as a result of both official and private sector initiatives and external developments.

The economic backdrop was propitious, with economic growth sustained in the United Kingdom for the fifth successive year, and inflation remaining low. Bond yields fell, by more in the United Kingdom than in many other countries. In Europe, the prospect of EMU came into sharper focus, with implications both for market yields and trading arrangements.

The Bank introduced reforms to its sterling money-market operations in March, widening the range of counterparties with whom the Bank would deal, and including gilt repo as a regular instrument in the Bank's open market operations. As a corollary, the Bank's counterparties in the gilt market, the gilt-edged market makers, were no longer required to be separately capitalised or specially supervised. Later in the year, the upgrading of the Central Gilts Office service at the Bank was completed, enabling the start of gilt strips trading. Looking ahead, work is under way to set up the UK Debt Management Office, which will assume responsibility for the Government's debt management from April 1998; changes to bring the sterling markets closer into line with the prospective euro markets are planned for 1998; and, following the introduction of index-linked auctions in the United States, HM Treasury is consulting the UK market about a similar initiative here.

Gilt and money-market yields in 1997

Short-term interest rates were increased five times in the United Kingdom in 1997. The rise in UK rates, 125 basis points, was greater than in any of the other Group of Seven (G7) industrialised countries, reflecting different cyclical positions.

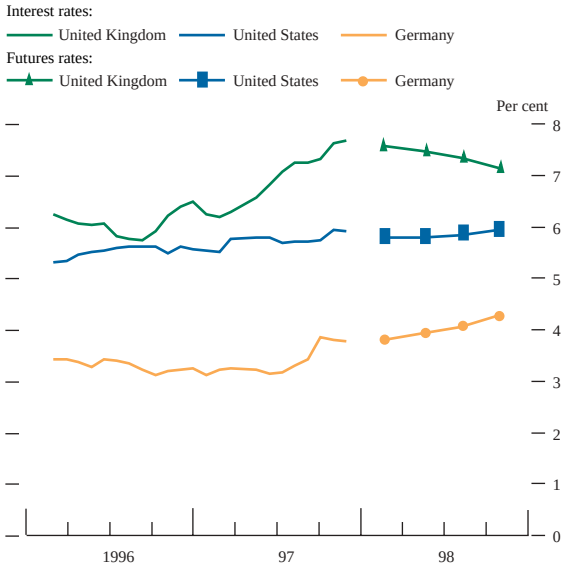
Chart 1 shows the path of three-month interest rates in the United Kingdom, Germany and the United States. The increases in UK official rates widened the gap between UK rates and German and US rates during the year. The chart also shows expectations of short-term interest rates, derived from futures prices. At the beginning of 1997, markets expected three-month sterling Libor to peak at 7.9% at the end of 1999. In the event, three-month cash rates reached 7.7% towards the end of the year, pushed up partly by credit conditions in the interbank market. By the end of the year, however, three-month cash rates were expected to fall from their December high, to 7.6% by March 1998, and to 6.5% by the end of 1999.

Gilt yields fell in 1997. At 10 years, yields fell by around 120 basis points (see Chart 2); at 20 years, they fell by around 155 basis points. Bond yields fell by less in most other industrialised countries so that, in the year as a whole, the gap between UK and overseas bond yields narrowed.

Bond yields rose in the first quarter. The rise in US short-term interest rates in March affected global bond markets. And in the United Kingdom, strong labour market and retail sales data led markets to expect interest rates to rise soon after the May General Election.

For most of the rest of 1997, global bond markets rallied (as Chart 3 shows), helped by two factors. First, markets

Chart 1
Three-month interest rates and futures rates(a)

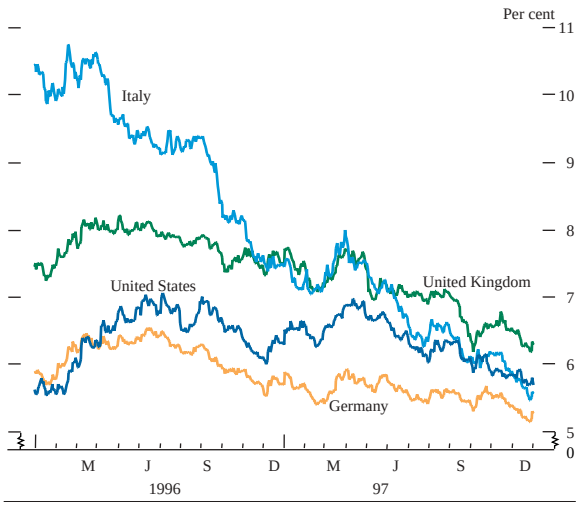


(a) Three-month Libor rates and rates implied by three-month futures contracts, traded on LIFFE and the Chicago Mercantile Exchange.

Chart 2
Par yields on British government stocks at 5, 10 and 20 years

appeared to put increasing weight on the view that global inflation pressures would remain low, largely because of continuing low inflation in the United States despite the strengthening labour market. Second, growing market confidence in EMU helped to stimulate convergence of European bond yields. The gap between Italian and German ten-year yields narrowed by about 145 basis points during the year, for example.

Chart 3
International ten-year bond yields

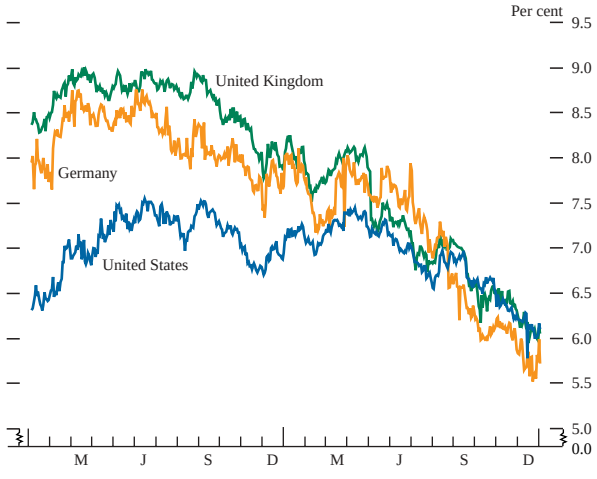


The gilt-edged market was also affected by three UK-specific factors:

- changes to the institutional monetary policy framework;
- the improving fiscal position; and
- the possibility of early UK entry into EMU.

On 6 May, the Government announced that the Bank would be given operational responsibility for setting interest rates to achieve the Government's inflation target, with

Chart 4
Implied forward interest rates(a)



(a) Nominal six-month annualised interest rates, ten years forward, derived from the zero-coupon yield curve.

immediate effect. The gilt market rallied strongly on this news: ten-year yields fell by 29 basis points on the day. Inflation expectations, derived by comparing conventional with index-linked bond yields, fell by nearly half a percentage point ten years ahead, on the announcement of the Bank's operational independence. Over the year as a whole, inflation expectations fell more sharply at long maturities than at short: 15 years ahead they fell by 0.9 percentage points, and 3 years ahead by about 0.7 percentage points (see Chart 5).

Chart 5
Implied forward inflation expectations(a)

(a) Six-month annualised inflation rates, 3, 5 and 15 years forward, derived by comparing yields on conventional and index-linked bonds.

In the second half of the year, markets took the view that the Government's fiscal position in the current financial year and in future years was stronger than previously expected. This also contributed to the fall in gilt yields. The Budget on 2 July revised down the forecast CGBR for 1997/98 from £20 billion to £12.4 billion. The pre-Budget statement on 25 November revised that forecast down further to £11.7 billion.

During September, markets focused on the possibility of early UK entry into EMU, pushing gilt yields sharply lower at the short end of the yield curve.(1) During the fourth quarter, the gilt market (like other bond markets) was affected by the financial turbulence in Asia. At times, gilts were seen as a 'safe haven' and yields fell.

The index-linked gilt (IG) market was also affected by some of the above factors. The fall in inflation expectations following the announcement of the Bank's independence tended to make IGs less attractive as an inflation hedge. During 1997, IG yields fell by around 45 basis points at twelve years, less than the fall in conventional yields at a similar maturity. A notable development during the year was the fall in UK real yields relative to those in the United States (see Chart 6). UK-specific factors may partly explain the divergence: in particular, the Minimum Funding Requirement, introduced in April, boosted demand for index-linked gilts from UK pension funds.(2)

Chart 6
Real yields on index-linked bonds

(a) Real yields on 3⅜% inflation-indexed 2007.
(b) Real yields on 2½% index-linked 2009.

Developments in the sterling money markets

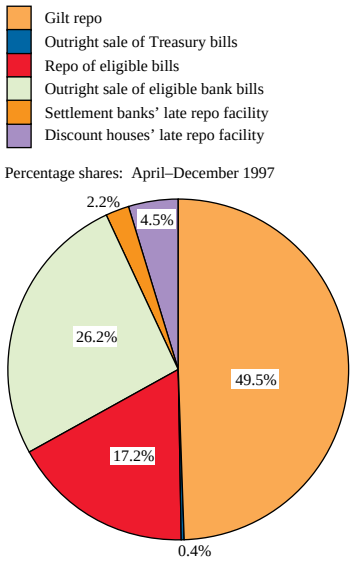
Open market operations

On 3 March 1997, the Bank introduced reforms to its sterling money-market operations. These reforms are described in detail in the May 1997 *Quarterly Bulletin*.(3) The two main elements of the reforms were the introduction of gilt repo as a regular instrument in the Bank's open market operations (OMOs), increasing the pool of eligible collateral; and increasing the number and range of counterparties with whom the Bank was prepared to deal. The reforms had a number of objectives:

- to increase the efficiency with which the banking sector's daily liquidity needs were met;
- to increase competition in the money market by making it more contestable (increasing the number of actual and potential counterparties);
- to relieve the strain on the bill market by increasing the pool of eligible collateral; and
- to continue to set very short-term interest rates, focusing on the two-week maturity.

During the first ten months of the new operations, about one half of the refinancing was provided by gilt repo, about one quarter by sales of bills outright, and about 17% by repo of eligible bills (see Chart 7).

Chart 7
OMOs—instrument overview



Sterling overnight interbank average rate (SONIA)

During the year, the market introduced a new measure of the shortest interest rate in the money market, the sterling overnight interbank average rate (SONIA). SONIA is a potentially useful tool to gauge short-term money-market conditions. Its derivative, the overnight indexed swap (OIS), provides a measure of expectations of official interest rates in the short term. SONIA is the average interest rate, weighted by volume of trade, on unsecured overnight interbank lending arranged by seven brokers in the London money market; it has been quoted since April 1997. SONIA is a better measure of the cost of borrowing money than, say, highs and lows taken from screens each day, because it is transactions-weighted: screen-quoted Libor rates are often merely indicative. Money markets in other countries, including France and Germany, have rates equivalent to SONIA. (See 'Monetary operations' in the August 1997 *Quarterly Bulletin*, pages 248–64 for further information.)

(1) See page 335 of the November 1997 *Quarterly Bulletin*.
(2) See box on page 341 of the November 1997 *Quarterly Bulletin*.
(3) See pages 204–7.

Overall, the reforms have proved successful. The stock of refinancing—the outstanding amount of refinancing that the Bank has provided to the market through OMOs—varied a little more in 1997 than in 1996. The higher variability in 1997 reflected the pattern of relatively even gilt financing, compared with the uneven profile of the CGBR and gilt redemptions—government spending is often bunched toward the end of the financial year; and this year, that effect was compounded by two large gilt redemptions in January 1998 and March 1998. As a result, the daily shortages tended to be larger and more variable: the shortages averaged £1.2 billion in 1997, compared with £0.9 billion in 1996, and their variability, measured by the coefficient of variation (standard deviation divided by mean), was 50% in 1997, compared with 43% in 1996.(1) The new system has coped well with these larger and more variable shortages.

The low stock of refinancing during August and September led the Bank to adapt its money-market operations. The redemption of £5½ billion of 8¾% Treasury Loan on 1 September 1997 meant that the Bank needed to drain additional liquidity from the money market during September. To cope with the expected fall in the stock of refinancing, the Bank issued one-month Treasury bills in addition to its regular tender of three-month bills. Issuing one-month bills allowed the Bank to target a particular month in which to drain liquidity. The Bank also adapted its daily money-market operations (to help deal with the particular day when the gilt matured)—adjusting the maturity of its repo operations and offering to buy in the maturing stock as part of its OMOs. (These operations are described in more detail in an article in the May 1997 *Quarterly Bulletin*, pages 204–7.)

The gilt repo market

The gilt repo market is now two years old. It grew less quickly in 1997 than in 1996. After its early rapid growth, the repo market has matured into an important form of secured money at the short end of the sterling markets. Table A puts the gilt repo market in the context of other sterling money markets. By November 1997, the amount of gilt repo outstanding was £72 billion, compared with £100 billion for sterling certificates of deposit (CDs). (The CD market has continued to grow; favourable treatment of CDs within the sterling stock liquidity regime may be part of the reason for that. CDs have also frequently been used as collateral in stock lending transactions making gilts available to repo market players.)

The stock of eligible bank bills (bills that may be sold to the Bank as part of its daily operations) was broadly unchanged last year, at around £21 billion. So the introduction of gilt repo to the Bank's daily OMOs has been invaluable in dealing with this year's larger daily shortages.

A working party of the Stock Lending and Repo Committee (SLRC), under the chairmanship of the Bank, has been reviewing the Gilt Repo Code of Best Practice, the Code that guides conduct in the gilt repo market. The Code was established as part of the Bank's preparations for open gilt repo, and the SLRC has agreed to ensure that it remains up-to-date and continues to reflect best practice in the market. A revised version will be published shortly. Changes are expected to be relatively minor and technical, including a number of amendments that reflect the recent introduction of the upgraded Central Gilts Office (CGO) settlement system. The present conventions regarding substitutions and partial deliveries may also change.

Table A
Sizes of sterling markets(a)

£ billions

		Commercial paper	Treasury bills	Eligible bills	CDs	Interbank (b)	Gilt repo	Gilt stock lending
1996	Feb.	7	12	22	77	110	37	5
	Nov.	7	5	23	89	124	68	16
1997	Feb.	8	4	22	94	119	71	14
	Nov.	8	3	21	100	135	72	24

(a) Outstanding amounts at the end of each month.
(b) Sight and time deposits.

Developments in the gilt market

The reform programme

Structural reforms in the gilt market continued in 1997. The principal developments during the year included the inauguration of the upgraded CGO service in November, and the start of the official gilt strips facility a month later; the lifting of the requirement for GEMMs to be separately capitalised; the announcement of prospective changes to the taxation of gilts; and consultation with the market on plans for changes in gilt market conventions. Meanwhile, the Government announced its intention to transfer responsibility for debt management from the Bank of England to a new Debt Management Office (see page 59).

Strips

The official gilt strips facility was launched on 8 December 1997. The new facility enables gilt holders to exchange a coupon-bearing gilt for an equivalent series of zero-coupon payments (strips): one for each of the semi-annual coupon payments and one for the final principal payment. Conversely, those who wish to exchange an appropriate bundle of strips for a coupon-bearing gilt can make use of the reconstitution facility. Stripping and reconstitution are both available through gilt-edged market makers (GEMMs); strips are held in CGO in dematerialised form.

Strips provide a flexible new instrument, with many potential uses for investors and traders. They enable investors to match their cash flows more closely with their liabilities; bullish investors can take positions in long strips; and long-term savings institutions may be interested in the higher durations that strips provide.

(1) One reason why daily shortages were larger than in 1996 was that the twice-monthly gilt repo facility, used as an additional tool to smooth the money-market position, was withdrawn soon after the new money-market arrangements started in March. The new arrangements gave counterparties the choice of when to use gilts as OMO collateral.

