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 in relation to the inflation target. The *Report* starts with a short overview section; the second section investigates money and financial markets, and the following three sections examine demand and output, the labour market and pricing behaviour respectively. The concluding sections present a summary of monetary policy since the February *Report*, an assessment of medium-term inflation prospects and risks, and information about non-Bank forecasts.

Markets and operations (pages 133–51)

The article reviews developments in international and domestic financial markets in the first quarter, and describes official operations in financial markets. The euro was successfully introduced over the New Year weekend. Euro-area economic data released during the first quarter generally indicated low inflation and weaker-than-expected growth; against this background, the euro exchange rate and the profile of expected future interest rates fell. In the United States, output data were unexpectedly strong, although inflation remained low, and market expectations about future interest rates were revised upwards. The dollar appreciated against both the euro and the yen. In Japan, there were important changes in monetary and public debt management policies. In the United Kingdom, official interest rates were cut by a total of 75 basis points during the quarter. Survey evidence indicated some recovery in business confidence, and the pound appreciated against the euro, though it fell against the dollar. Equity prices rose in most major markets.

The international environment (pages 152–60)

This article discusses developments in the global economy since the February 1999 *Quarterly Bulletin*. Growth in the United States remained well above trend in the fourth quarter of 1998, and recent data suggest continued strength into 1999. Japan stayed in recession, with a sharp fall in GDP in the fourth quarter. Euro-area GDP growth was on a downward trend throughout 1998. Inflation was broadly unchanged in the major industrialised countries in 1999 Q1. OPEC agreed oil-supply quotas on 23 March, and oil prices have risen to \$16.80 dollars per barrel, an increase of more than 60% since 1 January. The Bank of Japan lowered the overnight call rate towards zero during February, and the European Central Bank cut its main refinancing rate by half a percentage point on 8 April. The Federal Reserve left US rates unchanged throughout the period. Output started to recover in a number of newly industrialised economies in Asia. The Brazilian authorities were able to reduce official interest rates without prompting large net capital outflows. Financial markets were calmer over the first quarter of 1999.

Report (pages 161–170)

Research and analysis (pages 171–206)

The transmission mechanism of monetary policy. This report has been prepared by Bank of England staff under the guidance of the Monetary Policy Committee in response to suggestions by the Treasury Committee of the House of Commons and the House of Lords Select Committee on the Monetary Policy Committee of the Bank of England.

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

Monetary policy and the yield curve (by Andrew Haldane of the Bank's International Finance Division and Vicky Read of the Bank's Foreign Exchange Division). This article examines and interprets movements in the yield curve at the time of changes in monetary

policy. These responses provide a measure of the degree of transparency and credibility of a monetary regime. There is evidence of yield-curve responses having been dampened since the introduction of inflation targeting in the United Kingdom in 1992—consistent with greater transparency and credibility of this monetary regime.

The Bank's use of survey data (by Erik Britton of the Bank's Structural Economic Analysis Division, and Joanne Cutler and Andrew Wardlow of the Bank's Conjunctural Assessment and Projections Division.). The Monetary Policy Committee (MPC) has access to around thirty 'state-of-trade' surveys, containing hundreds of different pieces of information. This article provides a brief outline of how surveys are used to inform the MPC's economic assessment and policy decisions, describing the techniques employed to compare surveys with official data, and to extract the 'news' from surveys.

Monetary policy and uncertainty (by Nicoletta Batini, Ben Martin and Chris Salmon of the Bank's Monetary Assessment and Strategy Division). This article describes various types of uncertainty that policy-makers may face. It summarises analysis, including recent work by Bank staff, that shows how different forms of uncertainty could lead to different policy responses.

An effective exchange rate index for the euro area (by Roy Cromb of the Bank's Structural Economic Analysis Division). Since 11 May, the Bank of England has published a daily effective exchange rate index for the euro area. The index is calculated using close-of-business rates in London and is compiled on the basis developed and used by the International Monetary Fund. This article describes the calculation of the index since the initial value of the euro was set on 31 December 1998, and also for the preceding period. The index is calculated, using 1990 as a base year, by weighting together the individual exchange rates of the eleven euro-area countries against non euro area currencies; so it represents an effective index for the eleven countries as a group, rather than for the euro as a currency. The article compares the Bank's euro-area index with recent movements of the euro against the US dollar, sterling, the Japanese yen and the Swiss franc; with the Bank (ECB); and with the IMF's 'broad' euro-area index, which has a greater country coverage. It also notes how the introduction of the euro has affected the exchange rate indices for individual countries.

The financing of small firms in the United Kingdom (by Melanie Lund and Jane Wright of the Bank's Domestic Finance Division). Economists have often argued that imperfections in the financing of small firms arise because of information asymmetries: the small business owner generally has much better information than the bank on his firm's performance. This is fundamentally different from the situation with large companies. This article examines the developments over the past decade in the financing of small businesses in the United Kingdom. It notes the sector's reduced dependence on external funds and increased use of a range of financing products. The article also assesses the current risks faced by the small firms sector and its providers of finance, suggesting that this sector is now more resilient to a downturn in the economy than in the early 1990s, thus reducing the likelihood of a recurrence of the high levels of business failures experienced in that recession.

Structural changes in exchange-traded markets (by Claire Williamson of the Bank's Market Infrastructure Division). This article outlines the main recent structural changes in exchange-traded markets—mergers between equity and derivatives exchanges, new international links between exchanges, and changes in exchanges' ownership structure. It analyses the factors that have prompted these developments, and reviews the implications that the changes may have for market-users, other types of infrastructure and the authorities.

This summary is also available from the Bank's web site at www.bankofengland.co.uk/summary.htm.

Markets and operations

This article reviews developments in international and domestic financial markets in the first quarter of 1999, and describes official operations in financial markets.

- The euro was successfully launched on 4 January.
- Euro-denominated bond issuance was heavy during the first quarter.
- Economic indicators in the euro area were generally disappointing, and the euro exchange rate weakened over the quarter. After the end of the quarter on 8 April, the European Central Bank (ECB) announced a cut in interest rates of 50 basis points to 2.5%.
- Economic indicators in the United States were unexpectedly strong, and market expectations of the path of US interest rates were revised upwards, but there was no change in the official target for the federal funds rate. Equity prices rose further.
- Japanese monetary policy was eased and public debt management policy was modified. Bond prices were volatile and equity prices rose.
- In the United Kingdom, the Bank of England's repo rate was reduced on two occasions during the quarter, by a total of 75 basis points, to 5.5% (and by a further 25 basis points on 8 April).
- Implied future sterling short-term interest rates fell over the quarter, but the implied short-term interest rate curve became upward-sloping, suggesting a rise in short-term interest rates during 2001. Equity prices rose.

International markets

The euro area

The euro was successfully introduced over the New Year weekend. All the necessary infrastructure for the new currency, including the TARGET payments system, was fully operational at the opening of business on 4 January, and most securities denominated in 'legacy currencies' had been re-denominated as planned. There was a spate of euro-denominated bond issues in the wake of the launch of the euro. Over the quarter as a whole, total issuance of corporate euro-denominated debt securities amounted to almost \$120 billion (see Table A).

Euro-area economic data released during the first quarter generally indicated low inflation and weaker-than-expected output growth, particularly in Germany and Italy; forecasts of output growth in the euro area were revised downwards. Against this background, expectations grew that the ECB would reduce official interest rates; and the euro exchange rate weakened, contrary to some earlier expectations that it would appreciate sharply at the beginning of the year (see discussion of foreign exchange markets below). On 8 April, the ECB announced a 50 basis point reduction in its two-week repo rate to 2.5%, with effect from 12 April.

Changes in government bond yields were generally modest in the quarter (see Chart 1). In Germany, ten-year yields rose by around 15 basis points, but yields on shorter-dated government securities

Table ACorporate bond issuance by currency

\$ billions; percentage share of total in italics

		US\$		Ster	ling	Euro		Othe	er
1998	Q1	116	48	28	12	72	30	23	10
	Q2	96	52	14	8	59	32	17	9
	Q3	58	46	14	11	41	32	14	11
1999	Q4	71	52	21	15	33	24	11	8
	Q1	131	45	24	8	119	41	19	7

Note: Totals of percentages may not sum to 100% because of rounding Source: CapitalData Bondware.







fell by up to 25 basis points, largely in anticipation of lower ECB rates. Spreads among euro-area government securities changed little during the quarter: short-dated yields converged, while longer-dated yields in Italy, Spain and Portugal moved away slightly from German levels.

European equity market performance in the first three months of the year was mixed, and appeared to reflect output growth and business confidence within each country. In Germany, the Dax index fell by 2%; in contrast, in France, where economic growth indicators were stronger, the CAC index gained 6%. The Dow Jones Euro Stoxx 50 price index (covering 50 blue-chip stocks across the whole of the euro area) rose by 7% over the quarter.

US developments

Three-month interest rates implied by eurodollar futures for June, September and December 1999 rose by some 10 to 20 basis points, and implied rates beyond mid 2000 increased by around 50 basis points. Over the quarter as a whole, the US yield curve shifted upwards by more than 50 basis points for ten-year bonds, to 5.6% (see Chart 2).

Early in the quarter, major government bond markets were supported by 'safe-haven' flows from emerging markets, especially Brazil. The upward shift in the yield curve was concentrated in late January and February, when some safe-haven flows were reversed, and when a number of data releases were key in changing perceptions about the US economy. Stronger-than-expected data for fourth-quarter GDP were published towards the end of January, followed in early February by a strong employment report. Markets feared that a tightening of monetary policy would follow. In his 23–24 February ('Humphrey-Hawkins') testimony on monetary policy, Federal Reserve Chairman Alan Greenspan said that 'the Federal Reserve must continue to evaluate, among other issues, whether the full extent of the policy easings undertaken last fall to address the seizing-up of financial markets remains appropriate as those disturbances abate'. This added to market expectations that official interest rates might be raised, but those expectations quickly diminished, as the markets failed to find much sign of a pick-up in inflationary pressure in the official data released in March. In particular, the February labour report, released on 5 March, showed a smaller-than-expected rise in average hourly earnings and a higher-than-expected unemployment rate. These data led to a fall in yields not only in the United States but in all major government bond markets. The Federal Open Market Committee left the official federal funds target rate unchanged at 4.75% at its 30 March meeting.

US equity prices rose in the first quarter, continuing the recovery begun in the final months of 1998. Information technology stocks performed particularly strongly, despite rising price/earnings ratios, investor concerns over earnings potential, and Microsoft's continuing anti-trust case. Stock prices rose sharply after the release of the February employment report, which reduced fears of higher interest rates, and later in March, when oil shares rose in the light of OPEC agreements to restrict oil production in order to maintain prices. The Dow Jones Industrial Average rose by 7% on the quarter, briefly exceeding 10,000; the S&P 500 and the Nasdaq Composite rose by 5% and 12% respectively.

Japanese developments

Japanese money and bond markets were dominated by developments in monetary and public debt management policies, and by continuing uncertainty about the economic outlook. In the light of disappointing economic data releases, rising long-term interest rates and yen appreciation, the Bank of Japan (BoJ) lowered its target rate, the overnight call rate, on 12 February by 10 basis points to 0.15%, and indicated that it intended to keep the overnight call rate as low as possible. In the second half of the quarter, the overnight call rate fell further, and remained at around 3 basis points during March.

By pushing the overnight call rate close to zero through its open market operations, the BoJ sought to depress term money-market rates and bond yields. In addition, from 12 February, the BoJ broadened the range of eligible collateral in its market operations, a move announced on 13 November 1998, in a further attempt to stimulate credit expansion.

Volatility in Japanese government bonds (JGBs) remained high. Ten-year yields, which had been as low as 0.7% on 2 October 1998, traded between 1.6% and 2.4% during the first quarter, reaching a peak closing-level on 5 February, largely reflecting market concern about the scale of upcoming bond issuance and the reduced role of the Trust Fund Bureau (TFB) in the bond markets (see Chart 3). However, the cut in the overnight call rate on 12 February and announcements by the Ministry of Finance (MoF) the following week encouraged investors back to the market. The MoF announced that the TFB would resume secondary market purchases of JGBs, albeit at around half the previous rate. At the same time, the MoF announced that it would switch funding away from supply of ten-year bonds in favour of more two and six-year issues. These arrangements were extended on 18 March, with the MoF announcing that the TFB would continue to purchase bonds for three months after April. The MoF also indicated that it would continue to reduce the issuance of ten-year JGBs in favour of issuance of four to six-year bonds and Treasury bills. These developments, together with the easing monetary stance, helped ten-year JGB yields to decline sharply.

Equity prices moved sharply higher during the quarter, especially in March, with the Nikkei 225 index rising by 14%. These gains have been sustained since the end of March, which suggests that they were not purely seasonal changes in advance of the end of the fiscal year. There appeared to have been some positive re-rating of Japanese stocks by foreign fund managers, who had been underweight in Japanese securities for some time, perhaps in the light of news of corporate restructurings, merger and acquisition activity, and an improving outlook for the banking sector in the wake of the official recapitalisation programme. The market may also have become more optimistic about the macroeconomic outlook for Japan, although data releases failed to provide any conclusive evidence of recovery.

Foreign exchange markets

G3 currencies

The US dollar appreciated against other major currencies in the first quarter of 1999 (see Chart 4). According to market participants, the main factors behind the dollar's strength were the continuing strong

Chart 3 Ten-year Japanese government bond yields^(a)



(a) Derived from Svensson par yield curve.

Chart 4 Dollar exchange rates



Commodity currencies

The currencies that usually move most closely with commodity prices have been strong this year despite continued falls in commodity prices, in some cases to historic lows. The benchmark Commodity Research Bureau (CRB) commodity price index was broadly unchanged over the first quarter of 1999, and at one point touched its lowest level in more than 25 years. But the Australian, New Zealand and Canadian dollars all appreciated against the US dollar in the first quarter of 1999. Chart A shows the typically strong correlation between the nominal US dollar exchange rates of these countries and commodities prices as measured by the CRB index.

Chart A

Nominal US dollar exchange rates vs the CRB index



The correlation between the commodity currencies and commodity prices has declined significantly this year. For example, in 1998 the correlations between daily movements in the Australian and New Zealand currencies and the CRB index were around 75% and 80% respectively. However, in the first quarter of 1999, they fell to around 5% and 30% respectively.

Various reasons explain the recent strength of these commodity currencies, including the following:

- Positive domestic economic indicators have strengthened, reinforcing the impression (in the case of the Australian and New Zealand dollars) that the impact of the Asian crisis may be receding.
- Commodity prices have been at their lowest since the early 1970s (see Chart B). There is now a growing perception among investors that commodity prices may not be far from bottoming out, or at least that they are unlikely to continue to fall as fast as they did in 1998. This view reflects the relatively strong performance of some major industrial economies and the fact that many economies, especially in Asia, have had a significant easing in monetary conditions and an improvement in external competitiveness.
- Many of the currencies in question are recognised as being at or near to previous cyclical lows, in both real and nominal terms.



performance of the US economy, robust stock markets, and a perception that the sustainable growth rate of the US economy might have increased. Interest rate differentials moved in the dollar's favour, as other countries cut official rates, and perceptions that US interest rates might be raised gained ground, particularly after the Humphrey-Hawkins testimony in late February. However, fears of a tightening of US monetary policy abated in March, for the reasons described above.

The rise in the dollar was not uniform. Against the yen, the dollar strengthened by 5% overall, although it fluctuated much more widely. In the first few trading days of 1999, the dollar fell, to a low of \$108.70 on 11 January, its weakest level in 28 months. With the market nervous that the yen might appreciate very sharply at that point, rumoured intervention by the BoJ reversed the rise in the yen and took the exchange rate back above \$110. Official

statements from Japan in January and February assisted the dollar's recovery: the BoJ and the MoF both indicated that they would be content with a weaker yen.

The dollar strengthened rapidly against the yen in mid February, when the BoJ lowered its overnight call rate. As a result, the dollar reached as high as ¥123.71 in early March. For the rest of March, the dollar traded lower, between ¥117–121, but was fairly volatile within this range. The exchange rate was subject to a number of short-term influences over the month, including the rally in the Nikkei 225, signs of investor optimism about the Japanese economy, and capital inflows relating to the Japanese fiscal year-end. Implied volatilities for the dollar-yen rate from the options market were lower than in the previous quarter; however, implied volatilities remained higher for the yen than for other currencies.

The dollar appreciated steadily against the euro in the first three months of 1999, by 8.3%, despite some initial expectations that the euro would appreciate sharply against the dollar early in the New Year. The euro exchange rate reached a high of $\notin 1=$ \$1.1892 on 4 January, but fell to $\notin 1=$ \$1.0794 by the end of the quarter.

Market participants suggested that some of the depreciation of the euro against the dollar could be explained by the unexpected strength of the US economy. US interest rates and bond yields rose during the quarter in absolute terms and relative to those in the euro area, making the dollar a more attractive currency for investors to hold. However, the euro depreciated against other currencies, such as sterling, which suggests that euro-specific factors were also influential. Economic data releases from the euro area in the first quarter were generally weaker than expected. Despite reasonably strong consumer sentiment, industrial production and confidence were lower than market expectations. Market sentiment was also affected by indications that euro-area governments would not welcome an appreciation of the euro. In the context of concerns about euro-area growth, markets were uncertain about the monetary policy response of the newly established ECB. This combination of influences pushed the euro lower.