Establishment of the new Debt Management Office

On 6 May 1997, the Chancellor of the Exchequer announced, as part of his decision to give operational independence in setting interest rates to the Bank, that the Bank of England's role as the Government's agent for debt management, the sale of gilts, oversight of the gilts market and cash management would be transferred to the Treasury. The Treasury published a consultation document on 29 July ('The Future of UK Government Debt and Cash Management'), setting out the Government's initial proposals for the implementation of the Chancellor's decision by establishing a debt management body as an executive agency of the Treasury. A summary of the response to this consultation, together with an update on the Treasury's latest thinking on how the transfer of responsibilities will be implemented, was published on 22 December.

The agency, which will be called the Debt Management Office (DMO), will be formally established on 1 April 1998. As an Executive Agency, the DMO will not require legislation for its establishment. As now, Treasury ministers will set the annual Remit for the agency, published in the Debt Management Report each March. The Chief Executive will report regularly to Treasury ministers on the delivery of the Remit requirements, and to agree any changes required to the Remit during the year. The precise relationship of the DMO to the Treasury will be set out in a published framework document.

The DMO will be responsible for implementing the annual gilt Remit for 1998/99. Hence, from April 1998, it will be responsible for decisions on auction stocks and sizes, taps of stock and any secondary market transactions within the terms of the Remit. The current intention is that the DMO's dealing capacity should be operational by 1 April 1998, but in the case of any delay, there may be a short period when the Bank continues to deal on the agency's behalf. The DMO will use the Bank's systems for settlement and registration.

There are no plans to change significantly the existing approach to debt management. The current policy of publishing an annual borrowing programme with a quarterly auction schedule, regular consultation meetings with market participants, and building up large benchmark issues will continue. Nor is it envisaged that there will be any significant change in the way in which the DMO will operate in the secondary market, compared with the Bank's current practice.

Traders can buy or sell strips for periods for which they have a view about interest rates; and by conducting similar transactions in strips in overseas bond markets, they may take or hedge a position on relative rates between the UK and those overseas markets at a precise period. Strips may therefore provide a useful source of information about these expectations.

The strips market has started quietly, as expected in its very early stages (see the box on pages 66–67 for more details). Around £82 billion of current outstanding stock is strippable, of which £873 million had been stripped as of 9 January. Market interest appears greatest at long maturities, but there has also been an interest in other maturity areas. For example, it has been suggested that short strips might be used to back retail products offering a guaranteed minimum return or, at the very short end, as a money-market instrument.

The authorities plan to review experience with strips trading during 1998 and may broaden the uses of strips in the light of the volatility and liquidity of the strips market. The Bank intends to make gilt strips eligible as collateral in its daily money-market operations and that, in due course, strips should be eligible for the purposes of RTGS facilities provided by the Bank to settlement members of the CHAPS Clearing Company Ltd. In addition, the Treasury is considering technical changes to facilitate stripping of index-linked gilts.

Launch of the upgraded CGO system

The upgraded CGO system was successfully launched on 10 November 1997. The Bank announced in November 1995 that the CGO system was to be upgraded to facilitate handling of gilt repo and strips. The new system now incorporates CREST software, and other new software designed to provide users with greater flexibility. The key benefits of the new system include: (i) a stripping and reconstitution facility for gilts held in CGO; (ii) facilities for more efficient processing and settlement of repo transactions, which will allow back offices to settle a greater volume of trades; and (iii) forward-dated settlement. The upgraded CGO offers a wider range of facilities, providing the gilt market with a more sophisticated and flexible system through which to settle gilt transactions.(1)

End of separate capitalisation for GEMMs

In March 1997, the Bank withdrew the requirement for GEMMs to be separately capitalised. This enabled GEMMs to assimilate their businesses into group-wide securities-trading operations to benefit from potentially lower regulatory capital requirements, and to integrate their systems, management and control structures more fully with those of the rest of the group. Most GEMMs took advantage of the ending of the requirement, with only five GEMMs (out of seventeen) remaining separately capitalised after December 1997.

(1) For more details, see the article on pages 70–78.

The Bank has also ceased specialist supervision of the GEMMs. From March 1997, there was a seven-month transition period during which GEMMs transferred either to the appropriate banking supervisor (the banking supervision department of the Bank of England or a European Economic Area banking supervisor) if the GEMM business merged with a bank, or to the Securities and Futures Authority if the GEMM business merged with a securities firm or remained separately capitalised. Supervision of GEMMs will be undertaken by the Financial Services Authority when it begins to operate, except where a GEMM has merged with a bank that is subject to supervision by an overseas EEA banking regulator. The Bank will of course continue to monitor developments in the gilt market: the Bank conducts open market operations in gilt repo; the Bank has a general interest in the safety and efficiency of sterling markets; and information about market conditions also contributes to the Bank's monetary policy analysis.

Changes to gilt taxation

Legal provisions introduced as part of the July 1997 Budget will facilitate the receipt of gilt income in gross form. From 6 April 1998, all gilt holders will be able to receive income from their gilts in gross form, and special applications to the Inland Revenue for gross tax treatment will no longer be necessary. New holdings will automatically receive gross tax treatment (unless gilt holders indicate otherwise). Income from existing holdings will continue to be treated as now (unless gilt holders specify otherwise). Gilt holders can indicate to the Bank of England Registrar's Department which tax treatment they prefer.

In addition, as part of the reform of Corporation Tax, in November 1997 the Chancellor announced plans to abolish quarterly accounting for gilts from 1 April 1999. Under the new regime: (i) tax payments will apply one quarter in arrears; (ii) the new arrangements will not apply to small companies; (iii) changes will be phased in over four years (but current arrangements will disappear in April 1999); (iv) the new arrangements will also apply to equities and corporate debt. These provisions apply both to strips and strippable gilts in the same way.

Gilt market conventions

In February 1997, the Bank issued a consultative paper on gilt market conventions. Three issues were raised for discussion: first, whether the daycount convention for the calculation of accrued interest should be changed from 'actual/365' to an alternative formula;(1) second, whether the convention of quoting gilt prices in fractions ($^{1}/_{32nds}$) should be changed to decimals; third, whether the ex-dividend period for gilts held in CGO should be abolished and the ex-dividend period for gilts held outside CGO reduced, and whether the special ex and special cum-dividend facilities should be amended or dropped.

In May 1997, the Bank announced the results of its consultation. In the light of market participants' responses, the Bank proposes to change to an 'actual/actual' convention for accrued interest calculations, and to the quotation of gilt prices in decimals. These changes will harmonise gilt market conventions with practices in European and other key bond markets (see the box on page 61) and were judged to be desirable whether or not the United Kingdom joins EMU. Implementation will take place by 1 January 1999.

A large majority of those responding to the consultation also favoured the abolition of the ex-dividend period for gilts held in CGO and the abolition of the special ex and special cum-dividend facilities. The launch of the upgraded CGO system was a pre-condition for such changes, though other systems amendments will also be necessary. A decision on possible changes to the ex-dividend period will be announced in 1998. If pursued, the implementation date would allow the market ample lead-time.

LIFFE contract changes

In response to market demand and competition from other exchanges, LIFFE announced on 25 November that they would shortly be launching a new five-year gilt futures contract. The detail of the contract was announced on 27 January. The front delivery month for the new contract will be June 1998. The contract will be listed and traded from 26 February 1998; gilts with four to seven years' maturity will be deliverable in fulfilment of the contract; the contract will be quoted in decimals, rather than fractions; and it will have a nominal value of £100,000.

The decision to launch the five-year contract in decimals ahead of the introduction of decimalisation in the cash market was taken as a result of feedback from LIFFE members, who expressed a desire to see the contract listed in decimals from the outset. (The Bank is planning to introduce decimalisation by 1 January 1999—see 'Market conventions' above). The quotation in decimals prompted LIFFE to set the nominal size of the contract at £100,000, thereby implying a tick size (the minimum unit of price movement) of £10. LIFFE members unanimously agreed that a contract size of £50,000 listed in decimals would have too small a tick size (£5).

The notional coupon on the five-year contract will be 7%. The notional coupon is key to the calculation of the price factor—the formula by which different bonds are equated to the futures contract for the purpose of delivery. When actual yields remain below the notional coupon, as has been the case with the long gilt future throughout 1997, the price factor system introduces a bias that encourages delivery of the high-coupon bonds.

(1) Daycount conventions are used to calculate redemption yields and accrued interest on bonds. For example, the accrued interest payable on a gilt using the 'actual/365' conventions would be the coupon multiplied by the actual number of days since the last dividend date, and divided by 182.5 (half of 365, because dividends on gilts are paid semi-annually). The calculation using the 'actual/actual' convention is the same except that the denominator used is the actual number of days in the dividend period. Most European government bond markets use a third, less exact, convention which assumes a 360-day year of twelve 30-day months ('30/360') to simplify the calculation.

Sterling markets and EMU

Following the Chancellor of the Exchequer's statement to the House of Commons on 27 October, confirming that the United Kingdom would not seek membership of the single currency at its start on 1 January 1999, it is clear that sterling markets will remain in being for some time after the introduction of the euro. But market participants will also have to proceed with preparations for conversion from sterling to the euro, following possible later UK entry into EMU.

Sterling markets following the introduction of the euro

The structure of the sterling money and bond markets will remain largely unchanged after the move of other countries to the third stage of EMU in 1999. The Bank of England has no plans to alter its operations in the sterling money markets because of the introduction of the euro. Likewise, the UK government will continue to issue gilts in sterling. Of course, the markets themselves will be affected by the existence of a very large neighbouring capital market. Gilt yields are likely to be influenced by movements in the euro yield curve. Traders already look closely at the yield differential between gilts and German government bonds. This type of trading behaviour is likely to increase after EMU begins, and as sterling and euro yields converge in line with expectations of UK entry into EMU.

The main wholesale market associations have agreed recommended market conventions for the euro, as set out in the table below. These were announced on 9 July and endorsed by the EMI Council in September. Sterling markets will not necessarily adopt these conventions. For example, the basis on which interest is calculated in the sterling money markets will continue to be the actual number of days from value to maturity divided by 365, as opposed to 360; and business days for sterling transactions will exclude UK bank holidays. But two changes to gilt market conventions are planned, and both are in the direction of harmonisation with the new euro standards. First, gilt prices will be quoted in decimals (£0.01 per £100 nominal) rather than fractions (£$^{1}/_{32nds}$ per £100 nominal). Second, accrued interest in the gilt market will be calculated on the basis of an 'actual/actual' daycount, rather than the current convention of 'actual/365'.(1) These changes will be implemented by 1 January 1999, and follow full consultation with gilt market participants.

Recommended market conventions for the euro

Euro money markets
- Daycount basis: actual/360
- Settlement basis: spot (two-day) standard
- Fixing period for derivatives contracts: two-day rate fixing convention
- Business days: TARGET operating days should form the basis for euro business days

Euro bond markets
- Daycount basis: actual/actual
- Quotation basis: decimals rather than fractions
- Business days: TARGET operating days should form the basis for euro business days
- Coupon frequency: no standardised practice is recommended
- Settlement dates: the standard for internationally traded cross-border transactions for the euro should remain on a T+3 business day cycle

Euro foreign exchange markets
- Settlement timing: spot convention, with interest accrual beginning on the second day after the deal has been struck
- Quotation: 'certain for uncertain' (ie 1 euro = x foreign currency units)
- Reference rate: the ECB (or national central banks) should be responsible for the publication of daily closing reference rates

(1) In practice, this means the accrued interest payable on a transaction is calculated as the semi-annual coupon multiplied by the number of days since the last coupon date, divided by the number of days in the coupon period. Currently, the denominator is always 182.5 (ie 365/2).

The specification of the existing March 1998 long gilt contract differs from the new five-year contract: it is quoted in fractions ($^{1}/_{32nds}$), and it has a 9% notional coupon and a nominal value of £50,000. In order to bring the short and long gilt contracts into line, LIFFE listed the June 1998 long gilt contract on 1 December 1997 with a reduced notional coupon of 7%. LIFFE subsequently announced, on 17 December, that the June 1998 long contract would switch from fractions to decimals with effect from the beginning of May 1998, resulting in a tick size of £5 until the contract's expiry (since the nominal value of the contract will remain unchanged at £50,000). The listing of the September 1998 long gilt contract has been deferred to the end of February, to enable the contract specification to incorporate decimals from the start; this contract will have a nominal value of £100,000, and hence a tick size of £10.

Extension of the LIFFE basis-trading facility

A basis trade involves the simultaneous exchange of a cash bond and an appropriate offsetting number of futures contracts, in a privately negotiated transaction between two parties, organised outside the trading pit. The cash and futures legs of the basis trade are negotiated simultaneously, but are executed separately. LIFFE's basis-trading facility (BTF) permits the futures leg of eligible basis trades to be transacted at a dedicated post and without price execution risk.

LIFFE's BTF has been available for the transaction of futures legs of basis trades involving deliverable (ie belonging to the deliverable basket of the relevant futures contract) cash government bonds since July 1995—initially for German bunds and later extended to Italian BTPs and UK gilts. Such 'deliverable basis trades' make use of the price factor. The price factor is the price of an individual cash bond such that its yield to maturity on the delivery day of the relevant futures contract is equal to the notional coupon of the futures contract (and then divided by 100). The price factor maps the futures price onto the price scale of the deliverable cash bond: the product of the price factor and the futures price is the forward price available in the futures market for that cash bond. The price factor is used in deliverable basis trades to establish the price relationship between, and the

Consultation on index-linked auctions

The 1997/98 Debt Management Report (published in March 1997) stated that the UK authorities saw positive merit in moving to an index-linked gilts (IGs) auction programme as soon as was feasible. This was subject to: first, reviewing the impact of the early US experience in auctioning inflation-indexed government securities; and second, conducting a further round of consultation with the market. In the consultation document 'The Future of UK Debt and Cash Management' (July 1997), the new Government confirmed that it intended to proceed with this consultation, with a view to introducing auctions for IGs in due course.

US experience of auctioning index-linked debt

The US Treasury conducted four auctions of its new inflation-indexed securities in 1997 and another in January 1998. Summary statistics from these uniform-price auctions appear in the table. To date a total of $39 billion of five-year and ten-year Treasury inflation-indexed securities (TIIS) has been issued.

Summary of US Treasury inflation-indexed security auctions

Auction date	Maturity date	Clearing yield (per cent)	Median yield (per cent)	Lowest yield bid (per cent)	Bid/cover ratio
1997 Jan.	Jan. 2007	3.449	3.400	3.200	5.31
Apr.	Jan. 2007	3.650	3.590	3.450	2.26
July	July 2002	3.744	3.668	3.550	3.31
Oct.	July 2002	3.600	3.580	3.499	3.56
1998 Jan.	Jan. 2008	3.730	3.699	3.580	2.94

The design of these inflation-indexed securities and the outcome of the first two auctions were examined in greater detail in the May 1997 *Quarterly Bulletin*. The US Treasury is currently engaged in a consultation exercise with the market on possible minor changes to the terms of trading TIIS in order to ensure fungibility between coupon strips from different indexed securities, and it plans to have established, by the end of 1998, a regular calendar for issuing new 5, 10 and 30-year TIIS.

Consultation document

Following the early US experience with TIIS auctions, the Treasury published on 5 January 1998 a consultation document on the introduction of IG auctions in the United Kingdom.(1) Responses were invited from GEMMs, end-investors and other interested parties.

The consultation document concentrated on four sets of issues:

(i) Structure of IG auctions

Views were invited on the size, frequency, and annual calendar of any IG auctions. In addition, comments were invited on the possible format of the auctions, including whether the type of bidding should be uniform or bid-price. (In a uniform-price auction, all successful bidders pay the clearing price, irrespective of their individual bids; in a bid-price auction, successful bidders pay what they bid.)

(ii) Issuance policy

Views were invited on whether IGs should be issued solely through auctions, or whether issuance through taps should continue between auctions. The presumption is that there would be no issuance (or buying in) in the two weeks before an auction, nor in the period immediately after the auction, at or near the auction price.

(iii) Market structure and index-linked gilts

In December 1995, the Bank of England conducted a consultation exercise on the advantages and disadvantages of establishing a separate list of IG market makers. At that time, market views were divided. The question has been reopened in the current consultation round, along with the issue of obligations and privileges that should attach to membership of such a list, including access to auctions.

(iv) IG redesign

Views were invited on the value that market participants would attach to a redesign of IGs—were the authorities to consider this—to bring them into line with the US/Canadian model (the main features of which include a three-month time lag in applying the inflation uplift, strippability, and benchmark issuance).

The consultation document asked for views on how IG coupon strips could be made fungible, and suggested that in order to achieve this, the nominal coupons on the bonds in question would have to be equal—equivalently, the bonds would need to have aligned coupon dates, the same base RPI value and the same real coupon.

(1) Copies can be obtained from Ms N Trebble, HM Treasury, Debt and Reserves Management Team, 2nd Floor, Treasury Chambers, Parliament Street, London, SW1P 3AG.

relative amounts of, the cash and futures leg (the 'gross basis' and 'hedge ratio', respectively).

From 23 February, LIFFE will permit the futures legs of basis trades involving a range of cash bonds outside the futures leg's deliverable basket to be transacted via the BTF. In the absence of price factors for such 'non-deliverable basis trades' (price factors only exist for deliverable cash bonds), the hedge ratio is established using the sensitivities of the cash bond and the futures contract to changes in yield (the price sensitivity of an instrument to changes in yield is quantified as the 'basis point value' or BPV). The resulting hedge ratio is known as the BPV or 'modified duration' hedge ratio. For example, if the price of a bond moved 7 basis points in response to a 1 basis point change in yield, its BPV would be 7. The BPV of a bond futures contract is the ratio of the BPV of the cheapest to deliver ('CTD') bond to the price factor of the CTD (the CTD bond in the deliverable basket that is, given prevailing market conditions, the most economically rewarding deliverable bond for the seller of the futures contract to select to deliver into the contract at delivery). The ratio of the BPV of the cash bond to the BPV of the futures contract (all then multiplied by the nominal amount of the cash bond and divided by the notional amount of one bond futures contract) gives the number of bond futures contracts required in the BPV hedge ratio.

Operational Notice

In July 1997, the Bank issued a revised version of the Operational Notice, first published in June 1996, setting out the objectives and procedures for the Bank's operations in the gilt-edged market, acting as the Government's debt manager. The notice describes the arrangements for the primary and secondary market operations that the Bank undertakes. It covers auctions, tap sales, sales from official portfolios and other secondary market operations.

The changes from the previous notice were largely technical, covering in particular the change in the timing of gilt auctions introduced in March (with bidding closing thirty minutes later, at 10.30 am).

Gilt sales requirement

The gilt sales requirement is set at the start of each financial year in the Remit given to the Bank as the Government's debt manager. (The box on page 59 discusses the impending transfer of responsibility for debt management.) The sales requirement may be revised during the year as the Government's financial requirements change. Gilt sales in the first calendar quarter of 1997 (the final quarter of the financial year 1996/97) totalled £9.7 billion, bringing the total for the financial year to £38.8 billion. Mainly as a result of a lower CGBR outturn than forecast, overshooting of the gilt sales target of £3.9 billion was carried forward into the following financial year.

The gilt sales target for 1997/98 was originally set at £36.5 billion in the annual *Debt Management Report* published on 12 March 1997, based on a CGBR forecast of £20.0 billion and expected gilt redemptions during the year of £19.6 billion. This target was subsequently revised down by £3.9 billion when the carry-over of excess gilt sales from the previous year was confirmed. Following the Budget in July, the CGBR forecast was reduced from £20.0 billion to £12.4 billion and the gilt sales requirement fell to £25.1 billion. In the November pre-Budget Statement, the CGBR forecast was again revised downwards to £11.7 billion, but the reduction in the expected contribution from National Savings, from £3 billion to £2 billion, meant that the gilt sales requirement increased slightly from £25.1 billion to £25.4 billion. By the end of December, three quarters of the way through the financial year, more than 80% of this target had been met.

Stocks issued

Gross gilt sales during 1997 were £30.7 billion, of which £20.9 billion was in the first nine months of the current financial year. Sales of index-linked gilts raised £4.9 billion. Index-linked sales in the 1996/97 financial year as a whole accounted for 15% of total gilt sales, precisely in line with the target in the Remit from the Government to the Bank. The target for index-linked sales for 1997/98 was increased to 20% of total gilt sales, reflecting the authorities' assessment that index-linked gilts continue to have cost and risk advantages for the Government, and expectations of increased demand for index-linked gilts following the introduction of the Minimum Funding Requirement under the Pensions Act in April.

The aim of approximately one third of conventional stock issuance in each maturity band (shorts 3–7 years, mediums 7–15 years, longs 15 years and over) was broadly achieved in 1996/97, with conventional funding distributed in the proportion of 34%, 31.5% and 34.5% across shorts, mediums and longs respectively. The target issuance pattern in the 1997/98 remit was changed slightly, skewed towards the short and long ends, with the targets for shorts, mediums and longs set at 35%:30%:35%. This revised distribution took into account the pattern of refinancing in the short term, while being broadly consistent with a stable portfolio mix in the longer term. It also reflected the greater likelihood of demand for gilt strips in the short and long maturity areas, and the stock maturities that fit more readily into the dual auction format (four of which were originally planned for 1997/98—see below).

Eleven of the auction sales during the year sold existing stocks, and two created new stocks. The first of the new stocks, issued in January, was the new ten-year benchmark (7¼% Treasury 2007), which was reopened three times during the year. The second new stock, issued in December, was a new five-year benchmark maturing in December 2003 (6½% Treasury 2003). The initial six-year maturity was intended to allow the authorities sufficient opportunity to build up liquidity in the stock in the light of the lower gilt financing requirement forecast for the next two years. There was no issuance of floating-rate stocks during 1997.

All of the £25 billion nominal conventional stocks issued during the calendar year were strippable (following the opening of the official gilt strips facility on 8 December 1997). It had been intended to build up the pool of strippable stocks further by making conversion offers during the year. In the event, however, this was prevented by the systems changes associated with the introduction of the upgraded CGO service, but the authorities reiterated their intention to make further offers in the 1998/99 financial year.

Methods of stock issuance

Auctions

Issuance of stock by auction accounted for all conventional sales in 1997, in line with the policy that auctions should constitute the primary means of conventional gilt sales. The frequency of auctions was slightly reduced in 1997, with auctions occurring in ten months of the year, compared with eleven in 1996. This reflected the cancellation of the auction originally scheduled for August, as a result of the reduction in the gilt financing requirement for the 1997/98 financial year announced after the July Budget (the auction scheduled for February 1998 was also cancelled). There were three dual auctions (auctions of two separate stocks held in close succession) in 1997, following their successful introduction in 1996, when two were held. Four dual auctions were originally scheduled to take place in 1997, but one of these was changed (together with that scheduled for the final quarter of 1997/98) to a single auction following the July Budget.

Table B details the auctions held in 1997. The average size of single auctions during the year was £2.1 billion (compared with £2.9 billion in 1996), and for each leg of the dual auctions the average size was £1.67 billion (compared with £1.75 billion in 1996).

Auction cover (the ratio of bids to stock on offer) was very slightly higher on average in 1997 than 1996, while yield tails (the yield difference between the average and lowest accepted price) were on average markedly lower. Higher cover at auctions in 1997 reflects greater bidding by the GEMMs for their own account (see Table C) as a proportion of the available stock. This appears related to the fact that auction sizes generally became smaller in 1997. There tends to be a negative correlation (albeit weak, with r-squared = 0.3) between the size of an auction and the amount GEMMs bid for (on a competitive own-account basis), which is related to the 'warehousing' role that GEMMs perform for clients. If the level of inventory risk exposure that GEMMs are prepared to face remains the same at each auction, then bidding would remain constant over time. When auctions become smaller, one would expect to see GEMMs' bidding increase, relative to the stock on offer, and this is what has happened during the last year. Allotments have also become less concentrated among the GEMMs, with more GEMMs being allotted more stock on a competitive basis than a year ago. This is also likely to have encouraged GEMMs' bidding.

Table B
Auction results

Stock title	Status	Amount of issue (£ billions)	Date of auction 1997	Average yield per cent	Times covered (a)	Tail (b) (basis points)
7¼% 2007	New Strippable	2.5	28 Jan.	7.57	2.17	1
7% 2002	Fungible Strippable	1.5	30 Jan.	7.13	3.82	0
8% 2021	Fungible Strippable	2.5	26 Feb.	7.38	1.93	1
7¼% 2007	Fungible Strippable	2.5	26 Mar.	7.64	3.09	1
7% 2002	Fungible Strippable	2.0	23 Apr.	7.24	3.49	1
7% 2002	Fungible Strippable	1.5	20 May	6.94	3.03	0
8% 2021	Fungible Strippable	1.5	22 May	7.24	1.29	4
7¼% 2007	Fungible Strippable	2.0	25 June	7.13	2.71	1
8% 2021	Fungible Strippable	2.0	23 July	6.86	2.32	1
7% 2002	Fungible Strippable	1.5	23 Sept.	6.71	2.30	1
8% 2021	Fungible Strippable	1.5	25 Sept.	6.57	2.33	1
7¼% 2007	Fungible Strippable	2.0	29 Oct.	6.66	2.39	1
6½% 2003	New Strippable	2.0	10 Dec.	6.53	1.77	2

Average outcomes

	1996 (c)	1997
Cover	2.48	2.51
Tail	1.83	1.16

(a) The ratio of bids to stock on offer.
(b) The yield difference between the average and lowest accepted price.
(c) Excluding floating-rate gilt auction.

Table C
Auction participation(a)

	1996	1997
GEMMs' own-account competitive bids	175	202
Customer competitive bids	71	47
GEMMs' cumulative shorting of positions covering the when-issued week, up to the evening before the auction	19	27
GEMMs' cumulative shorting during the when-issued week, including morning of auction	33	38

(a) Average for all auctions (as a percentage of the stock on offer). The figures are not weighted by the size of auction.

Client bidding also appears to have been affected by the smaller size of auctions. Clients of the GEMMs bid for about one quarter less in 1997 than in 1996 (as a percentage of the stock on offer). Smaller auctions have been associated with lower yield tails, which may reduce the attractiveness of bidding to clients, as lower-priced bids are less likely to be successful at smaller auctions. And anecdotal evidence suggests that smaller auctions tend to attract less publicity than larger ones and are therefore not as well bid by investors. Instead, clients have increasingly purchased stock during the 'when-issued' period before an auction, which is often seen as a substitute to bidding at the auction itself. Such purchases now tend to be made later on in the 'when-issued' period than has historically been the case, though clients have tended to buy less stock on the morning of the auction than they did in 1996.

Index-linked gilts

Index-linked gilts continued to be issued through the tap mechanism. The Treasury's *Debt Management Report 1997/98* stated that the UK authorities saw positive merit in moving to an index-linked gilt auction programme and intended to do so as soon as was feasible. But it was felt beneficial to observe further experience of the US Treasury inflation-indexed (TII) note auction programme and undertake further consultation on the format, timing and size of UK auctions before proceeding (see the box on page 62 on consultation on index-linked auctions).

The Minimum Funding Requirement contained in the Pensions Act, which came into force on 7 April 1997, is expected to lead to greater demand for index-linked bonds as a close match for some pension liabilities. The development of inflation-indexed bonds in the United States and elsewhere has also generated international interest. In anticipation of this increased demand, and bearing in mind the cost and risk advantages of such issuance to the Government, it was decided to increase the target for index-linked sales from 15% to 20% of total issuance for the 1997/98 financial year. This initially implied an index-linked sales target of £7.3 billion. This was reduced to £5.0 billion following the revised CGBR forecast in the July Budget, and then increased slightly to £5.1 billion following the Chancellor's November Pre-Budget Statement and the reduction in the expected contribution from National Savings. The reduced sales requirement contributed to the strong performance of the sector in the second half of the year.

A monthly average of £402 million of cash tap sales of index-linked gilts was made during 1997. In addition to the factors mentioned above, sales during 1997 were bolstered by institutional switching out of equities both in anticipation of, and following the removal of, pension funds' tax credit on dividends in the July Budget (which made equities less attractive relative to bonds), as well as the increased volatility in UK and other equity markets stemming from the turbulence in Asia.

There were eleven index-linked tap packages issued in 1997, of which eight comprised two stocks and three were for single stocks. The size of the packages varied between £150–400 million in nominal terms (or between £250–650 million by value). Issuance was particularly concentrated in the June-September period, in response to institutional demand before and after the July Budget. Demand was more subdued in April and May because of the increase in the index-linked sales target announced in March; the reduction in inflation expectations, and hence the attractions of index-linked stock following the changes to the institutional monetary policy framework announced on 6 May; and a US TII auction on 8 April that disappointed some market participants. The pace of issuance slowed again in the final quarter, in part reflecting the lower sales target.

Conventional taps

Taps of conventional stocks are used for market-management purposes, when there is temporary excess demand in a particular stock or sector. Conventional tap sales are becoming increasingly rare. In the financial year 1996/97, they amounted to only 1.5% of total issuance, well below the indicative ceiling of 10% of total issuance. There were no conventional taps in 1997.

Secondary market sales

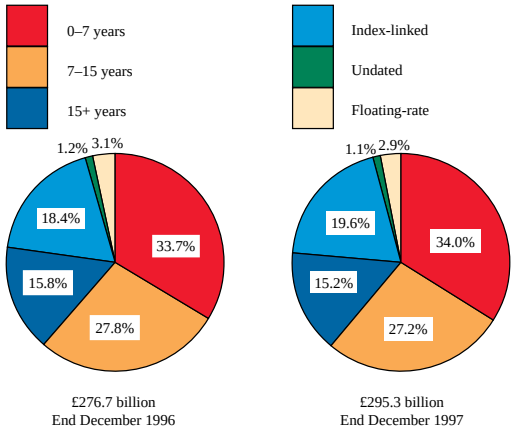
Net secondary market sales constituted only 1.3% of total gilt sales in 1997, consistent with the authorities' policy of concentrating sales in conventional auctions and index-linked tap sales.

The amount of stock available through the Bank's 'shop window' was boosted in the first half of 1997 by some sales of stocks by public funds managed by the Commissioners for the Reduction of the National Debt. This encouraged wider participation among the GEMMs and facilitated much greater switching activity, enhancing the liquidity of the market. Monthly switching turnover in the first half of the year averaged more than £590 million nominal, with turnover in February alone reaching £960 million. Outright sales from the shop window were made in response to GEMMs' bids during the strong market rally between May and September. There were no stocks in the shop window by the end of September, and monthly turnover of stocks in the shop window during the second half of 1997 was much lower, averaging just £92 million.

Stock outstanding

Chart 8 shows the breakdown of stock outstanding (in nominal terms, including the inflation uplift on index-linked gilts) at end 1996 and end 1997. Total gilts outstanding rose from £277 billion to £295 billion. Changes in the portfolio shares of different maturities reflect the effect of new issuance, redemptions and ageing. In 1997, the proportion of shorts:mediums:longs within conventionals changed very little, from 46:35:19 in 1996 to 45:35:20 in 1997. The percentage of index-linked gilts in the portfolio

Chart 8
Maturity breakdown of stock outstanding(a)



(a) Assuming latest possible redemption date for double-dated stock.