Towards the end of the quarter, the euro depreciated further as the situation in Kosovo deteriorated: NATO's commencement of air strikes on 24 March provoked selling of the euro, which reached lows for the quarter on 29 March at \$1.0683 and £0.6608. The conflict in Kosovo also caused some nervousness in central and eastern European currencies, and in the Greek drachma. The drachma weakened from GrD 321.5 against the euro on 23 March to GrD 326.5 at the end of the quarter. However, it remained stronger than its central parity against the euro in the Exchange Rate Mechanism II (ERM II) throughout the period. The other ERM II currency, the Danish krone, was stable over the quarter.

Sterling

Sterling appreciated by 5.2% against the euro over the quarter, but depreciated by 3.0% against the dollar (see Chart 5). Sterling's effective exchange rate index (in which the euro has a 65% weight) appreciated by 3.2%. Some market participants attributed sterling's movements to the same factors, described in previous sections, that influenced the euro and the dollar. UK official interest rates were reduced by a total of 75 basis points during the quarter; although





such a fall had been anticipated by the market at the beginning of the year, the path of sterling short-term interest rates implied by futures contracts for the second half of 1999 fell during the quarter (see Chart 6). The path of implied future euro short-term interest rates also fell, but that of dollar rates rose.

Among other factors, mergers and acquisitions added to the demand for sterling. The market may also have increased its estimate of the United Kingdom's trend growth rate relative to that of the euro area, potentially increasing the relative attractiveness of UK equities, which could have encouraged demand for sterling.

Emerging market currencies

The focus generally shifted away from the emerging markets in the quarter, as many of the Asian currencies hit by the emerging market crisis in 1997 began to recover. The main exception was Brazil, where the real depreciated significantly early in the quarter, before recovering a little in March.

On 12 January, the Brazilian authorities shifted the top of their intervention band for the real from R1.21 to R1.32 against the US dollar, in the light of increasing capital outflows. However, the market did not see these new bands as credible, and started to sell the currency, ultimately forcing the Brazilian authorities to abandon their exchange rate target on 15 January and officially float the real on 18 January. At the same time, Brazilian short-term interest rates rose by around 15 percentage points, to 45%. In early March, the real reached a low of R2.195 against the dollar,

Bank of England participation in BIS loan to Brazil

The Bank for International Settlements (BIS) is involved with the IMF and other multilateral organisations in a financing package for Brazil. The BIS facility to Banco Central do Brazil (BCB) totals \$13,280 million. The loan is effectively guaranteed by 19 participating central

Participation in the BIS facility to Brazil

Total	13,280	
BIS	350	
Norges Bank	50	
FRBNY	5,000	
Sveriges Riksbank	300	
Schweizerische Nationalbank	250	
Banco de Portugal	350	
De Nederlandsche Bank N.V.	300	
Osterreichische Nationalbank	50	
Banque Centrale du Luxembourg	50	
Banca d'Italia	830	
Central Bank of Ireland	50	
Bank of Greece	50	
Banque de France	1 250	
Suomen Pankki—Finlands Bank	50	
Banco de Espana	1,000	
Bank of England	1,250	
Dautacha Bundashank	1 250	
Danmarka Nationalbank	50	
Banque Nationale de Belgique	500	
	200	
	(\$ millions)	
	of principal	
	Maximum amount	

banks (PCBs), including the Bank of England, and the BIS. In the event of any default by the BCB in the payment of interest or repayments of amounts drawn under the BIS facility, the BIS may require the PCBs to substitute for the BIS in the provision of the facility. The United Kingdom, France and Germany have the same share of the facility, each at \$1,250 million. The Federal Reserve Bank of New York (FRBNY) has the largest share, at \$5,000 million (see the table).

Two drawings have been made under the BIS facility to date:

- \$4,150 million on 18 December (UK share \$391 million).
- \$4,500 million on 9 April (UK share \$426 million).

The Bank of England's participation in the Substitution Agreement with the BIS is indemnified by HM Treasury.

The Bank of Japan has chosen not to participate in the BIS facility, but has provided BCB with a separate facility of \$1,250 million.

representing a 45% depreciation in the dollar value of the currency since 4 January.

The Managing Director of the International Monetary Fund (IMF), Michel Camdessus, announced on 8 March his intention to recommend the revised economic programme for 1999–2001, proposed by the Brazilian government, to the IMF Executive Board. A growing recognition that the real had become undervalued and that the proposed macroeconomic reforms were credible lent support to the currency. By the end of March, Brazilian financial markets had stabilised: the real had steadily recovered to around R1.75, and short-term interest rates had eased slightly to 42%. A rally in the domestic stock market also reflected increased economic confidence, and the IMF approved the revised economic programme on 31 March. The situation continued to improve in April.

The events in Brazil had some knock-on effects in other markets, but there was generally much less contagion than there had been from the Russian crisis last year. For example, the real's devaluation drew renewed attention for a time to Hong Kong and China, where there was already concern at the scale of debts at GITIC, China's second-largest finance firm, which had gone into liquidation.

Sterling markets

Short-term interest rates

In the United Kingdom, the official repo, cash money-market rates and interest rates implied by short sterling futures for the second half of 1999 all continued to fall in 1999 Q1 (see Chart 6). By the end of the quarter, the official repo rate stood at 5.5% and three-month Libor was 5.32%, compared with end-1998 levels of 6.25% and 6.26% respectively. Implied short-term interest rates from mid 2000 onwards changed relatively little, and at the end of the quarter, the rate curve implied by the short sterling futures market and the interest rate swap market for dates in and beyond 2001 was fairly flat in the range $5^{1/4}\% - 5^{1/2}\%$.

The official reportate was cut twice in the quarter, by 25 basis points on 7 January and by 50 basis points on 4 February. A 75 basis point cut in the quarter had been largely discounted in the short sterling futures market at the beginning of the year: on 4 January, the March contract implied three-month Libor at 5.56%. In the first quarter of 1999 as a whole, implied interest rates derived from the June and September 1999 short sterling futures contracts fell by around 15 basis points (see Chart 6). At the same time, the 'Millennium spike'(1) in this market became less pronounced, with the interest rate premium of the December 1999 over the average of the September 1999 and March 2000 contracts falling from 34 to 18 basis points. The successful and orderly launch of the euro may have given markets more confidence that technical challenges would be overcome. Before 1998, a year-end premium had not normally been observed in the sterling market.

Domestic factors continued to dominate changes in implied future UK interest rates. In the first half of the quarter, market



98

Bank repo rate

97

3

1996

8.0

6.5

- 6.0

5.5

5.0

₹^{4.}

01

Futures curve as at 31 Dec

2000

Futures curve as at 31 Mar

99



⁽¹⁾ The 'Millennium spike' refers to the high three-month interest rate implied by the December 1999 short sterling future. It probably reflects speculation that systems difficulties could lead to tighter liquidity conditions around the year-end.

Chart 7

Interest rate announcements: change on the same day in nearest short sterling contract^(a)







expectations about future output growth and inflation were revised down. At the same time, the trend in implied short-term interest rates was reinforced by the Brazilian crisis and the associated fall in implied future US interest rates. The three-month interest rate implied by the June 1999 short sterling contract fell to 4.99% on 11 February. The fall in expected future rates extended to rates implied for 2002 and beyond. Implied rates for 2002 fell by more than 40 basis points, and ten-year swap rates were around 25 basis points lower than at the end of 1998.

Market sentiment changed after mid February. This partly reflected the emergence of survey evidence showing some recovery in business optimism. In addition, the projection in the *Inflation Report*, published on 10 February, indicated that, in the Monetary Policy Committee's view, inflation was likely to exceed the 2^{1/2}% target if interest rates changed as implied by short sterling futures markets. Market concerns about the possibility of a rise in US interest rates also put upward pressure on implied UK rates for a period, but the release of US labour statistics on 5 March reversed some of this upward international pressure. Thus, on balance, implied future UK interest rates rose in the second half of the quarter. The largest increases during this period were in interest rates implied for 2001 and beyond, steepening the curve and reversing the earlier fall in rates implied for these dates.

Although the reduction in short-term interest rates over the first quarter had been largely anticipated at the end of 1998, the timing of the step reductions was not certain and the announcements, on the days when they came, did affect the interest rates implied by the nearest short sterling futures contract, as Chart 7 shows.

Trading conditions in short sterling futures were generally more stable than in the previous quarter. Volatilities implied by options markets were lower than in 1998 Q4, but remained above the levels seen before their sharp upturn in September 1998.

Gilt repo

According to the Bank's quarterly survey, the gilt repo market grew from £94 billion at end November 1998 to £105 billion at end February this year (see Chart 8). The latest figure for repo outstanding is just above its previous high, reached in August 1998. There are several possible reasons for the growth of the gilt repo market between end November and end February.

First, the stock of refinancing (the amount of assets held by the Bank as a result of its open market operations) was high in February for seasonal reasons, and was £3 billion higher than in the previous November. As a result, the Bank's counterparties had to operate in larger size in the repo market to distribute cash provided in the Bank's open market operations. The maturity profile of the repo market (shown in Table B) shows a marked increase in activity at the nine-day to one-month maturities, consistent with this interpretation.