The start of the strips market

Since the launch of the gilt stripping facility on 8 December, strip market activity has been modest. This has allowed the market to develop liquidity gradually, as dealers and other market participants develop their systems and analytical capabilities without taking large risk exposures close to the year end. Experience has shown that the stripping and reconstituting mechanisms in CGO both work as intended. During the first month:

- GEMMs' turnover with their clients was roughly 2.3% of the average turnover in conventionals and index-linked gilts during the same period, representing a quiet but positive start;
- GEMMs were mainly taking positions in principal strips, mostly at the medium to long end. Between GEMMs, the trading activity appears mostly to be between principal strips and the matching coupon gilt;
- clients' interest has been both in principal and coupon strips. They have bought strips across the yield curve, with somewhat more trading in short and medium strips (perhaps because of the larger number and nominal value of strips at the shorter end);
- turnover in short and medium strips has been about equal, though a relatively higher interest in shorts might have been expected. The interest in mediums may reflect the fact that some medium strips have a similar duration to longer coupon-bearing gilts. This enables an investor to take a view by switching between coupon-bearing and zero coupon gilts, while keeping duration at the same level.

Stock outstanding

Stripping facilities already exist in the United States, Canada and France, among other countries; they were recently introduced in Germany and the United Kingdom, and will soon be introduced in Spain. The data below indicate that the most active strips markets are (i) relatively mature and (ii) provide large nominal outstanding values of strippable stock—notably the United States and France.

US, German, French, and UK strips markets(a)

	Date of start	Number of strippable stocks	Total strippable stock outstanding (billions)	Percentage stripped (by nominal value)
United States	February 1985	58	$1,150 (£701) (b)	20.2%
Germany	July 1997	4	DM 102 (£34)	7.56%
France	May 1991	22 9	FFr 1,229 (£124) ECU 20 (£16)	15.3% 3.95%
United Kingdom	December 1997	8	£82	1.1%

(a) Federal Government stocks only. US data are as of 7 January 1998. German data are as of 30 December 1997. French data are as of 30 December 1997. UK data are as of 9 January 1998.
(b) Exchange rates as at 2 January 1998.

Gilt strip pricing and zero-coupon curves

So far, strips are a small part of the gilt market, and strips prices may largely have been derived from those of coupon bonds. Strips prices can be derived using a model of the yield curve, but market practitioners have different models, and this has been reflected in the strips prices they have quoted. As trading builds up, arbitrage may bring prices quoted by different GEMMs closer together.

There is some evidence that convergence has been taking place. Each day, the GEMMs provide prices for gilts and gilt strips to the Bank of England, from which the Bank calculates reference prices on behalf of the Gilt-Edged Market Makers' Association (GEMMA). The standard deviation of the yields calculated from the prices quoted by each GEMM on the December 2007 coupon strip fell only slightly from 0.041 on 28 November to 0.040 on 9 January, but for the December 2017 coupon strip the corresponding fall was from 0.052 to 0.020. The prices

Table D
Strippable stocks outstanding (at end December 1997)

Stock title	Nominal amount in issue (£ millions)
8% Treasury Stock 2000	9,800
7% Treasury Stock 2002	9,000
6½% Treasury Stock 2003	2,000
8½% Treasury Stock 2005	10,373
7½% Treasury Stock 2006	11,700
7¼% Treasury Stock 2007	9,000
8% Treasury Stock 2015	13,787
8% Treasury Stock 2021	16,500

increased from 18.4% to 19.6%. Table D shows the amounts outstanding in each of the eight strippable stock at end 1997. The total nominal outstanding of the stocks amounted to 35% of total conventional stocks in issue.

Turnover in the gilt market

Customer turnover in gilts with the GEMMs (in value terms and excluding repo transactions) was on a rising trend through 1997 (see Chart 9). Average total weekly turnover was £24 billion in 1997, compared with £21 billion in 1996. Chart 9 shows that activity was highest in February, May and September, when the market rose. Turnover was also highest in those weeks when the Bank held an auction of gilts. On average, retail turnover in gilts was 12% higher in auction weeks compared with non-auction weeks in 1997. Interest in the auction stocks helps to stimulate activity in other stocks, eg through switching between bonds of a similar maturity. It may also reflect a perception that liquidity improves in auction weeks, thereby encouraging potential buyers and sellers of gilts into the market around times of an auction. Meanwhile, actual changes in short-term interest rates during 1997, as well as expected interest rate changes, probably contributed to an increase in overall gilts turnover. The rise in the amount outstanding in the gilt repo

submitted on 28 November were 'trialling' prices before trading had started, and probably reflect the different term structure models used to value strips in the early stages of the market.

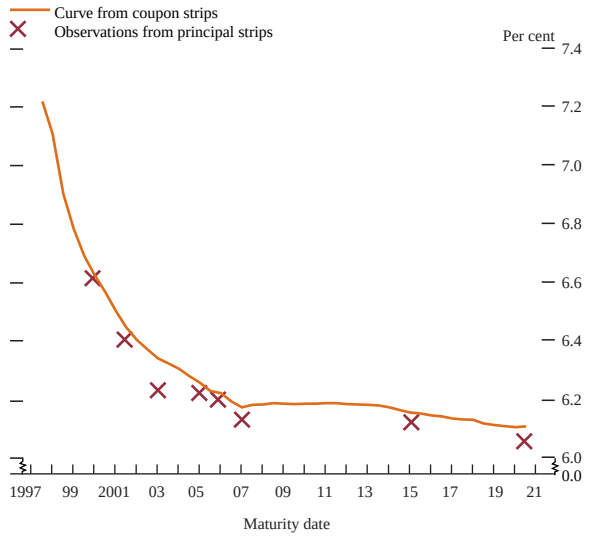
Factors that may explain why spot yields quoted on strips differ from spot yields derived from coupon-bearing gilts, other than yield curve model variations, include the following:

- Strip yields are likely to reflect liquidity considerations. Other things being equal, short coupon strips may be more liquid than longer-dated coupon strips (since there is a larger volume of short-dated strips outstanding, because of their accumulation from each of the individual strippable gilts); similarly, individual strips are likely to be less liquid than benchmark coupon gilts of the same maturity;

- 'segmentation effects' in the term structure of actual spot rates may occur, because demand is concentrated at particular points on the yield curve. For example, demand for short strips by financial institutions seeking assets with low credit and interest rate risk, and demand for long strips by pension funds seeking to match their long term liabilities, is likely to depress yields on short and long strips.(1) The main reasons why these demand effects may not have been eliminated by arbitrage are the relative lack of liquidity in this new market, and the risks and costs involved in taking short or long positions;

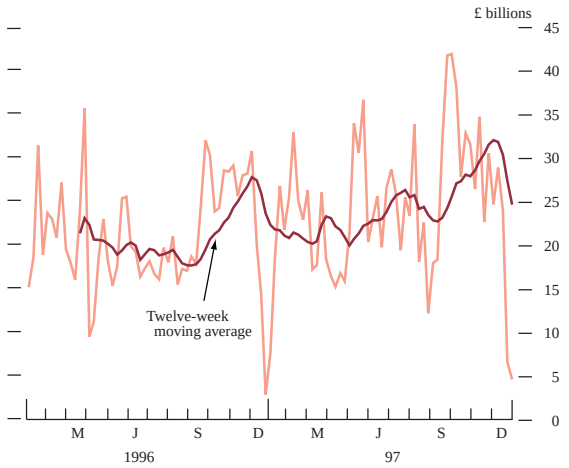
- since the principal strips have much greater amounts outstanding than the coupon strips of the same maturity (and hence are potentially more liquid) they will tend to trade at a lower yield. Early evidence suggests that this 'principal strip premium' is worth 0.5–3.0 basis points in yield terms, depending on maturity. But the coupon/principal yield difference can be well outside this range at any specific maturity. This is because the principal strip required for reconstituting a gilt is unique and cannot be constructed from coupon strips, and so any supply or demand influences on the underlying gilt (for example, status as a benchmark) will also affect the yield on the principal strip, and *vice versa*. For example, the December 2003 coupon/principal strip difference was around 10 basis points on 29 December 1997, reflecting the small amount outstanding of the new 6½% Treasury Stock 2003 issue. The chart illustrates the yield level differences between coupon and principal strips, as well as the large maturity gaps between the principal strips (which complicate the direct estimation of a complete zero-coupon curve from the principal strips).(2)

UK nominal interest rate spot curves (using strips prices) on 29 December 1997



(1) These effects may not occur to the same degree as with coupon-bearing gilts. For example, for a given maturity, strips provide higher durations than coupon-bearing gilts, and so for duration-matching reasons, strip spot yields at the long end are likely to be depressed relative to spot yields derived from coupon-bearing gilts.
(2) This chart uses the average of the reference prices quoted by the market makers, as calculated by the Bank of England.

Chart 9
GEMM customer turnover



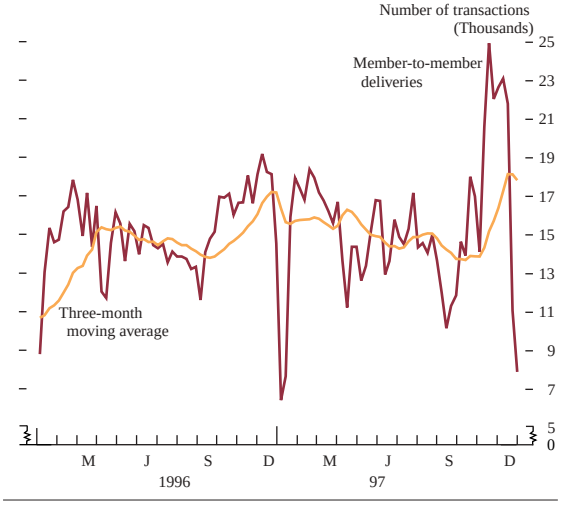
market will also have contributed to greater cash market activity.

Activity increased most in 1997 for those gilts with a very short maturity (one year or less), where the value of turnover rose by two thirds. The value of gilts outstanding in the under one year maturity range increased by less than 2% last year, partly because there were some substantial redemptions. For example, £3.7 billion of 10½% Exchequer Stock 1997 matured in February, and £5.5 billion of 8¾% Treasury Loan 1997 was redeemed in September last year. The value of redemptions in 1997 was significantly higher than in 1996, which helps to explain the strong rise in turnover in gilts with a maturity of less than one year—often market participants will switch into other stocks with a slightly longer maturity when gilts are near their redemption date ('churning'). This helps to maintain

the duration of an investor's gilts portfolio. There are also some large redemptions in the first half of 1998. For example, £8.1 billion of 7¼% Treasury Stock 1998 will be redeemed in March, which will be the biggest redemption in the history of the gilts market.

Data on work volumes (the number, not the value of transactions) in the Central Gilts Office are shown in Chart 10. The number of member-to-member deliveries (transfers of specific stocks) increased slightly from an average of 15,000 per week in 1996, to 15,500 per week in 1997.

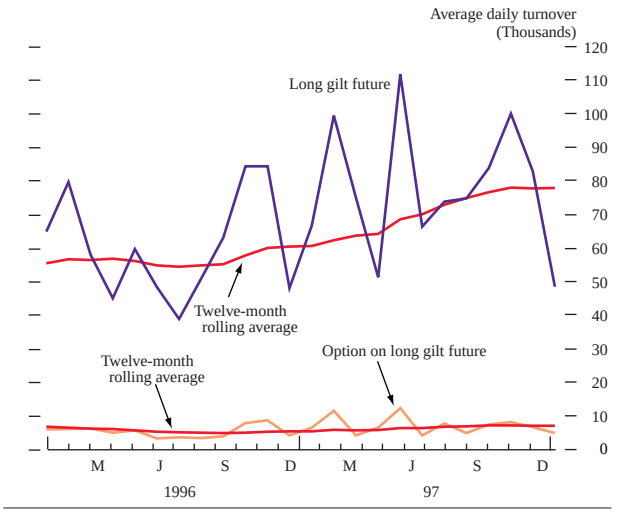
Chart 10
CGO weekly volumes



Turnover in long gilt futures on the London International Financial Futures and Options Exchange (LIFFE) increased by almost one third in 1997, averaging 78,000 contracts per day, compared with 60,000 per day in 1996 (see Chart 11). Volumes were highest in February, May and October, when the gilt market rose. Volatility helps to explain the amount of activity in the futures market as well as the cash market. Econometric tests suggest that in 1997, 'implied volatility' (which measures the expected level of volatility over the life of an option) and gilt futures turnover each explained one quarter of the movement in the other variable. But volatility in the gilt market was lower in 1997 than in 1996, so other factors will also have been important in explaining the rise in futures activity last year.

First, it is likely that expected and actual interest rate changes spurred activity in futures through 1997. Second, there is evidence that turnover in long gilt futures is highest in those weeks when there is an auction of gilts by the Bank, as in the cash market. On average, turnover in futures is about 5% higher in auction weeks than in non-auction weeks. Futures allow investors to hedge the interest rate risk on government bonds, and help dealers to manage the risk on their position-taking. Increased use of the futures contract as a hedge at auction times helps to explain the rise in futures turnover, though the rise in gilt futures turnover during auction weeks in 1997 was not as great as the increase in non-auction weeks. Finally, the extension of LIFFE's basis-trading facility to cover gilts in October 1996 has contributed to higher futures turnover in 1997. Basis trading arises from the difference between the clean price of a cash gilt (the price excluding accrued interest) and the clean price at which the gilt is bought through the purchase of a futures contract. This difference is known as the gross basis. Much of the difference can be explained by the difference between the running yield on a gilt and the current repo rate, but a residual amount will be unquantifiable, known as the net basis. For example, it will depend partly on the delivery option implicit in the futures contract (holders of short positions in a futures contract can choose which gilt to deliver, and at which point in the delivery month, hence the implicit option). Traders take positions on the size of the net basis.

Chart 11
LIFFE gilt derivatives: number of contracts



Bund futures turnover on LIFFE also appears to be higher in gilt auction weeks—about 9% higher than in non-auction weeks. Again, the rise in bund futures activity in auction weeks in 1997 was not as pronounced as during non-auction weeks.

Reversing the decline of last year, options turnover rose by a third in volume terms, averaging 7,000 contracts a day. Higher options turnover in 1997 is likely to reflect the more mature and liquid futures market in gilts. Greater interest in options also indicates more volatile trading conditions in 1997. Though the growth of the market has been significant, turnover in gilt options remains fairly low relative to the amount of futures contracts traded.

GEMMS' financial performance

One GEMM left the market last year, leaving a total of 17. In aggregate, the GEMMs continued to make a profit in 1997. Total post-tax profits were reported to be £59 million in 1997, compared with approximately £11 million in 1996. Last year, many GEMMs merged with their parent companies, so the 1997 figure includes GEMM-related business that would previously have been booked outside the GEMM entity (for example, certain hedging and arbitrage trading activities). Last year's figure is therefore not directly comparable with the previous year. It is likely that

the fall in gilt yields through 1997 contributed to GEMMs making a profit, though the aggregate figure masks some significant differences across firms.

The end of the requirement for GEMMs to be separately capitalised meant that many GEMMs have made regulatory capital savings by conducting their gilts business in the wider entity (as firms have more opportunities to net out positions when calculating their overall risk exposure). It has also meant that these GEMMs will now have access to a larger capital base in the wider entities with which they merged.

Upgrading the Central Gilts Office

By Christopher P Mann of the Bank's Market Services Division and Controller of the CGO Project.