Second, in November, the effects of the late-summer market turmoil were fresh in the minds of many, and this was thought to have led to some disengagement, even from such a relatively safe instrument as repo, when participants were unsure of the creditworthiness of some of their counterparties. Moreover, at the

Table BMaturity breakdown of repo outstanding andreverse repo over time(a)

Per cent	On call and next day	2–8 days	9 days to 1 month	1–3 months	3–6 months	Over 6 months
Repos						
 1996 year average 1997 year average 1998 Feb. May Aug. Nov. 1999 Feb. 	25 24 14 20 27 23 16	32 24 23 24 15 18 18	24 26 25 19 17 20 28	15 20 19 19 18 16 17	4 5 11 12 11 12 14	1 7 8 11 10 7
Reverse repos						
1996 year average 1997 year average 1998 Feb. May Aug. Nov. 1999 Feb.	26 19 14 22 28 24 16	29 25 29 28 20 14 23	21 25 23 17 18 19 19	20 23 19 13 15 20 21	4 6 10 12 7 11 13	1 2 5 10 12 11 8

Note: Totals of percentages may not sum to 100% because of rounding

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





Chart 10 Two and ten-year gilt yields^(a)



end of 1998, the approach of the euro led many to wind down positions in order to make the transition as smooth and as risk-free as possible. This exaggerated the lack of activity in what is, in any case, normally a quiet time for the market. After the successful introduction of the euro and the calming of markets in the New Year, however, both of the latter two effects were probably largely reversed by the time that the end-February figures were collected.

The spread between unsecured and secured borrowing rates widened sharply at the end of last year, reflecting heightened liquidity and credit concerns. Chart 9 shows that the spread between three-month general collateral repo and interbank rates increased steadily from 20 basis points at the start of September to nearly 60 basis points by the end of the year. Following the introduction of the euro and the easing of some emerging market concerns, the spread reduced to more normal levels.

Throughout the period, two particular gilt-edged stocks were consistently expensive to borrow in the repo market. Institutional demand for long-dated stock has exceeded the limited supply of gilts. As a result, the market has been persistently short of 6% Treasury 2028 (which is the longest-dated gilt and is relatively small in size—£5 billion in issue). This has pushed up the price of the stock and increased the need for market-makers to borrow the stock to cover short positions. In addition, hedging of the 30 and 40-year tranches of the London and Continental Railways issue and other large long-dated issuance (see section on sterling bonds below) will have added to the borrowing demand for 6% Treasury 2028, over which the bonds were priced. This stock is therefore trading special over the period until the end of May, when further supplies are scheduled to be auctioned. Futures-related activity also increased the borrowing demand for 9% Treasury 2008 over the delivery periods for the June and September LIFFE long gilt contracts.⁽¹⁾

The European Banking Federation introduced a new repo agreement, the European Repo Agreement (ERA), early in 1999. Its aim is to consolidate the various master agreements used within the euro area and neighbouring countries into one harmonised standard document. Though the ERA is in most respects similar to the existing Public Securities Authority/International Securities Markets Association (PSA/ISMA) agreement, there are some technical differences and, unlike the PSA/ISMA agreement, it includes financial transactions other than repo, such as swaps and foreign exchange.

Long-term interest rates

Gilt yields rose modestly during the first three months of the year. Movements during the quarter can be split into three phases: yields fell to fresh lows in January, rose during February, then declined in March (see Chart 10). By the end of the quarter, the yield on $5^{3}/_{4}$ % Treasury 2009 had risen on balance by around 25 basis points, to 4.5%. With short-dated yields falling as the Bank repo rate was lowered, the curve became less inverted during the quarter: the spread between the ten and two-year gilt yields narrowed from around -60 basis points to around -30 basis points.⁽²⁾

⁽¹⁾ The 9% Treasury 2008 is by far the cheapest to deliver into these contracts, and so market participants take account of the risk of a potential shortage of the stock for delivery on expiry of the futures contracts.

⁽²⁾ This spread is calculated using 5³/₄% Treasury 2009 and 8% Treasury 2000.

The main domestic influences in the early part of the quarter were the downward revisions to the market's expectations for UK output growth and inflation as described in the section on short-term interest rates above. Externally, major government bond markets continued to be supported by safe-haven flows away from emerging markets, especially Brazil.

By late January, these supportive influences were beginning to fade, and yields began to rise. JGB yields rose sharply at the end of January, markets became concerned about a possible rise in US interest rates, and safe-haven flows were partly reversed. Domestically, market expectations about the economy, and so about the future path of short-term interest rates, were revised upwards. Issuance of long-dated euro-sterling bonds helped to meet the demand left unfilled by long gilt supply (see the section on other sterling bond issues below). Later in the quarter, yields fell back as concerns about a possible rise in US interest rates diminished. The Budget had little obvious influence on the gilt market other than in the very short term.

Institutional factors continued to influence the demand for sterling bonds, including gilts. The minimum funding requirement (MFR) applied under the Pensions Act 1995 to pension funds since 1997 has led to strong institutional demand for bonds, especially long-maturity and index-linked gilts.⁽¹⁾ In addition, there has been substantial demand by insurance companies for bonds, to hedge liabilities arising from guarantees of minimum returns on annuities sold several years ago when yields were much higher than now. Moreover, the demand to borrow gilts on repo means that holders can readily increase their effective yield by being prepared to lend gilts. These factors have led to strong demand for sterling bonds and, given a very limited new supply of gilts and a reduction in liquidity in the gilt market, gilts have become more expensive (ie lower-yielding) than government securities in other countries, relative to comparable instruments such as interest rate swaps. For example, at the end of March, ten-year swap spreads above government bond yields were more than 80 basis points in the United Kingdom, compared with 40 basis points in Germany. This appears to be too big a difference to be accounted for by different perceptions of the credit risk of swaps. In addition, market participants reported a decline in gilt market liquidity, temporarily aggravated by the introduction of electronic trading for the long gilt futures contracts at LIFFE.

These institutional influences on supply and demand in the gilt market have been strong enough to suggest that in current circumstances, gilt yields do not provide an accurate guide to market expectations about future short-term interest rates. The swap market, where liquidity is reported by participants to be greater, provides useful additional information about the expected future path of Libor, given that this rate is directly used on one side of the transaction.

Swap rates fell as official UK interest rates were cut in January and February, and by the end of the first quarter, the swap yield curve had become very slightly upward-sloping, whereas the gilt yield curve was slightly inverted (see Chart 11). This suggests that the swap market foresaw higher future short-term interest rates.

Chart 11 UK gilt and swap curves^(a)



(a) UK government Svensson par yield curve and market swap rates.

A review of the MFR is now under way, to be carried out by the Faculty and Institute of Actuaries Pension Board in conjunction with the Department of Social Security.

Table C Gilt issuance

Auctions

Date	Stock	Amount issued (£ millions)	Cover	Yield at common accepted price
27.01.99	21/2% Index-linked Treasury Stock 2024	450	1.83	2.01%
Other				
11 01 99 (a) 53/4% Treasury Stock 2009	400		

Note: Real yields are calculated using a 3% inflation assumption

(a) Issued to the DMO as part of a facility to switch holdings of 8% Treasury Stock 2009 into 534% Treasury Stock 2009.

Chart 12 Sterling and euro six-month forward rates:^(a) gilts, euro and swaps— 31 March 1999



(a) These forwards are derived using Svensson curves

Chart 13 Sterling swap spreads: two and ten years^(a)



Chart 12 compares the forward short-term interest rates implied by sterling and euro swap rates, and by gilts and euro-denominated government securities, as at 31 March 1999. Forward rates implied by gilts were well below those implied by euro government securities for dates beyond about five years in the future, but rates implied by swaps showed closer convergence.

Swap spreads (over government securities) reflect not only supply and demand conditions in the government securities market but also other influences, including market perceptions of the creditworthiness of swap counterparties. Chart 13 shows how UK swap spreads narrowed in the second half of January and February as credit concerns declined, particularly about Latin America and Asia. At shorter maturities, this also reflected a weakening of demand from mortgage borrowers to borrow at fixed rather than floating interest rates.⁽¹⁾ However, short-maturity spreads rose in March, and finished higher on the quarter. This partly reflected a greater demand for short-dated liquid collateral, rather than a rise in credit concerns, triggered by large gilt redemptions (notably the Floating Rate Treasury 1999 on 11 March and 12¹/₄% Treasury 1999 on 26 March). It is also possible that increasing concerns about collateral over the Millennium year-end added to the demand for liquid short-dated gilts and led swap spreads higher.