The Central Gilts Office system, first introduced in 1986, was designed and built to meet basic market demands: the provision of settlement for gilt-edged securities through an efficient and secure system of electronic book-entry delivery of stock in real time against an assured payment. By 1994, it had become apparent that the system needed to be upgraded to reflect continuing improvements in information technology (especially in data security) and developments in market practices, as well as structural reforms in the gilt market and payments systems and the possibility of UK membership of European Monetary Union. This article explains the background to the decision taken in 1995 to upgrade the system, describes the process involved and sets out some of the features and changes introduced by the upgraded system.

Consultation

In August 1995, the Bank issued a consultative paper on the need for an upgrade of the Central Gilts Office (CGO) system and the options for achieving it.(1) There were a number of reasons for upgrading the system:

- the current software, though efficient, cost-effective and providing fault-free performance, could no longer easily be adapted for the new developments in prospect;
- Euroclear and Cedel, the international Central Securities Depositories, were preparing to become members of CGO. More sophisticated links between these systems and CGO could only be developed from an upgraded platform;
- trading in gilt repo(2) was planned to start in January 1996. Work during 1995 by the Gilt Repo Settlement Working Party had revealed the need for facilities specifically for repo settlement, which the existing CGO would find it difficult to provide;
- a market in gilt strips, and the ability to strip and reconstitute gilts(3) as an essential ingredient of such a market, could not be handled by the existing system;
- the existing system could not easily be upgraded to defend against increasingly sophisticated security attacks;
- the values settled each day in CGO, and the exposures incurred by settlement banks in the system to the CGO members on whose behalf they made payments, had grown considerably and were expected to grow further with the start of gilt repo. The need to be able to measure and control such exposures had grown commensurately; and
- similarly, the exposures settlement banks incurred to each other had grown with the system. The elimination of such risks via a link between CGO and the planned real-time gross settlement (RTGS) system(4) could only proceed on the basis of upgraded CGO software.

The options for upgrading the system were to amend the existing software or to adapt another platform. The two platforms considered were the European Securities Office (ESO) system, introduced by the Bank in September 1993 for settlement of Ecu-denominated bonds; and CREST, the platform then under development for the settlement of equity trades. Although ESO provided a sound platform, it had significant gaps—notably the fact that it was not built to handle registered securities and so had no link to a register; nor did it have the ability to handle deliveries by value (DBVs)(5) or strips. The CREST software, in contrast, built on the successful CGO, CMO and ESO systems and was an obvious platform for upgrading the CGO. A feasibility study by the Bank early in 1995 had shown that, as

(1) A description of the original CGO can be found in 'Gilt-edged settlement: Phase 2 of the CGO Service', in the *Quarterly Bulletin*, February 1987, pages 80–2.
(2) Repo is short for 'sale and repurchase agreement'. A gilt repo is a transaction where two parties agree that one will sell gilt-edged securities to the other and (at the same time and as part of the same transaction) commit to repurchase equivalent securities on a specified future date, or at call, at a specified price, under a formal legal agreement. The difference between the price at which the securities are bought and sold is expressed as an interest rate, the 'repo rate'. Where the stock to be received is not specified, the repo is known as 'general collateral' or GC repo. (In gilt repo, it is possible to provide general collateral by using the delivery-by-value (DBV) mechanism of CGO; it is then known as a DBV repo.) Where a particular stock is specified, the repo is known as a 'special' repo. Further details can be found in the Bank of England's *Annual Review of Gilts and the Gilt Market for 1996/97*, available from Public Enquiries on 0171-601 4012.
(3) Stripping is the process of separating a standard coupon-bearing bond into its individual coupon and principal payments, which can then be separately held and traded in their own right as (zero-coupon) bonds. Reconstitution is the reverse. Anyone who holds gilts in CGO, whether directly or through a nominee, is eligible to hold strips in CGO. The facility to strip and reconstitute gilts is available to the market through the gilt-edged market makers (GEMMs), who can use the facility specially added to the upgraded CGO. Further details can be found in the Bank of England's *Annual Review of Gilts and the Gilt Market for 1996/97*, available from Public Enquiries on 0171-601 4012.
(4) The RTGS system, which consists of accounts held by settlement banks in the books of the Bank of England that can be updated continuously, is described in the article 'The development of a UK real-time gross settlement system' in the *Quarterly Bulletin*, May 1994, pages 163–8.
(5) Stock to a specified aggregate value (as determined by system reference prices) can be selected and assembled automatically by the system and delivered on an overnight basis, the stock being automatically returned the following morning. This is known as a delivery by value. Deliveries by value are used primarily to provide collateral and, more recently, to settle repos.

designed, there was a large overlap between the facilities to be offered by CREST and the needs of the upgraded CGO. Key features were:

- forward-dated input, of particular value for the input of gilt repo;
- specific capability to handle stock loans;
- the ability to transfer stock free of payment and to make payments such as interest and redemptions without a movement of stock;
- a debit cap mechanism to control settlement banks' intra-day exposures to their clients;
- matching of inputs by each party to a trade;
- transaction reporting to regulatory authorities,(1) enabling a single input to fulfil several functions;
- a flexible account structure, allowing account designations and the sponsoring of members;
- enhanced file transfer capability to very high security standards; and
- a shorter registration cycle.

During the consultation period, it became apparent that a further option warranted consideration. This was the merger of settlement of gilts and equities to provide a single UK settlement system for gilts and equities. The Bank's advice was that this would be an extremely ambitious undertaking. Experience in delivering UK settlement systems led the Bank to believe that there were clear benefits in continuing, as in the past, deliberately to focus on building carefully specified systems. This was especially important given the range of major infrastructural projects in payment and settlement systems in which the London market was involved.

Following the consultation, the Bank announced, on 24 November 1995, that CGO was to be upgraded using the CREST software, a copy of which CRESTCo (the company that developed and runs CREST) had agreed earlier in 1995 to provide to the Bank as the basis for upgrading gilts settlement. But given the clear benefits that members saw in a single UK settlement system, the Bank also announced that CGO and CRESTCo would work to ensure that the option of merging the two settlement systems in due course was kept open. A committee, comprising members of both the CGO project team and the CRESTCo development team, was set up to ensure that CGO and CRESTCo were kept fully informed of the development of each other's services and, where possible, to minimise software differences and duplication of effort. A joint Bank-CRESTCo working party concluded in November 1996 that full merger of the two systems was technically feasible. In July 1997, the Treasury announced that the Bank would consult market participants on priorities for IT development, taking into account the costs and benefits of a CGO/CRESTCo merger. This process is due to be completed by summer 1998. The Treasury is discussing with the Bank, CRESTCo and the Financial Services Authority (FSA) the regulatory and governance implications of merger, including possible legislative requirements.

One consequence of the decision to upgrade CGO using CREST software was the need to agree arrangements with CRESTCo for the shared use of the networks provided by the CREST network providers, SWIFT and BT Syntegra. In upgrading the system, it was decided that the legal and contractual foundations of the existing CGO would remain essentially unchanged except where necessary (eg to accommodate the introduction of debit caps or the sharing of networks), as would the Bank's role as operator of the system. The box on page 72 summarises the legal structure of the upgraded system.

Specific gilt market requirements

The first task was to distinguish the specific requirements of the gilt market from those of the equities market, so that changes to the CREST software could be made. To this end, the CGO Upgrade Group was established. The Group's role was to assist the Bank in agreeing the scope of the changes, and to provide an effective means of exchanging and synthesising views on issues of concern to the gilt market. It also acted as a channel of communication specifically for the project, alongside the existing standing committees of the CGO, the Operational Subcommittee and the User Liaison Group, from which a number of members of the CGO Upgrade Group were drawn.

The Group met seven times between March 1996 and May 1997. By May 1996, agreement had been reached on the few areas of the CREST software where changes were considered necessary to meet the specific needs of the gilt market. These were:

- stock delivered by means of the DBV mechanism should continue not to be registered except (as previously in CGO) where it could not be returned. (The CREST software provides for the registration of DBVs.) Among other things, registration of gilt DBVs generates risks for the deliverer of a gilt, if a dividend is paid to the taker while the stock is registered in the taker's name. The Bank received legal advice that the arrangements that had been used since the inception of the CGO in 1986 were robust and that there was no need to change them;

(1) Members of the London Stock Exchange are required to provide full details of all trades conducted on the Exchange on the day that the trade is executed. If both parties to the trade are reporting to the same reporting system, transaction reports have to be matched by the two parties to the trade. These complement trade reports, which are one-sided reports that members have to provide, via the Exchange's Sequence system, within three minutes of the trade being transacted. Transaction reports are also required by the Financial Services Authority from all firms subject to regulation. Prior to the inauguration of CGO, transaction reports were provided via separate input to the Stock Exchange's Checking system. In May 1996, the London Stock Exchange and the Securities and Futures Authority agreed to take transaction reporting data from the upgraded CGO. Transaction reporting via a settlement reporting system reduces the number of inputs required by member firms.

The contractual arrangements relating to CGO

Though a number of pieces of legislation, principally the Stock Transfer Act 1982, relate to the transfer of stock in CGO, the operation of the system rests on contracts signed between participants, rather than statute. This box explains the principal contracts.

The relationship between the Bank and the CGO members (for these purposes including sponsors) is governed by the CGO Rules. The Rules consist of the *Reference Manual*, and the *Membership Agreement* that all members sign with the Bank. The former describes in some detail how the Bank will operate the system. The latter sets out the rights and obligations of the Bank and the member, and provides the contractual basis for the transfer of equitable title within the system.

Settlement banks are also subject to the CGO Rules, and each signs a bilateral agreement, similar to the *Membership Agreement*, with the Bank. In addition, all settlement banks enter into a multilateral *Assured Payment Agreement* with one another, governing the creation and settlement of assured payments within the system.

CGO also shares certain facilities with CRESTCo: the communication networks provided by SWIFT and BT Syntegra; the certificated gilt delivery service operated by TNT; and two computer sites. It is important that CRESTCo can demonstrate to its regulator, the FSA, that CGO's use of these facilities will not compromise the CREST system. To enable it to do so, the Bank has signed an agreement with CRESTCo governing the use of these facilities by CGO, and all CGO members are likewise required to sign an agreement protecting CRESTCo from loss.

Finally, the Bank has also signed agreements with each of the network providers, regarding the provision of communications networks for CGO. These agreements govern the standards with which the networks must comply, the procedures for making changes to the networks, and the respective rights and obligations of the Bank and each network provider.

- the ability to specify an interest rate for the settlement of a DBV repo. No other changes to facilitate the settlement of repos were deemed necessary, given that the key requirements (ie the ability to input both legs of a repo at the same time, taking advantage of the forward input facility, and the ability to make margin payments using the facility to deliver stock free of payment, or to make a payment without movement of stock) were present in the CREST software. Possible changes that were rejected on the grounds that they were desirable but not essential were the ability to flag a DBV used to settle a DBV repo; automatically rolling over a DBV until the maturity of a DBV repo; the automatic revaluation of repos; and generation of margin payments, and of the return leg of a repo. At some stage in the future, consideration may be given to adding these features, possibly by development of the separate stock loan capability of the system, which has some of these features; and

- the introduction of a degree of tolerance into matching.(1) (There is currently no tolerance in CREST matching. Its introduction in 1998 is being considered.)

The Group also agreed to the retention of a number of features available in CREST that had not previously been available in CGO. These were:

- the ability to provide transaction reports to specified regulators such as the London Stock Exchange (LSE) and the FSA;

- the provision of a more flexible account structure, including sponsored membership and account designation. The box on page 73 summarises the key features of the revised structure;

- the use of five decimal places for reference prices, allowing more accurate stock valuations (prices were expressed as an integer in the original CGO); and

- the use, unchanged, of the graphical user interface (GUI) provided by CREST, by which members can communicate with the system. The box on page 74 describes how members can communicate with CGO.

Managing project risks

One risk in adapting the CREST software (which was recognised at the time) was that, when the decision was made, the software had yet to be tested and trialled and proved in a live environment. The inauguration of CREST and the start of a six-month period of transition of equities

(1) In the original CGO, the deliverer of stock input the information, which the recipient could view and accept without further input. This was known as 'acceptance'. It allowed considerable flexibility. For example, for a large-value trade, a buyer, up against a deadline, might choose to accept a consideration perhaps many thousands of pounds different from what he considered to be the correct amount, though a trivial difference in comparison with the value of the trade, which might run to hundreds of millions of pounds. In this way, he would avoid the trade not settling at all and the risk of a potentially large late-settlement charge. The difference would be resolved later. But acceptance was open to error, and potentially fraud, and it did not meet the standards required for transaction reporting. It has therefore been replaced by 'matching' in the upgraded system, a procedure found in most securities settlement systems. Matching requires both parties to a trade to input certain key pieces of information, which must agree exactly if the trade is to move forward to settlement. To prevent trades failing because the consideration does not match exactly, for example if the two parties to a trade use slightly different ways to translate a fraction to a decimal, or to calculate the price including accrued interest, the Upgrade Group agreed that the software should be amended to allow a small margin of disagreement. It is currently set at £20 in CGO.

Membership structure in the upgraded system

The upgraded system allows a more flexible approach to membership and account arrangements. Members may have direct or sponsored membership. To all intents and purposes, sponsored members enjoy all the rights of a direct member, except that another user of the system provides the interface with the system, carrying out the sponsored member's requirements for settlement. Direct and sponsored members have a unique participant ID; users of the system also require a unique user ID. Sponsored members do not need a user ID, as another party uses the system on their behalf.

Sponsored and direct members both have accounts in their own name in CGO and on the register. Both types of member must arrange for a settlement bank to provide assured payment facilities on their behalf. In addition, an insubstantial company, such as a nominee company, or one which is prohibited from assuming the liabilities of a sponsored member, may join as a Sponsored Member (Nominee), as long as a member undertakes its liabilities on its behalf. In all other respects, such a member enjoys the same status as a sponsored member.

Users, who have a link to the system, can operate solely on behalf of third parties, (such as partnerships, which may not become direct or sponsored members of the system), or act as direct members, carrying out their own business as well as that of other companies, for example in the same group. As in CREST, all users of the system, including providers solely of interface services not otherwise authorised, are subject to authorisation under the *Financial Services Act*. (Users have the power to send instructions on behalf of others. So through error or fraud, they could misdirect ownership of another party's gilts.) Being a user of the system, either as a direct member or sponsor, costs £5,000 per annum. Membership of the system, either direct or sponsored, costs £20 per annum.

Other entities with access to the system are settlement banks, the Bank of England's Registrar's Department and regulatory bodies.

In addition to an account in their own name, members may open any number of separately designated accounts. The charge for each extra account is £5 per annum. The designation of such accounts is reflected on the register. This facility allows custodians, for example, to segregate stock into separately designated accounts for individual clients. (Such clients are often referred to as indirect participants in the system.)

from the Stock Exchange's Talisman system did not take place until July 1996. The original date proposed for the inauguration of the upgraded CGO was early 1997. It was not possible to be more specific for three reasons. It was necessary to see how the CREST software performed in a live environment; volume and response time tests had to be performed and assessed, which could not be done until the Bank team had taken delivery of the software (in September 1996); and it was necessary to assess the state of preparedness of software suppliers to CGO members and third parties.

By late November 1996, it had become clear to the Bank that a number of prospective members and suppliers were unlikely to be fully ready to commence participant trialling in time for inauguration in early 1997. It was also becoming clear that the time allotted for trialling in the original timetable was unlikely to be adequate to generate the necessary confidence that the upgraded system would run smoothly at full volume from the outset. This was essential because, with the endorsement of the Upgrade Group, it had been agreed earlier in 1996 that, in order to avoid disruption to the gilt market, it was necessary to transfer from the existing to the upgraded system over a single weekend. On 3 December 1996, the Bank announced that an extension to the timetable for upgrading CGO until 26 August 1997, following the August bank holiday, was sensible, to enable market firms to concentrate in the immediate period ahead on the transition of equities into CREST, and for changes to the CREST software to be applied to the version being developed by the Bank for CGO. The date was chosen because, at the time, it was believed that transfer could only be achieved prudently over a bank holiday weekend. The box on page 75 discusses the approach to the transfer in more detail.

The extension to the timetable allowed further work, undertaken by three new groups. The first was convened to review thoroughly the strategy for trialling and transfer; the second was formed to help the Bank assess the readiness of members and other participants for trialling and eventually for inauguration. The assessment was based on a number of agreed criteria ('acceptance' or 'success' criteria).

The experience gained from transition to CREST also led to the creation of a third group to advise on market practices in the use of CGO. The upgraded system provides considerably greater flexibility in its use, with a number of options. CRESTCo's experience in transition had identified that it was essential for the efficient use of the system that norms on the use of such options should be established. The norms are enshrined in the rules for the use of the system by members, and are expected to be observed except where there is bilateral agreement to the contrary.(1)

(1) Full details can be obtained from the Central Gilts & Moneymarkets Office at the Bank of England.

Communicating with CGO

In the original CGO, members were provided with terminals linked to CGO via the Stock Exchange's Integrated Data Network (IDN). Input was mainly clerically through terminals, though some rudimentary file transfer was available.

In the upgraded CGO, members can communicate with the central system in two ways. They can either use the CGO-provided graphical user interface (GUI), a Windows-based set of screens by which members input data and are able to view data in real time, interactively, or they can build (or purchase from third parties) a system that interfaces with the central system using real-time file transfer or interactively. Interactive transfer involves the transmission of a single message at a time and receipt of its associated response, and is generally clerically operated; file transfer allows the packaging into a single file of a number of messages, to which all the responses are returned, also in a single file. So it allows the automation of much of the input and processing previously done manually, and paves the way for 'straight-through' processing(1) and the possibility of a significant reduction in costs. CGO provides detailed instructions on the formats and protocols that must be followed in constructing files to be sent to the central system by means of Data Exchange Manuals (DEX) for both file transfer and interactive methods. Messages either transfer data from the member's systems to the central system, or request data to be transferred from the central system to the host system (eg requests for the status of a transaction as it moves through the various stages from input to final settlement). Messages are transferred via two dedicated networks.

Each network provider has to demonstrate that its network services will comply with rigorous requirements on functionality, security and performance. The networks are shared with the CREST service, and members can use the same gateways and network links to access both CREST and CGO. The Bank and CRESTCo monitor the performance of the two networks closely.

The networks enable settlement instructions and enquiries to be transmitted securely and speedily between CGO members' offices and CGO. All messages passing over the networks are encrypted and authenticated using the latest cryptographic techniques. The networks are designed to have a high level of resilience to ensure minimal loss of service.

Members can also acquire backup gateway equipment from the network providers that enables them to choose the level of contingency that best suits them. In the original CGO, the Bank provided access to terminals for members unable to use their own. With the greater variety of means of communication available with the upgraded system, this service has been withdrawn, and members are required to provide their own contingency arrangements.

(1) 'Straight-through' processing is the transfer of data from one electronic system to another without clerical intervention. It can be limited to a member's own internal systems (eg between a trading platform and a back-office system); it may involve the automatic generation of messages to be sent to central settlement or payment systems, or to correspondent bank or custodians in other financial centres; at its best, it will allow the recipient automatically to process the inward message without manual intervention, updating its own systems, and in some cases delivering the message to other banks or payment and settlement systems. Though very hard to achieve in practice, except in a highly controlled environment where a set of file standards and protocols can be imposed, it nevertheless represents a major goal of payments and settlements because of the huge cost savings it can generate.

Trialling

Participant trialling commenced on 12 May 1997 and continued until the end of July. The box on page 76 describes the approach to testing and trialling. At the end of July, the acceptance criteria were carefully reviewed. It was concluded that, though the programme of trialling had shown that the physical infrastructure of the upgraded system could handle the volumes likely to be experienced in live running, and that the system had the necessary capability in place and was operating substantially as intended, the criteria had not been fully met. Trialling had revealed the need to make certain adjustments to the system in two key areas: there had been occasional instances where the system had allowed payments to be made in excess of debit caps (which limit the amount of credit members are granted intra-day by their settlement banks); and there had been occasions when more stock had been delivered than the deliverer held, resulting in a stock overdraft and more stock apparently in existence in CGO than on the register. It also appeared that not all trades that could settle were settling. For this reason, it was decided that a further dress rehearsal was needed and that the upgraded system would not be inaugurated on 26 August.

A further dress rehearsal was held at the end of September 1997, after which the Bank concluded that the conditions for a successful implementation of the upgraded system had been met, and announced on 3 October that inauguration should take place on 10 November. The opportunity was also taken to announce the planned start of the official gilt strips facility on 8 December, with trading on a when-issued basis in strips permitted from 1 December.

Benefits of the upgraded CGO

Apart from introducing features intended to improve the efficiency of settlement, the upgraded system also reduces risk in settlement, as well as providing a platform from which further steps in risk reduction can be taken.

The most significant change, which gave rise to the greatest change to the system and for members using it, was the introduction of debit caps. Members can pay for stock

Transferring to the upgraded CGO

Early on in the project, the Bank adopted the principle that no interruption to the smooth functioning of the gilt market should arise from the upgrade. Since the start of 1996, the introduction of gilt repo meant that gilts were used more than before in members' day-to-day financing needs. At the end of 1997, the Bank announced its decision to start operating in the money markets via gilt repo. The new operating techniques were introduced in March 1997.(1) The gilt market is the vehicle through which the government raises funds. For it to be able to do so at the most advantageous rates, it is essential that there is a deep, liquid market. A condition for this is smooth, efficient settlement of trades, often of very large value: on a typical day, stock to the value of some £100 billion can be transferred in CGO.

A key element in the decision on how best to transfer was the use of gilts as collateral for short-term financing, which enables traders to finance their positions. Since all gilts enjoy the same credit status, they are used indistinguishably as collateral. The need to avoid any disruption to the orderly functioning of the market, so as not to raise traders' financing costs, and the need to maintain the general acceptability of all gilts as collateral, so as not to undermine the liquidity of any issue, led to the conclusion that transfer to the upgraded system had to be achieved over a single weekend. Initially, it was considered prudent to allow three days as a sufficient (contingency) period in case of problems, but in the event it was achieved smoothly over an ordinary weekend.

Special software was written to aid the transfer of data from one system to the other. In addition, at transfer the register had to be brought into line with CGO: prior to the upgrade, movements of stock in CGO were reflected on the register three days later. Over the transfer weekend, this delay had to be eliminated because of the introduction of a real-time link between the two systems in the upgraded system. Finally, numerous reconciliations had to be performed, for example, between CGO and the register at the end of each update of the register, to eliminate the timing difference between the two systems, and between the original and the upgraded database in CGO. Reconciliations had also to take account of withdrawals of stock from CGO in certificated form that had yet to be registered.

In addition to database transfer, it was also agreed with the membership that there should be a 'big bang' transfer to the wholly new stock loan capability provided by the upgraded system. Stock loans were not separately identified in the original CGO. The only way loans outstanding at transfer to the upgraded system could be reflected in the new system was for the stock out on loan to be returned (by means of an ordinary member-to-member delivery) to the lender, who would return it to the borrower on the same day, using the stock loan function of the upgraded system. The alternative was to allow loans outstanding at transfer not to be reflected as loans in the upgraded system, leaving them to mature, whereas new loans entered into after inauguration of the upgraded system would be settled using the new capability. The gilt stock lending market is highly concentrated and intermediated, as was revealed by a survey of the market, specially commissioned in early 1997 by the project team. On the survey date in early April 1997, of the approximately 2,000 loans outstanding, seven main holders of stock accounted for around two thirds and five main intermediaries, a fifth. On the borrowing side, eleven main borrowers accounted for half of all borrowings and the intermediaries, a third. (The intermediaries tend to parcel their borrowings into fewer loans for on-lending.) Stock loans should be revalued each day and, if necessary, margin called. To have to operate two systems side by side—one for existing loans not reflected in CGO until they were called or matured, and another taking advantage of the upgraded systems' extra capability (which revalues loans automatically for members and generates the margin call if required)—was considered undesirable by members. The decision was taken to transfer to the new function a week after inauguration. But because it was essential that no stock should end up in the wrong place, and because all loans had to be closed out and entered into afresh in the new system, nearly doubling the number of inputs required on the day, two of the dress rehearsals (see the box on page 76) involved a dress rehearsal of stock loan transfer.

(1) Further details of the new arrangements can be found in the article 'Operation of monetary policy' in the *Quarterly Bulletin*, February 1997, page 12.

Testing and trialling

Large IT systems go through a series of tests and trials before inauguration. Once the overall capability to be delivered by the software has been agreed, more detailed design specifications are drawn up. These are used as the basis for programming, usually in modular form. The modules are then tested singly and in functional groups, using scripts developed from the design specification. This process is called system testing. The application software is then handed over to the business development team, who have the task of exercising it according to pre-defined scripts, designed to capture as far as possible all the ways in which the software might be expected to be used. The Bank describes this as internal trialling. Errors detected at this stage or the previous stages are referred for correction either by the designers or the programmers as appropriate. Changed modules are again tested and, depending on the analysis of the impact of any changes requested on other parts of the system, other modules may be re-tested to establish that they have not been affected. This is called regression testing. Tests are also performed to establish system response times, so as to identify any problems in system performance.

At the end of this process, the application software is subjected to trialling by all the users of the system. This is known as external or participant trialling.(1) In the CGO project, this was divided into two parts. The first consisted of scripted trials, during which members used the system adhering strictly to scripts prepared by the Bank business team, to ensure that all the functionality was correctly exercised. This was followed by a period of unscripted trialling, which was in two parts: dress rehearsals during which real days' business from earlier dates was 'replayed' on the new software over a weekend; and unscripted use of the system during business days by members wishing to test out their own software and communications, as well as providing staff training. (A computer-based training module was built and supplied to members as part of the project.)

There were four dress rehearsals in all, three in July 1997 and a final one in late September 1997, involving the full membership and other users of, or suppliers to, the system. Dress rehearsals can usually only be carried out on non-business days, since the staff involved in them are carrying out live business on business days. Dress rehearsals are an invaluable way of demonstrating that the system as a whole meets the business needs of all the members. It allows the system operators to ensure that their ability to handle the system is fully proved, and it gives a good idea of how the application software is likely to perform in a live environment.

In the case of CGO, the transfer of stock from the old to the upgraded database required that on the day of inauguration, members carefully reconciled their balances in CGO to their own systems before and after the return of DBVs (the only term transaction to be identified separately as such in the old CGO). In addition, settlement banks had to input and authorise debit caps for each member. As a result, the opportunity was taken during the dress rehearsals to rehearse the extra, one-off work involved on the day of inauguration itself, to ensure that it went as smoothly as possible, but also in order to establish the extra amount of time needed.

Because the networks are shared with CREST and so members can, in consequence, use the same gateway to access both services, a need was identified for a certain degree of joint trialling with both services simultaneously. CRESTCo was able to provide test facilities for members at the same time that trialling was taking place with CGO.

(1) In some cases, full external trialling is preceded by use of the system by a selected sub-set of users, in part on a scripted basis, to flush out any residual problems. This is sometimes known as 'beta' testing. It was used prior to the final dress rehearsal.

either by drawing down a balance on their cash memorandum account(1) or by drawing down secured or unsecured credit granted by their settlement bank. Secured credit is secured against stock in a member's account, as well as stock being received for which payment is being made.(2) This is achieved by linking to the debit cap the member's account in which the stock is held or is to be received. If an account is not linked, stock balances in it, or to be received, cannot be used as collateral for a debit cap. At present, members have the sole ability to link accounts to debit caps or to de-link them, and the responsibility to ensure that only proprietary stock, or stock in custody for which there is authority for use as collateral, is used. But with effect from the early part of 1998, linking or de-linking

(1) Track of payments and receipts by customers in CGO is kept on memorandum accounts in CGO. Actual payment takes place between settlement banks only at the end of the settlement day, each bank making or receiving a payment to or from each other settlement bank, representing the net of all such payments during settlement. Credits and debits are passed by the Bank of England across the settlement banks' accounts in the Bank's books. In addition, each settlement bank is advised of its net position *vis-à-vis* each of the members on whose behalf it has been making or receiving payments, and credits or debits the member's account in its books accordingly, also at the end of the day.

(2) The stock is valued according to reference prices held in the system. Settlement banks can set a margin to be deducted from the system value of the stock, known as a 'bank category margin'. The margins can be applied to four categories of stock—short, medium, long and undated—reflecting the different price-volatility characteristics of the stock concerned. (Strips are allocated to the date category that follows the category to which they would be allocated on the basis of their maturity date, to reflect their potentially greater volatility. So for example, medium-dated strips are allocated to the long-dated category.)

an account will require the electronic sanction of the settlement bank concerned.

Settlement banks have control over the credit limits they are prepared to grant in the system, and have to activate the debit cap (the sum of the secured and unsecured credit granted) before any settlement for that member can take place. Settlement banks are also able to reduce, to nil if they choose, credit limits in real time during settlement. Settlement banks put great reliance on the operation of debit caps, and it was this part of the system that required the most thorough testing.

In the original CGO, there was no mechanism to limit the payments that settlement banks undertook to make on behalf of members. It was therefore not subject to any cash constraints, and settlement took place whenever stock was available. In the upgraded CGO, settlement can only take place if there is sufficient cash or credit available to the parties to a trade as well as sufficient stock. Situations where the delivery of stock is dependent upon a receipt of stock, where for example a member has sold stock short before buying it back or borrowing it, are resolved by a mechanism called 'circles'. In the upgraded system, the circles mechanism, which was present in the original system, is designed also to resolve situations where a cash payment is dependent on a cash receipt because the member has insufficient cash or credit. The need for the system to check that there is both adequate cash or credit, as well as stock, before settlement can take place represents a very considerable processing overhead compared with the original CGO.

The procedures for depositing stock in certificated form(1) in CGO have also changed as part of the upgrade.

In the original CGO, whether stock was being deposited or transferred within the system, registration took place two days later. This meant that stock deposited in CGO could be on-delivered within the system on the same day it was deposited, since both movements would register on the same day. Market makers could, therefore, offer the same settlement cycle for retail as for wholesale trades, since the matching sale of a purchase of certificated stock could settle at the same time.

In the upgraded CGO, the CREST standard for the registration of transfers has been adopted. Intra-CGO transfers and withdrawals of stock have to be registered within two hours, whereas stock being deposited has up to 28 hours to be registered from the time the certificate and the stock transfer form are received at Registrar's, usually the day following the deposit in CGO, to allow time for processing. The reduction to two hours in the interval for the registration of trades settled within CGO significantly reduces risk in the wholesale market, by ensuring that the buyer acquires legal title shortly after settlement; and it opens up the possibility of abolishing the ex-dividend period for holders of stock in CGO.(2) In the upgraded CGO, therefore, if a matching on-delivery of stock within CGO on the same day as it was deposited were to be allowed, its registration would be attempted before the stock being deposited could be registered. If the member did not have sufficient stock already registered in his name, the on-delivery within CGO could not be registered. This would give rise to a bad delivery in CGO—a transfer of equitable title that cannot be followed by a transfer of legal title. The rules of CGO require bad deliveries to be reversed.(3) Because bad deliveries are to be avoided if at all possible, since they undermine the basis on which secured credit is granted and assured payments made, in the upgraded system the on-delivery of stock deposited into CGO is not allowed until the original deposit has been successfully registered. This has increased the period for the settlement of a purchase by a CGO member from a non-CGO member by two days. As a result, market makers now quote prices for such trades based on five or ten-day settlement, depending on circumstances. The box on page 78 provides further details of the settlement of certificated gilts (retail gilts) in the upgraded system.