The Government's financing programme for 1999/2000 was described in the March Debt Management Report (available from HM Treasury). The Debt Management Office (DMO), on behalf of the Government, will aim for gross gilt sales of approximately £17.3 billion in 1999/2000, at a broadly even pace through the year. The DMO will aim to make about 20% of its gilts sales in index-linked stocks, subject to upper and lower limits. On the initial financing requirement, this would result in sales of £3.5 billion by value of index-linked stocks. Five auctions of conventional stocks are planned in 1999-2000: two each in short (3-7 years) and long (15 years and over) maturities and one at medium (7-15 years) maturity. On 20 April, the DMO announced that the estimated gilt sales overshoot for 1998-99 had been revised to £4.1 billion, from £2.3 billion estimated in the March report. The volume of planned gilt sales for 1999-2000 (and the number of gilt auctions) would be unchanged, but planned Treasury bill issuance would be lower. This revision followed publication of the preliminary Central Government Net Cash Requirement for 1998–99, showing a repayment of £4.5 billion, higher than the £2.7 billion forecast in the Budget.

UK investment institutions (insurance companies, pension funds and trusts) made very little net investment in gilts in 1998 Q4,

Mortgage lenders, who have floating-rate liabilities, often pay fixed and receive floating interest in the swaps market, to hedge income from fixed-rate mortgages.

Table DOfficial transactions in gilt-edged stocks

£ billions; not seasonally adjusted

	1998/99 AprDec.	1999 Jan.	Feb.	Mar.
Gross official sales (+) (a) Redemptions and net official	7.3	0.8	0.0	-0.1
year of maturity (-)	-6.6	-1.9	0.0	-8.5
Net official sales of which net purchases by:	0.7	-1.1	0.0	-8.5
Banks (b) Building societies M4 Private sector Overseas sector LGs & PCs (c)	0.1 -0.2 -4.2 4.0 1.1	-0.5 -0.1 0.9 -1.4 0.0	0.5 0.3 -0.4 -0.5 0.0	-5.7 -0.1 -4.1 1.4 0.0

(a) Gross official sales of gilt-edged stocks are defined as official sales of stock with more than one year to maturity, net of official purchases of stock with more than one year to maturity, apart from transactions under purchase and resale agreements.

(b) Excluding repurchase transactions with the Bank of England.
 (c) Local Government and Public Corporations.

Chart 14 UK implied inflation rates^(a)



following disinvestment of £4.6 billion in 1998 Q3. Within the 1998 Q4 total, long-term insurance funds bought £1.6 billion (net) of gilts, compared with net sales of £2.6 billion in the previous quarter. Institutions have been increasing total net investments in UK company securities—which reached a record £8.3 billion in 1998 Q4—and overseas securities.

Strips

Strips turnover continued to be relatively low, averaging around $\pounds 120$ million a week over the first quarter of this year. This is equivalent to under 0.5% of turnover in the conventional gilts market. Some market observers had thought that the inverted yield curve made strips less attractive relative to conventional gilts, and the volume of strips fell from $\pounds 2.45$ billion to $\pounds 2.35$ billion over the quarter.

Index-linked gilts

Real yields for most maturities of index-linked gilts (IGs) fell during the first three months of this year. For instance, the yield on the $2^{1/2}$ % Index-linked Treasury 2009 eased from 2.0% to 1.8% on 31 March. Although it is difficult to quantify, institutional demand for IGs from pension funds is believed to have continued to be robust. In addition, supply remained limited.

At the turn of the year, ten-year IG yields dipped below 2% for the first time since their launch in 1981. But as new-year trading got under way, there was uncertainty about how strong institutional demand would prove to be for the IG in the upcoming auction. On 27 January, the DMO auctioned £450 million nominal of $2^{1}/_{2}$ % Index-linked Treasury 2024. The common price was £181.60, giving a real yield of 2.01%, and the auction was 1.83 times covered. Prices of IGs ticked higher in the market after the result of the auction was announced.

The Minimum Funding Requirement led to strong institutional demand for IGs. The combination of strong and rather price-insensitive demand (largely from pension funds) with limited supply, has pushed real yields down, perhaps more than in the conventional gilt market. Consequently, real yields in the IG market may not be a good guide to the real yields prevailing in the economy at large.

Implied inflation expectations derived from the conventional and index-linked gilt markets rose steadily in the first three months of 1999, albeit from low levels. These implied inflation expectations had been falling steadily over the past few years, with five and ten-year expectations reaching historic lows (since 1981 when IGs were first launched) in autumn 1998 (see Chart 14). These lows were nearly reached again for five and ten-year expectations in late January at around 1.9% and 2.1% respectively, but rose thereafter to 2.5% and 2.7% by end March.

Break-even inflation rates⁽¹⁾ derived from overseas government debt markets have shown a similar pattern to those exhibited in the United Kingdom during the first quarter, although levels are lower. For instance, break-even inflation rates derived from ten-year

The inflation rate above which it would pay an investor to hold an index-linked bond in preference to a conventional bond of the same maturity.

Chart 15 Real yields on index-linked government bonds



Chart 16 Fixed-rate issuance



Chart 17 Average yield spreads: UK corporates vs benchmark gilts



conventional and index-linked US Treasuries rose by around 50 basis points in the quarter, to 1.3%. In general, real yields on index-linked bonds in the United States, France and Sweden remained broadly stable during the quarter (see Chart 15), while nominal yields rose.⁽¹⁾ This need not indicate that global inflation expectations have picked up over the past few months. In many countries, conventional yields were probably depressed in the early part of the quarter by the flight to liquidity in late 1998, which subsequently reversed.

Other sterling bond issues

Total fixed-rate issuance (other than gilts) in the first quarter was $\pounds 11.7$ billion, roughly equal to that in the previous quarter, but below the $\pounds 13.8$ billion in 1998 Q1. Issuance was heavily concentrated at longer maturities, with long-dated issues amounting to $\pounds 7.1$ billion; shorts and mediums totalled $\pounds 1.5$ billion and $\pounds 3.1$ billion respectively (see Chart 16). Corporate bond spreads fell during the quarter as credit concerns receded further (see Chart 17).

The first quarter normally has high issuance levels-issuers and arrangers are keen to get their new-year funding under way, and institutional investors have newly allocated funds and investment strategies to pursue. However, the sterling debt primary market was relatively subdued for the first five weeks of the year, as the market awaited the launch of £2.65 billion Government-guaranteed bonds issued by London & Continental Railways (LCR) to finance the Channel Tunnel Rail Link (initially scheduled for January but delayed until early February). Some borrowers had brought forward funding in order to avoid clashing with these bonds and to take advantage of still-attractive swap rates, so that issuance was relatively high in 1998 Q4. In addition, the narrowing of swap spreads in January (see above) reduced the scope for arbitrage-driven issues, and international interest became focused on the launch of the euro, with significant demand for euro-denominated paper, particularly from the Far East.

Although a large proportion of UK institutional funds had been earmarked for LCR bond issues, a few large long-dated issues were brought in the first few weeks of 1999 (for National Grid, Norsk Hydro and Severn Trent Water), targeted at institutional demand, as well as a limited number of swap-driven shorter-dated issues (for Abbey National, Tesco and AAA-rated supranational borrowers). Bookbuilding for the first two tranches of the LCR bonds finally began on 8 February. However, the amount of institutional funds that had been set aside for the deal far exceeded the amount of bonds on offer, and the £1.2 billion 30-year and £425 million 40-year LCR bonds were heavily oversubscribed. Other AAA-rated borrowers (EIB, KfW and IBRD) quickly brought further long-dated issues to soak up the unsatisfied demand. The third LCR tranche, due in 2010, was brought the following week and also went well, with the shorter maturity attracting a wider interest from both continental and UK investors. With no conventional gilt supply until Q2 (and some large redemptions), and a continued need to match long-term liabilities, institutional demand for sterling bonds remained strong through the rest of the quarter. When the LCR bonds had been absorbed, UK companies

The ten-year US index-linked yield rose by 10 basis points, but this was modest by comparison with the nominal Treasury yield rise.

were keen to take advantage of low long-term financing rates, and longer-dated issuance volumes increased. Other issuers were also able to tap UK institutional demand for long-dated issues, including the Kingdom of Spain—the first sovereign to bring a 30-year sterling bond since the Republic of Italy last July.

With low gilt yields and reduced credit concerns, investors increasingly looked for yield enhancement, and sub-investment grade borrowers were able to come to market for the first time since last year's Russian debt crisis. In February, Coral (the UK bookmaker) became the first high-yield debt issue since Hurst Publishing last August. The marketing of new corporate bond funds, with the approaching final deadline to buy PEP funds before they were replaced by ISAs, was an additional source of demand for sterling bonds in March. This stimulated the issue of a number of PEP-eligible bonds (for Bass, Capital Shopping and Wessex Water), and several bonds for lower-rated UK companies (London Exhibition Centre, engineering group Luxfer, cable companies NTL and Telewest) had also been issued or were in the pipeline by the end of March.

Securitised deals further boosted sterling issuance toward the end of the quarter. In addition to the familiar asset and mortgage-backed deals, there were two Private Finance Initiative related bonds (for Stirling Water and Worcester Hospital) and the recapitalisation of the Unique Pubs Group (allowing Nomura to divest its venture capital). Barclays also issued a bond backed by shared-appreciation mortgages,⁽¹⁾ following the structure used by the Bank of Scotland in 1997.

In addition to the substantial fixed-rate issuance, £2.9 billion in floating-rate notes were brought during the quarter. Of these, £1.2 billion were short-dated, mainly issued by building societies and banks, with the remainder almost exclusively long-dated, securitised issues. Previously, all such deals were to refinance sub-prime mortgages or other assets. However, higher-rated mortgage lenders have also seen opportunities to use securitisation to release capital, and Abbey National brought its first securitised deal during the quarter (through a special-purpose vehicle, Holmes Funding).

Equities

UK equity prices rose steadily in the first quarter of 1999, after the volatility experienced in the second half of 1998. Behind this recovery was the cumulative effect of recent months' interest rate cuts, corporate earnings sometimes on the high side of market expectations, signs of the economic slowdown being less severe than initially feared, the recovery in the oil price, PEP-related year-end cash inflow, and a firm equity market in the United States. The FT-SE 100 had a relatively subdued start to the year, but the index gained 6% by the end of the quarter. Implied volatilities continued to decline over the quarter, falling to levels comparable with the first half of 1998.

Early in the quarter, there was concern about earnings potential among investors. But broadly speaking, fourth-quarter corporate profit results were at worst neutral, and in some cases were at the

Shared-appreciation mortgages allow the mortgagee to give up (effectively to the bondholder) part of the valuation gains on the property in exchange for a lower loan rate.

Chart 18 OMOs—instrument overview



Percentage shares: January–March 1999. Figures in brackets represent January–December 1998 average.

Table E Average daily money-market shortages

£ millio	ons		
1996	Year	900	
1997	Year	1,200	
1998	Year	1,400	
1999	January	1,400	
	February	2,200	
	March	1,200	

Chart 19

Stock of money-market refinancing and foreign exchange swaps outstanding (at end-months)



high end of market expectations, notably in the UK banking sector. The speed and extent of cuts in the Bank repo rate since October 1998 were cited by markets as helping to underpin equity prices. As the quarter progressed, publication of economic surveys dispelled some of the market gloom on the economic outlook. The FT-SE 250 index, which is more domestically oriented than the FT-SE 100, and which had earlier underperformed the FT-SE 100, rose by 13% on the quarter.

Two particularly active sectors during the quarter were oil and telecommunications. Last year, oil was the worst performing of the four largest sectors in the FT-SE 350 index, in which BP Amoco has the largest weighting.⁽¹⁾ Oil shares were chiefly responsible for the FT-SE 100's rally in early March this year. Hopes of oil production cuts to maintain prices, which were announced at the OPEC meeting on 23 March, buoyed the sector. The FT-SE 100 was also boosted at the end of March by BP Amoco's announcement that it is to buy the US oil company Atlantic Richfield. The share prices of telecommunication companies continued to rise in the quarter, supported by merger and acquisition activity.

The moves in the US Dow Jones Industrial Average and the FT-SE 100 were positively correlated during the first quarter. Both indices rose by similar amounts over the quarter, and reached record highs. The Dow's impact on the FT-SE 100 was particularly marked in the second half of March. For example, as the Dow struggled to close above 10,000, the rise in the FT-SE 100 also faltered and temporarily reversed.

Market operations

Open market operations and Treasury bill issuance

The stock of money-market refinancing held by the Bank rose from £8 billion in December to £15 billion in February (see Chart 18 for composition). The high stock in January and February reflected the seasonal government revenue surplus and the pattern of gilt financing and redemptions over the year as a whole. The high stock of refinancing in February resulted in average daily shortages of some £2.2 billion, compared with £1.4 billion in 1998 as a whole (see Table E). Foreign exchange swaps are used as an additional means to provide money-market liquidity, particularly when the stock of refinancing is high. The use of foreign exchange swaps was heavy in the first two months of the year, and £3 billion were outstanding at the end of February (see Chart 19 and Table F).

The stock of refinancing fell in March as around £5.7 billion of Floating Rate Treasury 1999 and £3.0 billion of $12^{1/4}$ % Treasury 1999 both matured, coupled with the seasonal rise in government spending at the end of the financial year. Money-market conditions softened ahead of this, as the market anticipated a period of smaller shortages. Accordingly, the Bank increased the size of the sterling Treasury bill tender; this helped support the size of the money-market shortages at a daily average of £1.2 billion. From 26 February, the three-month tender was increased from £100 million to £200 million a week and a tender of £500 million a week of one-month Treasury bills was introduced. This was the

 The four largest sectors in the FT-SE 350 by market capitalisation were retail banks, pharmaceuticals, telecoms and integrated oil.

ECB monetary policy operations

The European Central Bank (ECB) conducts its operations through the national central banks of the eleven countries that adopted the euro on 1 January 1999. Together, they are known as the Eurosystem. Within the ECB, the Governing Council is responsible for the formulation of monetary policy, and the Executive Board implements monetary policy. The primary objective is to maintain price stability across the euro area. The ECB has three main instruments to achieve its objectives:

- open market operations;
- standing facilities; and
- minimum reserves.

Open market operations

The ECB uses refinancing operations to steer interest rates and manage liquidity in the Eurosystem, enabling eligible institutions to meet their reserve requirements. The main instrument used is reverse transactions (either repo or collateralised loans). Two types of reverse transaction operations are routinely used: the main refinancing operation (MRO) and the longer-term refinancing operation (LTRO).

The MRO is conducted weekly with a two-week maturity. It provides the bulk of the liquidity required, and to date has been conducted at fixed-rate tenders, with the ECB using it to signal its main refinancing rate (which was 3% throughout the first quarter of 1999). The ECB meets to review this rate fortnightly, setting it for the next two MROs. On 8 April, the ECB Governing Council announced that it would lower its main refinancing rate by 50 basis points to 2.5% with effect from 12 April. The liquidity provided at each MRO is determined by the ECB, which has so far provided between ≤ 39 billion and ≤ 102 billion at weekly tenders, depending on the estimated liquidity needs of the system at the time of each tender.

The LTRO is conducted monthly with a three-month maturity. It is not used as a signalling mechanism, and is conducted through variable-rate tenders. Tenders usually take place on the first Wednesday of each maintenance period. To set up this pattern, the ECB conducted three tenders for settlement on 14 January of 42, 70 and 105 days' maturity. Each LTRO has provided \in 15 billion of liquidity to the market to date. As each tender matures, it has been rolled over, maintaining a total provision of \in 45 billion through this facility. The ECB has announced that it intends to continue rolling over the maturing amounts until September.

The four LTRO tenders conducted in January and February were variable-rate tenders, using a single-rate ('Dutch auction') allotment method. Allotment decisions for variable-rate tenders are made by ordering bids in diminishing order of offered interest rates. The bids with the highest interest rate levels are satisfied, then successively lower bids are accepted until the total liquidity to be allotted is reached. The lowest interest rate level accepted is the marginal interest rate. In a Dutch auction, the liquidity is provided to all successful bidders (those at the marginal interest rate and above) at a single rate-the marginal interest rate. The ECB announced on 4 March that the LTRO tender for settlement on 24 March and subsequent tenders would use the multiple-rate ('American auction') allotment method. Here, the bids are collected in a similar fashion to the Dutch auction. However, the allotment to successful bidders is at the interest rate actually bid, rather than at the marginal interest rate.

The ECB has a number of fine-tuning operations available either to provide or absorb liquidity for short periods and at short notice as necessary. These were not used during the first three months of the year.

first time since the third quarter of 1997 that one-month sterling Treasury bills had been offered. The use of one-month bills allows more flexibility to reduce the outstanding stock of assistance quickly if required.

Demand for the extra Treasury bills was high. Cover at the one and three-month tenders averaged five or six times the amount of bills on offer in March. The new bills were a welcome addition of stock liquidity following the two gilt redemptions.

The DMO announced on 20 April that following the decrease in the estimated cash requirement for 1998/99 (see the long-term interest rate section on page 141), its estimated net Treasury bill issuance during 1999/2000 had been revised downwards from £3.6 billion to £1.9 billion.

Standing facilities

The refinancing operations provide two-week or three-month funds to institutions that are successful in the tenders. Standing facilities are used to provide and absorb overnight liquidity, limiting the overnight interest rate. The provision of overnight liquidity is via the marginal lending facility. Liquidity is provided against collateral to institutions eligible to take part in ECB operations. There is no limit to the amount that can be borrowed, providing that an institution has sufficient collateral. Institutions with excess funds can use the overnight deposit facility. The marginal lending rate was 4.5% and the deposit rate 2% in the first quarter of 1999. To smooth the introduction of the euro, the ECB Governing Council set the marginal lending and deposit rates at 3.25% and 2.75% respectively from 4-21 January. The marginal lending and deposit rates provide a corridor for the overnight rate for euro (see the chart).