Summary

The upgrading of CGO, using CREST software, has made available new features for the continued efficient and safe settlement of trades in the gilt market. These new features:

- facilitate stripping and reconstitution of gilts;
- allow back offices to process repos and stock loans more efficiently, helping them to settle a greater volume of trades as the market develops;
- effect automatic reporting to the FSA and the LSE, reducing back-office work for all gilt deals settled through CGO;
- offer more flexible membership and account management arrangements. It is expected that this will result in a widening of membership and increase the scope for investors to hold gilts in dematerialised form, reducing the volume of paper in the settlement process;

(1) Stock held in CGO is dematerialised. The instruction to the Registrar's Department to register a transfer in CGO is represented by the electronic registrar update request (RUR). Most gilts in CGO can also be held and transferred outside CGO in certificated form; the legal instrument on which Registrar's will register such transfers is the stock transfer form. Stock in certificated form can be deposited into CGO, whereupon it is dematerialised and the certificate is cancelled by Registrar's, or withdrawn, whereupon a new certificate is issued. Gilts that cannot be held in certificated form and which, in consequence, can only be transferred in CGO, are strips and the Floating Rate Treasury Stock 2001.

(2) The period between the ex-dividend date and the date the dividend is due is called the 'ex-dividend period', and is to facilitate the preparation and despatch of dividend payments. The ex-dividend date is the latest date for registration of a transfer for the new holder to receive the next dividend. In January 1996, the ex-dividend period was reduced from thirty seven days to seven working days (with the exception of 3½% War Loan, where the period is ten working days because of the large number of holders). Further details on consequential changes to ex-dividend arrangements proposed by the Bank can be found in the *Annual Review of Gilts and the Gilt Market for 1996/97* and in the article on page 55–69 in this *Quarterly Bulletin.*

(3) A bad delivery reversal is a separate transfer of stock, not the unwinding of the original transfer for which there is no provision in CGO, all transfers taking place with finality at the point of transfer. It is up to the parties involved to make arrangements for the reversal of any associated payment, the reversal of stock taking place without payment.

Settlement of retail gilt trades

Though CGO was originally conceived principally for the use of the wholesale market, the recent upgrade has made the service more accessible to retail market practitioners, and so to their clients, by introducing a more flexible membership structure and by reducing costs. A number of retail brokers have already become direct members of the system, and a number of others have expressed interest. Sponsored membership is a low-cost alternative for those firms whose gilts volumes do not merit direct access to the system, but who still wish to offer their clients a safer, faster settlement, registration and custody service.

In order to make the most of the CGO service, members, or investors holding their stock with members, will need to 'dematerialise' their holdings—in other words to deposit their certificates into CGO and to hold their stock in the system in book-entry form, much as they would deposit cash into their bank. Otherwise, the investor will not be able to settle transactions according to wholesale market timetables. Dematerialisation is very simple, and can be carried out by the investor's broker.

Investors who continue to hold their stock in certificated form have two options. They can choose to buy and sell stock through a CGO broker. The broker will deposit their clients' stock into CGO for onward delivery to a market maker within the system, or withdraw stock received from a market maker into their name. This can be done in as little as three days. Alternatively, for those acting through non-CGO brokers, stock and money will need to be exchanged outside the system.

Because delivery of stock and cash takes place outside the system, those using non-CGO brokers will face a slightly longer settlement period than those using member brokers. The Bank has introduced arrangements designed to minimise, at least for a period, the settlement cycle for those using non-member brokers, by effecting transfers between investor and market maker by electronic input to the register. These procedures are carried out by the Bank's Registrar's Department.

- allow better control by settlement banks of their exposure to the CGO members for whom they act, reducing any residual risk in the settlement process; and
- reduce the interval between transfer of equitable title in CGO and legal title on the register, from three days to not more than two hours.

Future developments

The Bank is working on a number of developments that will affect the CGO service.

Most immediately, it is introducing a real-time register. Apart from speeding up processes at the Bank's Registrar's Department, for example the registration of stock deposits, it will be able to handle stocks denominated in more than one currency, enabling the introduction of euro stocks to the register and CGO. It will also make it possible for dividends and redemption payments to be made direct to members' cash memorandum accounts, rather than outside the system as at present. As noted above, registration on the same day as a transfer in CGO opens up the possibility of abolishing the ex-dividend period for holders of gilts in CGO. There may be advantages in doing this, in that the existence of the ex-dividend period can be a source of credit risk in the gilt repo market if a dividend is paid to the purchaser of the stock after a repo has matured.

As mentioned above, work is under way to enable settlement banks electronically to sanction the linking or de-linking of accounts to or from debit caps. This enhancement is expected to be introduced early in 1998. In addition, in 1998, the Bank intends to enable the multi-currency capability available in the software to accommodate the use of the euro as a payment currency by the start of European Monetary Union. It will also be completing its programme of ensuring Year 2000 compliance.

The Bank plans to link CGO in real time to the Bank's RTGS system. Payment obligations arising between settlement banks in CGO will then be able to be settled gross in the Bank's books as they arise, instead of on a multilateral net basis at the end of the day as at present. Such a link will further reduce settlement risk in UK large-value payment and settlement systems. A working group established by the Bank, with APACS and CRESTCo, to look at the technical options for the introduction of such a link, completed its initial work in late 1996 on a number of potential models. This has been followed up by more detailed analysis of the options. No timetable for its introduction has yet been established. One reason for this is the current consultation, mentioned on page 71, on relative IT priorities.

UK monetary framework and preparations for EMU

In his opening remarks,[1] *the* ***Governor*** *briefly outlines recent changes at the Bank of England and new procedures for operating monetary policy. He then considers the UK position on EMU, noting that uncertainty about whether the United Kingdom would participate at the start was helpfully dispelled by the Chancellor's statement on 27 October. This statement provides greater clarity, if not absolute certainty, about the timescale and conditions in which to make preparations for EMU, and together with the Government's commitment to both fiscal and monetary stability, on lines that run parallel to the macroeconomic discipline of EMU, it provides a solid foundation for a positive and constructive relationship between the United Kingdom and the initial members of EMU. The* ***Governor*** *concludes with a description of the Bank's contribution to EMU preparations.*

I am delighted to have this opportunity to meet the European Parliament's Monetary Policy Sub-Committee. It is a critical time for the evolution of monetary affairs within Europe, and you will be playing an important part at the beginning of May next year in the process of deciding which members of the European Union are to be initial participants in EMU.

At the same time, and particularly during the past seven months, the Bank of England has been experiencing changes to its structures and responsibilities as great as any it has known since 1946, and possibly in all the 303 years of its existence.

In these introductory remarks, I shall try briefly to describe these changes and the role that the Bank is playing in the preparations for the single currency.

Changes at the Bank

On 6 May 1997, four days after the new Labour Government took office, the Chancellor announced a new monetary policy framework, giving the Bank operational responsibility for setting short-term interest rates to achieve an inflation target to be set by the Government in Parliament. Without prejudice to this objective of price stability, monetary policy will 'support the Government's economic policy, including its objectives for growth and employment'.

A fortnight later, the Chancellor announced his intention to transfer responsibility for banking supervision to a single Financial Services Authority, which will become responsible for the authorisation and regulation of all kinds of financial institutions in the United Kingdom. The Bank will, however, remain responsible for the overall stability of the financial system. There are advantages in separating the central bank's responsibility for the overall stability of the financial system as a whole—which is an intrinsic central banking function everywhere—from the supervision of individual banking institutions, where the public policy interest has increasingly focused on consumer protection, in this case the protection of depositors. That is not a natural habitat for a central bank, and it may produce a conflict of interest if it causes the central bank to become over-protective of individual institutions, giving rise to moral hazard in the system as a whole.

In giving the Bank operational responsibility for the conduct of monetary policy, the Chancellor's primary objective has been to ensure the credibility of monetary stability in the United Kingdom, as an essential basis for sustainable economic growth. In certain respects, notably the setting of targets, the Bank of England Bill falls short of the independence criteria required by the Maastricht Treaty and would have to be extended before we joined. But it is clearly a significant step in the direction of independence, and in other respects, such as accountability to Parliament, it could be said to go beyond what is currently envisaged for the European Central Bank. A very high degree of transparency has been introduced into our monetary policy-making: the details of the analysis and deliberations of the Monetary Policy Committee are both published, together with the individual votes of the members participating in interest rate decisions; and I and other members of the Committee regularly appear before the Treasury Select Committee of the House of Commons to report and be questioned on our work.

Perhaps it would be helpful if I were to explain in a little more detail how our new procedures for operating monetary policy are working. In discussion with parliamentarians in the United Kingdom, I find that a great deal of interest, and indeed anxiety, focuses on the extent to which we take into account developments in the real economy and the effects of our monetary policy decisions on the lives of ordinary people. I can assure you, as I do them, that we are extremely conscious of both of these concerns.

(1) At a meeting of the European Parliamentary Monetary Policy Sub-Committee in Brussels on Monday, 24 November 1997.

We are not just inflation nutters or even only number crunchers!

The objective we are currently set by the Government is an inflation target of 2.5%. This is different from the previous objective, before the change in the arrangements, which was a target of 2.5% or less. In betting terms, we ought to have moved from an odds-on to an evens chance of hitting 2.5%. In other words, in the new regime we have as much incentive to avoid going below as we have to going above 2.5%.

Our procedures are briefly as follows. In the week before our monthly decision-making meeting, the nine members of our Monetary Policy Committee (five professional members of the Bank, and four outside appointees of high economic expertise and distinction—including two non-nationals, which I think is unique among monetary policy-making bodies) sit down with the Bank's economists to analyse all the latest relevant data. This includes data from statistical sources, comparison of the work of other outside analysts or institutions, and the input from our twelve regional Agents, who are in regular contact with all sectors of economic activity in their regions. At this stage, we confine ourselves to evaluating the information, and in a two-day meeting in the next week the Committee draws the necessary conclusions from it. The result—ie whether there is or is not to be a change in the short-term interest rate—is announced at midday on the Thursday of that week. The minutes of the two-day meeting at which that decision is made, together with a summary of the information presented by the staff, are published in the week after the following meeting. Those minutes also record the individual votes of each member of the Committee.

Beyond this, we publish a regular assessment of monetary policy, including a forecast of inflation over the two-year period that we believe is relevant, given the lags between policy actions and inflation outturns, in the Bank's quarterly *Inflation Report*. And the Treasury Select Committee of the House of Commons regularly summons me and other members of the Monetary Policy Committee to give evidence on the basis of these reports.

Finally, the Government has made it a requirement that, if we miss the target of 2.5% by 1% or more in either direction, the Committee must write an open (ie public) letter to the Chancellor, explaining why and what we intend to do about it.

These arrangements taken together provide a framework of transparency and accountability quite unlike any that applies anywhere else in the world.

Preparations for EMU

Let me now say a few words about the UK position on EMU. The uncertainty about whether the United Kingdom would participate in the start of monetary union was helpfully dispelled by the Chancellor's statement on 27 October.

He made it clear first of all that the United Kingdom will exercise its opt-out, and not participate in EMU in the first wave. That, I believe, should come as a considerable relief to many of our European partners, because UK participation at a time of substantial cyclical divergence would certainly have increased the economic risks of the project in its early stages. It will leave the United Kingdom free to concentrate on ensuring an orderly decision-making process during the crucial period of our EU Presidency in the first half of next year. But the Chancellor also made it clear that the Government is not opposed to membership of EMU as a matter of principle, but will make the decision in the light of a pragmatic assessment of the potential economic benefits and risks, which in turn depend upon the achievement of genuine and sustainable convergence. He recognised that it is very unlikely that it would be realistically possible to reach such a conclusion before the end of the present Parliament, which could run until May 2002, but he has put in hand arrangements to ensure that the United Kingdom is prepared both for the advent of the euro and for our participation when the necessary economic conditions are in fact satisfied.

This is the clearest statement on its attitude to EMU made by a British Government for a very long time. It implies that the United Kingdom is to be regarded effectively as a 'pre-in'. Taken together with the Government's commitment to both fiscal and monetary stability, on lines that run parallel to the macroeconomic discipline of EMU, this in my view provides a solid foundation for a positive and constructive relationship between the United Kingdom and those EU member countries that do participate in monetary union in the first wave. I very much welcome this. It is clearly very much in our mutual interest to build such a constructive relationship. And it provides a realistic basis on which we can all now plan for the future.

The position, therefore, is that we now have greater clarity, if not absolute certainty, about the timescale and conditions in which to make our preparations for EMU.

The Bank's contribution has hitherto been in two main directions. In the context of the EMI and the Monetary Committee, we have been fully participating in the elaboration of and preparations for monetary union. We have taken as our planning assumption the likelihood that EMU will begin on 1 January 1999. As Europe's leading financial centre, London would be significantly affected whether or not the United Kingdom is a first-wave member. We have therefore taken the lead in the past two years in preparing the financial sector. Thus we:

- co-ordinate preparations where necessary;
- serve as a catalyst to stimulate preparations of the necessary infrastructure;

- plug gaps where we identify them;
- promote consensus where we believe a harmonised approach makes sense, including at the European level; and
- communicate as widely as possible the state of the developing preparations (our *Practical Issues* series has a circulation of up to 40,000, including 4,000 overseas).

We are confident that the City will in fact be ready for 1 January 1999 and will retain its pre-eminent position among the financial centres of Europe. But I want to emphasise that a successful City should be seen as a resource for the whole of Europe, not just for the United Kingdom. All can benefit from the efficient intermediation of savings and capital flows, in the real economy just as much as in the financial sector narrowly conceived. Nor should the financial activity that will be generated by the introduction of the euro be seen as a zero-sum game: London's success need not be at the expense of the main continental financial centres.

We have also sought collaboration with private sector bodies such as the CBI and Chambers of Commerce, to encourage other sectors of the British economy to understand the practical issues that would arise from the introduction of the euro. With the changed approach of the new Government, this part of our activity has moved under the aegis of the Treasury.

It has also moved into a higher gear. The Chancellor has set up a standing committee on which I serve, together with the Presidents of the Board of Trade and the CBI and the Association of the British Chambers of Commerce, to help with the practical preparations that business as well as the Government will have to make before a decision to join a successful single currency can be taken. We shall be studying the lessons from decimalisation in 1971, the preparations for 1999 in other countries, what the United Kingdom needs to do for 1999, and the timetable and critical path for preparations for the United Kingdom to join. We shall receive reports from business advisory group working parties, and early next year we shall initiate a programme of conferences and seminars.

As for the UK economy more generally outside EMU, what matters above all is the continued pursuit of stable, non-inflationary policies. These will parallel those to be followed in the euro zone, governed by the Treaty obligation on the European Central Bank to achieve price stability, together with the Stability and Growth Pact obligation on governments to maintain prudent fiscal policies. Against that background, there is every chance that the day will be brought forward when the Government is able to conclude that the economic tests that it has set for entering EMU have been met.

Recent problems in Asia

After noting recent favourable economic developments in the United Kingdom and the United States, the ***Governor***[1] *discusses the causes of the recent problems in Asia and the lessons for the future. He notes that progress towards stabilisation is being made, and that this is an important first step towards achieving a balance between market and macroeconomic policy adjustment and official and private financing. The* ***Governor*** *concludes by reviewing estimates of the impact of the Asian problems on world growth. He argues that it is in the interests of the industrialised countries, as well as the Asian economies themselves, that the latter recover as quickly as possible and that they receive help towards that end.*

The role of the Chamber is to promote Anglo-American trade and investment, and you're doing a pretty good job. Two-way trade in goods and services is running at around $50 billion in each direction, and has grown at an annual average rate of about 8% during the past five years. In the same period, the United States has accounted for just over half of all inward direct investment into this country and close to one third of all UK outward direct investment. These examples suggest that our commercial relationships are in good shape.