When the ECB announced the lowering of the main refinancing rate on 8 April, it also reduced the marginal lending rate by 1 percentage point to 3.5% and the deposit rate by 0.5 percentage point to 1.5%, with effect from 9 April. The corridor for the overnight rate was thus narrowed from 250 basis points to 200 basis points, with the main refinancing rate positioned centrally within it.

Minimum reserve requirement

The ECB operates a minimum reserve system to create (or enlarge) the structural liquidity shortage within the Eurosystem. Each institution eligible to take part in ECB operations has to keep a zero or positive balance on a reserve account at its national central bank at the end of each day. This balance must average at least 2% of an institution's eligible liabilities over the 'maintenance period', usually one month. This is the ECB's reserve requirement. Holdings of required reserves are remunerated at the key operational rate (the main refinancing rate), but excess reserves are not remunerated. There are penalties for failing to meet the reserve requirement at the end of the maintenance period.

EONIA and standing facility rates



The ECB publishes an estimate of the aggregate level of required reserves for the Eurosystem as a whole. The ECB publishes any revisions to its estimates as the maintenance period progresses, and publishes the definitive level near the end of the period. It also publishes a rolling average of actual holdings of reserves by institutions against the estimate to give an overview of the liquidity situation across the Eurosystem.

For the Eurosystem, the reserve requirement was \notin 98.3 billion from 1 January to 23 February and \notin 100.6 billion from 24 February to 23 March. The preliminary figure for the period 24 March to 23 April was \notin 100 billion.

The DMO is expected to take over the Government's cash management during the course of 1999/2000, though the timing is dependent on successful systems implementation.⁽¹⁾ After the transfer of cash management, Treasury bills will be the primary short-term financing instrument used to meet the seasonal fluctuation of the Government's within-year cash requirements. Daily changes in the net cash position will be reflected in the DMO's holdings of short-term cash instruments. Previously, this role was performed by the Ways and Means overdraft with the Bank of England. When the DMO takes over cash management, Ways and Means advances will cease to be used as the means of balancing the Government's day-to-day needs, and Ways and Means advances will be frozen.

See The Future of UK Government Cash Management: the New Framework, UK Debt Management Office, 4 December 1998.

Table F

Influences on the cash position of the money market

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

	1998/99 Apr-Dec	<u>1999</u> Ian	Feb	Mar
CONCD (1)	1.2	10.0	0.5	
UGNUR (+)	1.2	-10.9	-0.5	5.8
National Savings (-) (a)	-0.7	-0.1	0.1	0.3
Currency circulation (-)	-4.9	24	-0.1	0.5
Other	3.2	3.0	-2.8	-2.3
Total	-2.0	-4.6	-3.2	12.9
Outright purchases of Treasury bills and Bank bills	-0.2	1.1	-0.6	-0.3
Repos of Treasury bills, Bank bills, and British Government stock and non-sterling debt	1.8	0.6	4.3	-8.5
Late facilities (b)	-0.3	0.6	-0.5	0.1
Total refinancing	1.3	2.3	3.2	-8.7
Foreign exchange swaps	0.8	1.9	0.0	-1.7
Treasury bills: Market issues and redemptions (c)	0.1	-0.1	0.0	2.4
Total offsetting operations	2.0	4.3	3.2	-12.8
Settlement banks' operational balances at the Bank	0.0	-0.3	0.0	0.1

(b)

Excluding repurchase transactions with the Bank. 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. Issues at weekly tenders plus redemptions in market hands. Excludes repurchase transactions with the Bank (market holdings include Treasury bills sold to the Dark in supervision tenders that the Treasent bills. (c) Bank in repurchase transactions) and tap Treasury bills

Chart 20 **Repo rate and SONIA**



On 1 April, the Bank announced that bids at the one and three-month Treasury bill tenders could be made at price intervals of 0.1 pence (previously, the interval had been 0.5 pence). This technical change was designed to allow counterparties to aim their bids more precisely at their target yield. The difference was particularly important at the one-month maturity, where each halfpenny bidding interval implied a yield difference of some seven basis points.

The Bank announced three technical changes to its money-market operations on 30 March:

- From 15 April, the Bank of England euro bills have been eligible as collateral in repo transactions (more detail on Bank euro bills is given later in this article).
- Also from 15 April, the Bank accepted gilt strips in member-to-member repo transactions. This adds to the existing capability to use gilt strips in deliveries-by-value in the Bank's operations.
- From 24 May, the yield at which bills may be sold outright to the Bank in its operations will be the Bank's repo rate. This replaces the discount rates currently posted for bills with different maturities.

Short-dated interest rates

Chart 20 shows the Bank's repo rate and SONIA for the past six months.⁽¹⁾ At the end of January and February, when tax payments were high, the money-market shortages were particularly large.⁽²⁾ This in turn put upward pressure on short rates, with SONIA rising relative to the Bank's repo rate.

The chart also shows SONIA rising in the days just before the interest rate cuts in October, November, December and February. This is one illustration of the extent to which the market had anticipated those repo rate cuts. During the week of those MPC meetings, many of the Bank's dealing counterparties preferred to roll over short positions overnight rather than lock in borrowing at up to two weeks from the Bank at the prevailing repo rate. This tended to push up overnight interbank rates to around a maximum of one percentage point over the Bank's repo rate (because that is the penalty rate at which counterparties can borrow overnight from the Bank at 3.30 pm).⁽³⁾ In each case when rates were subsequently cut, counterparties resumed borrowing from the Bank in the two-week facility at the new lower repo rate.

HM Treasury and Bank of England euro issues

The Bank of England, on behalf of HM Treasury, continued to hold regular monthly auctions of $\in 1$ billion of euro Treasury bills during the first quarter, comprising €200 million of one-month, €500 million of three-month and €300 million of six-month bills each month. The auctions continued to be oversubscribed, with issues covered an average of 4.0 times the amount on offer in the first quarter of 1999. During the first quarter, bids were accepted at average yields of 20, 22 and 23 basis points below the euribid rate

SONIA is the sterling overnight interest rate average.
 On the last days of January and February 1999, the shortages were £3.7 billion and £2.4 billion respectively.
 This penal rate can rise by up to 1¹/₂ percentage points above the Bank's repo rate at the 4.20 pm

for the one-month, three-month and six-month maturities respectively. At end March, there were \in 3.5 billion of UK Government euro Treasury bills outstanding.

On 5 January, the Bank of England announced that during the course of 1999 it intended to take over from HM Treasury as the issuer of euro bills. The details are set out in the Bank of England Euro Bill Information Memorandum published on 6 April 1999. Apart from the change in issuer, there are no other changes to the main features of the euro bill programme. The first Bank of England euro bills were auctioned on 13 April, and the Bank will have fully taken over the programme from HM Treasury by October. The proceeds of Bank of England euro bills will be used by the Bank to finance the provision of intra-day liquidity, on a secured basis, to participants in CHAPS euro, as part of the arrangements for TARGET.

€500 million of a new three-year euro Treasury Note, the eighth in the programme of annual new issues, was auctioned on 19 January 1999. Cover at the auction for the 2.75% January 2002 issue was very strong, at 4.8 times the amount on offer, and accepted bids were in a range of 2.83% to 2.89%. At the end of January, the Note issued in 1996, for €2.0 billion, matured. The total of Notes outstanding with the public under the UK euro Note programme thus fell from €6.0 billion in the fourth quarter of 1998 to €4.5 billion in the first quarter of 1999. Further auctions of the new Note are planned for April, July and October 1999.

The international environment

This article discusses developments⁽¹⁾ in the global economy since the February 1999 Quarterly Bulletin.

- Growth in the United States remained well above trend in the fourth quarter of 1998, and recent data suggest continued strength into 1999.
- Japan stayed in recession, with a sharp fall in GDP in the fourth quarter. The unemployment rate reached a record high in February. The March Tankan survey suggested that firms were less pessimistic about business conditions, but improvements in confidence may prove fragile.
- Euro-area GDP growth was on a downward trend throughout 1998. In Germany, GDP fell in Q4, but in France, the outturn was stronger. Growth in Italy continued to be low relative to France and Germany, as it has been since 1995.
- Inflation was broadly unchanged in the major industrialised countries in 1999 Q1. OPEC agreed oil-supply quotas on 23 March, and oil prices have risen to \$16.80 dollars per barrel, an increase of more than 60% since 1 January.
- The Bank of Japan lowered the overnight call rate towards zero during February, and the European Central Bank cut its main refinancing rate by half a percentage point on 8 April. The Federal Reserve left US rates unchanged throughout the period.
- Output started to recover in a number of newly industrialised economies in Asia. The Brazilian authorities were able to reduce official interest rates without prompting large net capital outflows.
- Financial markets were calmer over the first quarter of 1999.