Economic developments in our two countries have provided a favourable backdrop to British-American commercial relationships. In the United States, Goldilocks continues to tiptoe through the tulips. Total output has been growing for seven years, at an average annual rate of around 2¼%. Unemployment has fallen from a peak of 7.4% to 4.7%, and consumer price inflation has averaged 3%.

In this country, output has been growing for the best part of six years, at an average annual rate of close to 3%. Unemployment on a comparable basis has fallen from a peak of 10.7% to below 7%, and underlying consumer price inflation has averaged around 2¾%. If that's not Goldilocks exactly, it is surely her younger sister! And while, in this country in particular, we are having to work harder to keep her from tasting Father Bear's porridge, there are now signs that the porridge itself may be beginning to cool down—as it needs to do, quite soon and quite quickly, if we are not to see inflation pick up.

Some US business people—and certainly some British business people—engaged in international trade are understandably uncomfortable at the recent strength of our respective exchange rates—not *vis-à-vis* each other, because the dollar-sterling rate has been relatively stable, but against the rest of the world. The domestic environment, here and in the United States, remains—actually and prospectively—relatively benign.

We are, though, both exposed to the chilly winds now blowing from Asia. And I should like to devote the rest of my remarks to discussing the problems in Asia and considering just how serious a threat they pose to the global economy.

I emphasise 'problems' in this context because it is important to recognise that the situation in Asia differs materially from one country to another, even though they are all inevitably affected to varying degrees (through their close commercial links with each other) by the present economic weakness in the region as a whole.

Let me begin with a few words on Japan. Japan is of course much the largest economy in Asia. After a spectacular period of sustained growth during the 1980s, the Japanese economy has stagnated during the past six years, as Japan has struggled to overcome the fragility of its financial system in the aftermath of the infamous Japanese financial bubble. A constraining factor for much of this time has been a widespread resistance to the use of public funds to strengthen the financial system, which has, in turn, constrained the financial system in its extension of domestic credit. Japan has been reluctant, too, given the size of its public debt, to use fiscal policy to stimulate the domestic economy. There is now evidence of a change of heart on both these fronts. Japan—which has an extraordinarily strong external position—was never at the eye of the storm that struck Asia around the middle of last year. But if, as I expect, these policy changes now lead to somewhat stronger domestic demand growth, and greater confidence in Japanese financial institutions, that will make a crucial contribution to the stabilisation of the region as a whole.

The storm mainly struck the ASEAN-4 (Thailand, the Philippines, Malaysia and Indonesia), spreading subsequently to South Korea, and intermittently battering Hong Kong and elsewhere.

It is still not wholly clear—to me at least—quite why the storm suddenly struck. Most crises of this sort have their origins in some evident macroeconomic policy failure. At least in hindsight, there are usually fairly clear tell-tale

(1) In a speech at the British-American Chamber of Commerce lunch on Thursday, 22 January 1998.

signs of expanding fiscal deficits and/or lax monetary policies, classically accompanied by evidence of imbalance in the form of accelerating inflation or a rapidly deteriorating balance of payments. There were such signs, perhaps most notably in Thailand, but they were not for the most part particularly pronounced in Asia. In fact, through the first half of the 1990s, and in some cases for much longer, the countries in question were remarkably successful. They attracted, by their very success, huge inflows of capital from the rest of the world in search of higher returns.

The capital inflow made a major contribution to sustaining the economic expansion in Asia, but, with the benefit of hindsight, the increasing scale of the inflow, and particularly the form that it took, became an important part of the problem. It was not all effectively employed. There was overinvestment in some production sectors; much went into ambitious property development; and much went into financial rather than real assets. The hoped-for higher returns could not be maintained.

Again with the benefit of hindsight, it is possible to identify a number of structural weaknesses in the mechanisms for financial resource allocation in the recipient countries. There was, for example, a general lack of reliable financial information, and a lack of transparency in relation to the financial position, in both public and private sectors. Complex and opaque links between government, financial institutions and non-financial companies made it difficult for outsiders to understand the real nature of their exposures. Financial markets were not well developed, leaving the system heavily dependent upon the banks. There was inadequate regulatory or supervisory oversight. There was widespread government influence over financial flows, which importantly also contributed to a perception that much of the borrowing was effectively underwritten by the government. The list could go on.

The problem was compounded by the absence of any real perception of exchange rate risk. Borrowers were evidently confident that governments would maintain their exchange rate pegs against the dollar, so that unhedged foreign currency debt, much of it short term, appeared a cheap alternative to domestic currency borrowing. The result was a build-up of short-term private sector foreign currency liabilities, by banks and non-banks, which was not fully appreciated, and which left the Asian economies especially vulnerable to a flight of capital in the event of a change in sentiment. The problem is that national authorities can create their domestic currency if they choose to do so, even if it leads to inflation, but they cannot simply create foreign currencies in the same way.

So once the run started, it was violent and contagious.

There are certainly all sorts of lessons for the future to be drawn from Asia's experience, relating to the structural weaknesses in the financial system that allowed the problem to emerge. These weaknesses certainly need to be addressed in the borrowing countries' own interests, if they are to continue to reap the great benefits of the free international movement of capital without similar extreme volatility in the future. But the immediate question was, and is, how to contain the present problem.

There are two broad options. One is simply to allow financial markets (exchange markets, interest rates, and stock and bond prices) to take the strain, and to seek to restore confidence and moderate the impact of market movements by restrictive macroeconomic policy adjustment. The second is to limit the financial market impact and the extent of the associated macroeconomic adjustment by providing or arranging alternative external financing. In practice these options are not, of course, mutually exclusive, and the real question is the appropriate balance between them.

Where a country has transparently been pursuing an undisciplined and unsustainable macroeconomic policy, most people find it easy to accept that that country should bear the burden and adjust, painful though that may be. Many people find that harder to accept where, as in the present case, conventional macroeconomic policies have, for the most part, been relatively responsible. There were certainly adjustments to macroeconomic policy that needed to be made—a more flexible exchange rate regime in some cases, for example, or a somewhat tighter overall macroeconomic stance, with perhaps some adjustment between fiscal and monetary policy. And once the capital outflow had started, adjustment needed to be more abrupt than might otherwise have been necessary, in order to re-establish confidence. But there are real dangers in extreme market movements, or in excessively severe macroeconomic adjustment to contain them. That could cause a vicious circle of domestic default and systemic financial weakness in the affected country. And it would have seriously adverse implications—in terms of both financial and economic knock-on-effects—for the global economy.

That is why it is in the self-interest of the international community to attempt to mitigate the market and macroeconomic adjustment pressures in Asia by providing financial support. It is why the international community responded to the crisis in Asia by promptly offering very large amounts of official assistance—$17 billion in the case of Thailand, $43 billion for Indonesia and $57 billion for South Korea.

But such official financial help cannot be unlimited, and it cannot be provided without strings. It, too, has real dangers. If it were too readily forthcoming it could encourage 'moral hazard', partly by encouraging macroeconomic laxity in other potential borrowing countries, but especially by encouraging commercial lenders—particularly foreign currency creditors—in the belief that they will be bailed out if things go wrong. That would be likely to add to the problem of potentially volatile capital inflows next time around. Not surprisingly, too, there is also strong political

resistance in many countries, including notably the United States, to the idea that public—taxpayers'—money should be used to bail out private creditors, especially foreign creditors.

Alternative external financing need not come solely from the public sector. Private finance would, in principle, serve the same purpose, and in many situations market price adjustments may be sufficient to stem the capital outflow. But given the extent of the loss of confidence in the present case, it would be optimistic to think that other private lenders were queuing up to volunteer to stand in place of those that are rushing for the exit. In practice, in the present situation private support means persuading existing creditors that their assets will be better protected if they are prepared to leave them in place. And they may be prepared to do so, if all other major creditors agree to do the same, especially if official support is being made available in parallel. But in this case too, difficult judgments have to be made. There is a danger that, if private creditors have to be in effect coerced into staying put, they will immediately cut their positions elsewhere while they can, adding to the international contagion.

Achieving a reasonable balance between market and macroeconomic policy adjustment and official and private financing was never going to be easy. It depends upon the good sense and judgment of key players all around the world—the governments, central banks and major market participants in both the major creditor and the debtor countries, as well as the international organisations. My impression is that after the initial shocks, in which market adjustments have been massively overdone, the key players are now co-operating more effectively to bring about stabilisation. Within the constraints imposed upon it, the IMF in particular is playing a very positive leading role. And I particularly welcome the constructive part that the major commercial banks, from all the main creditor countries, are now playing in rolling over their loans to Korea. This has already helped to begin to stabilise the situation there, and it has provided a breathing space while new market financing is organised. Together with the availability of the further official support already committed, this, I am reasonably confident, will enable Korea to regain control of its external position, and go on to rebuild confidence on the back of the underlying strengths of its economy and an already rapidly improving current account. That, in turn, would do more than anything to help to re-establish stability elsewhere.

Stabilisation, of course, is not the end of the story—it is simply the necessary first step.

Even assuming, as I do, that we are able in fact to contain the immediate financial turmoil, there is bound to be a substantial economic aftershock. Domestic economic activity in much of Asia will inevitably be subdued, with knock-on effects elsewhere, and major imbalances are likely to emerge in international trading patterns.

It is too soon to have any very clear view about the likely scale or duration of these economic effects. The IMF, in its interim *World Economic Outlook*, based on information available up to early December, has tentatively estimated that world GDP growth this year—at 3½%—might be around 1% lower than it had expected in the autumn. They expected much of the impact to fall on the Asian economies themselves—with forecast growth in the newly industrialised Asian economies falling by 2½%, whereas growth in the G7 countries was expected to be only about ¼% lower (at 2¼%), with a substantially larger impact on Japan. My impression is that, notwithstanding these revisions, most analysts would still see the risks as being quite heavily on the downside.

There have been suggestions that the dampening of activity, particularly in this country and in the United States, as a result of these developments is welcome insofar as it will help to prevent the re-emergence of inflationary pressures. And that is true—up to a point. It is clearly not desirable that the necessary moderation of demand should be narrowly concentrated on those sectors that are exposed to international competition. And while some of the industrial countries can certainly tolerate significant external deficits for a time, persistent large deficits would not be sustainable indefinitely. So it is clearly in our own interests as well as theirs that the Asian economies recover as rapidly as possible and that we help them towards that end. That represents a difficult international economic and financial agenda for the future—which, given the time, is perhaps the subject for another occasion. The immediate first step is financial stabilisation in Asia, and my message to you today is that we are making progress towards that end.

Bank of England publications

Working Papers

The *Working Paper* series are available free of charge. A complete list of the *Working Papers* is available from the address below. The *Working Papers* still in print are:

No	Title	Author
19	The effect of futures trading on cash market volatility: evidence from the London stock exchange *(December 1993)*	Gary Robinson
20	M0: causes and consequences *(December 1993)*	F J Breedon P G Fisher
21	An empirical analysis of M4 in the United Kingdom *(December 1993)*	P G Fisher J L Vega
22	A model of building society interest rate setting *(June 1994)*	Joanna Paisley
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75	The information content of the inflation term structure	Francis J Breedon Jagjit S Chadha
76	Electronic versus open outcry markets: the case of the bund futures contract	Francis J Breedon Allison Holland

Statistical Abstract

The annual *Statistical Abstract* comes in two parts: Part 1 contains a range of banking and other financial data; Part 2 provides longer runs of monetary statistics and related items. For 1997, each part is priced at £20.00 (including postage) in the United Kingdom. A concessionary price of £15.00 per part is available to academics in the United Kingdom and £12.00 per part to students and secondary schools in the United Kingdom.

Monetary and Financial Statistics

A monthly publication, *Bank of England: Monetary and Financial Statistics,* was launched in January 1997. This comprehensive publication (priced at £70.00 per annum in the United Kingdom for 1998) contains detailed data on money and lending, bank and building society balance sheets, international positions of banks operating in the United Kingdom, government financing and the money markets (including gilt repo and stock lending), issues of securities and short-term paper, interest and exchange rates and occasional background articles. If you would like more information please contact Daxa Khilosia, Monetary and Financial Statistics Division HO-5, telephone 0171–601 5353.

Financial Statistics Users Group seminar

In March 1997, the Bank of England and the ONS hosted a Financial Statistics User Group (FSUG) conference which was introduced by Mervyn King, Executive Director of the Bank of England. A full report of this seminar was published in July 1997; if you wish to receive a copy or would like to be on the mailing list of FSUG, please contact the Group secretary, Daxa Khilosia, Monetary and Financial Statistics Division HO-5, telephone 0171–601 5353.

Targeting Inflation book

In March 1995, the Bank hosted a conference of central banks currently adhering to inflation targets. This book, edited by Andrew Haldane, draws together contributions from each of the eight countries represented at the conference. It details cross-country experiences of this monetary framework and the key operational and theoretical issues it raises. The book is suitable for both academics and practitioners. The price of the book is £20.00 plus postage and packaging.

Index-linked debt book

In September 1995, the Bank held a conference to discuss a broad range of theoretical and practical questions raised by index-linked debt in general, and the UK experience in particular. This book contains revised versions of the papers presented at the conference, as well as the papers that were circulated by the Bank ahead of the conference, setting out background information and key policy issues. The price of the book is £10.00 plus postage and packaging.

These publications are available from Publications Group, Bank of England, Threadneedle Street, London, EC2R 8AH; telephone 0171–601 4030; fax 0171–601 5196; email mapublications@bankofengland.co.uk.

Quarterly Bulletin and Inflation Report subscription details

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Destination	1998				1997			
	Quarterly Bulletin and *Inflation Report* package		*Inflation Report* only (1)		*Quarterly Bulletin* and *Inflation Report* package		*Inflation Report* only (1)	
	Annual	Single	Annual	Single	Annual	Single	Annual	Single
United Kingdom by first class mail (2)	£40.00	£10.00	£12.00	£3.00	£40.00	£10.00	£12.00	£3.00
*Academics, **UK only***	*£27.00*	*£6.75*	*£8.00*	*£2.00*	*£27.00*	*£6.75*	*£8.00*	*£2.00*
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(1) There is a 25% discount if five copies or more of the same issue are purchased.
(2) Subscribers who wish to collect their copy(ies) of the *Bulletin* and/or *Inflation Report* may make arrangements to do so by writing to the address given below. Copies will be available to personal callers at the Bank from 10.30 am on the day of issue and from 8.30 am on the following day.
(3) All countries other than those in Zone 2.
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Readers who wish to become **regular subscribers**, or who wish to purchase single copies, should send to the Bank, at the address given below, the appropriate remittance, payable to the Bank of England, together with full address details, including the name or position of recipients in companies or institutions. Existing subscribers will be invited to renew their subscriptions automatically. Copies of the above publications can also be obtained over the counter at the Bank's front entrance or at the Bank Museum in Bartholomew Lane; copies of the most recent *Inflation Report* are on sale at selected bookshops.

The **concessionary rates** for the combined *Quarterly Bulletin*/*Inflation Report* package and the separate *Inflation Report* are noted above in *italics*. **Academics at UK institutions** of further and higher education are now entitled to a concessionary rate. They should apply on their institution's notepaper, giving details of their current post.

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An index of the *Quarterly Bulletin* is also available to customers free of charge from Publications Group at the address given below. It is produced annually and lists alphabetically terms used in the *Quarterly Bulletin* and articles written by named authors.

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