Robust consumption and a rebound in investment supported strong growth in the United States in 1998 Q4. Growth in the industrial sector may have stabilised, after declining throughout last year.

In the United States, output grew by 1.5% in the fourth quarter of last year, the highest quarterly growth rate since the middle of 1996. Growth for 1998 as a whole was unchanged from the previous year, at 3.9%. The outturn in the fourth quarter reflected continuing strong growth in domestic demand and the first positive contribution to growth from net trade for two years. But a number of special factors may have supported growth in the fourth quarter, including exports of large items, particularly aircraft, and stronger activity in construction due to mild weather. There was also a rebound in car production, following a strike earlier last year at a major producer.

Advance data for the first quarter indicate that GDP grew by 1.1%. Some of the factors supporting growth in Q4 did not persist. Net trade made a negative contribution, reflecting a fall in exports. Investment growth remained strong, but was lower than in the

(1) Based on data up to 28 April 1999.

Chart 2 US manufacturing



Chart 3 US consumer price index and unit labour costs



Chart 4 US GDP levels



previous quarter. However, consumption growth increased further to 1.6%.

The continued strength in consumption reflects sustained growth in employment and household income, and further increases in US equity prices. Consumption continued to grow faster than income in recent months, and the measured savings rate fell to -0.5% in 1999 Q1, from 0% in 1998 Q4. Consumer confidence has continued to rise, which might suggest further strength in consumption in the months ahead (see Chart 1).

Although growth in US export markets is still weak, there have been signs that the outlook for the industrial sector has, at least, stopped worsening. The National Association of Purchasing Managers' production index, which has been a good leading indicator of growth in manufacturing output in the past, increased strongly in the first quarter (see Chart 2). This was supported by the Federal Reserve survey of regional business conditions in January and February, which found 'the tone of manufacturing improved in most districts'. However, stronger survey data has not yet been reflected in official data; indeed, growth in manufacturing output fell slightly in March.

The US unemployment rate fell to 4.2% in March, after averaging 4.5% last year. Employment growth has been volatile in recent months, possibly reflecting erratic, weather-related influences. The annual growth in average earnings continued to ease, despite a tight labour market by historical standards.

As a result of weaker earnings growth and continuing growth in productivity, unit labour costs have fallen over recent months. This helps to explain why core annual price inflation has been unchanged at 2.1%. However, largely because of the recent rise in oil prices, the headline rate increased from 1.6% in February to 1.8% in March (see Chart 3).

The United States has experienced a period of continuous growth in the 1990s, which is as long as the period of growth in the 1980s. Chart 4 compares cumulative GDP growth in the past three upturns: 1975 Q2 to 1982 Q3; 1982 Q4 to 1991 Q1; and 1991 Q2 to 1998 Q4.⁽¹⁾ The cumulative growth in the 1990s overtook the growth in the late 1970s last year, but it is still below the cumulative growth in the 1980s upturn. However, this is somewhat misleading, as growth has been very similar in the 1980s and 1990s, apart from at the start of each period. As Chart 5 shows, the early phase of growth in the 1980s was stronger, with annual growth peaking at 8.4% at the start of the upturn, although this followed a deep recession. In contrast, in the 1990s, growth was weaker at the start of the upturn, but has tended to pick up since then.

Another feature of the 1990s has been the consistently strong growth in investment compared with the 1970s and 1980s (see Chart 6). In the 1990s upturn, the level of investment has grown continuously, whereas in the two previous upturns, investment grew strongly at the start of the period, but then stalled. The composition of growth has been very different in the 1990s in other ways, with much stronger growth in imports, but slightly

⁽¹⁾ The starting-point of each period is the first quarter of positive quarterly growth in GDP after at least two quarters of falling output. The period is taken forward to include the next phase of falling output.

Chart 5 US GDP growth







Chart 7 European GDP growth



weaker growth in private consumption and much weaker growth in government consumption. Export growth has been quite similar in the 1990s to the 1970s and 1980s.

The strong growth in investment in the latter half of the 1990s has been driven by business investment. Residential investment grew by 5.1% on average between 1995–98, on an annualised basis, whereas business investment grew by 13.7%. Investment in information technology (IT) has been growing particularly strongly, which may partly reflect the expansion of the Internet. Because IT equipment tends to have a shorter life than buildings or machinery, more gross investment is required to achieve the same increase in the capital stock. However, this is unlikely to explain all of the increase in investment in the 1990s, so there seems to have been a marked increase in the capital stock. And this may explain the continued increase in labour productivity.

One indication of whether strong investment in the 1990s has helped to keep capacity in line with actual output is the industrial capacity utilisation rate. This increased by 10 percentage points in both the 1970s and the 1980s, suggesting a decline in spare capacity. In the 1990s, capacity utilisation increased by 5 percentage points up to 1995, but has since fallen back to its level at the start of the upturn. The fall in the capacity utilisation measure since 1995 mirrors the continued increase in investment shown in Chart 6. But it only measures capacity in the industrial sector, where growth in production fell sharply in 1995 and has since been fairly weak. Capacity utilisation may be higher in the services sector.

Comparison with the 1970s and 1980s suggests three key points about growth in the 1990s. First, the current upturn is now as long as that in the 1980s. Second, the rate of growth has been less volatile in the 1990s. Finally, growth in the 1990s has been supported by stronger and more sustained growth in investment than in the previous two cycles.

Growth in the euro area slowed throughout last year. Recent data for industrial production in France and Germany suggest that growth may be weak again in the first quarter of 1999.

Output in the euro area as a whole grew by 0.2% in 1998 Q4 (2.0% on a year earlier), according to preliminary Eurostat data. Growth has declined through the year (see Chart 7). Investment growth fell strongly throughout 1998, but private consumption growth increased slightly. Although net trade made a small negative contribution to growth in 1998, gross trade flows slowed sharply. Annual export growth slowed from 10.0% in the first quarter to 0.5% in the fourth quarter, and import growth fell from 11.9% to 2.7%. Net trade made a negative contribution to output in Germany, France and Italy, but for most of the other euro-area countries, imports fell more sharply than exports.

Since the preliminary Eurostat data in Chart 7 were published, GDP growth in Germany has been revised down sharply (year-on-year growth in 1998 was revised from 2.8% to 2.3%). But the recent quarterly profile has not been changed very much and still shows that growth declined throughout 1998. German consumption growth increased over the year, but there was a sharp

Chart 8 Euro-area consumer and industrial confidence



Chart 9

Italian export growth and real effective exchange rate



Chart 10 Harmonised consumer price indices



decline in investment growth and a negative contribution from net trade. In France, annual growth fell from 3.8% in 1998 Q1 to 2.8% in Q4, also reflecting a negative contribution from net trade. Growth in industrial production in France continued to decline in early 1999, and in Germany the level of industrial production was lower than a year earlier.

A divergence has emerged between business confidence and household confidence in the euro area (see Chart 8). The Eurostat measure of household confidence has tracked business confidence fairly closely in the past, although business confidence has shown larger swings in sentiment. But since the middle of last year, business confidence has been falling sharply, partly reflecting the weaker outlook for world trade. In contrast, consumer confidence has continued to increase, and has recently reached the same level as its previous peak in the late 1980s. This divergence between business sentiment and household sentiment has occurred in all euro-area countries.

Household confidence seems to have remained buoyant as unemployment has been falling in most euro-area countries and real household disposable income has been rising. But the weakening industrial confidence in recent months has been reflected in weaker forecasts for euro-area growth for this year (for instance, the European Commission has revised down its spring forecast to 2.2%, from 2.6% last autumn, although this was before the European Central Bank (ECB) cut its repo rate). If output growth continues to weaken, the outlook for personal sector finances will deteriorate. And this might cause consumer confidence to fall more into line with business confidence. Indeed, in the most recent release, covering March, consumer confidence fell slightly. But industrial confidence also fell, leaving the degree of difference unchanged.

Compared with France and Germany, growth in Italy has been weak since 1995. Average year-on-year growth since 1995 has been 2.1% in Germany and 2.4% in France, but only 1.2% in Italy. Much of this can be explained by low growth in Italian exports, which has averaged 2.6% since 1995, compared with 7.1% in Germany and 8.0% in France. In contrast with export performance, average domestic demand growth has been very similar in all three countries—1.8% in France, 1.7% in Germany and 1.8% in Italy and so has the growth in imports. The relative weakness of Italian export growth can partly be explained by the sharp appreciation of the lira in 1995 (see Chart 9). But Italy may also have been more affected by the sharp depreciation of some Asian currencies (these are not included in the exchange rate index in Chart 9), because it competes more directly with those countries.

Annual harmonised consumer price inflation in the euro area increased to 1.0% in March from 0.8% in February, largely reflecting a rise in German inflation from 0.1% in February to 0.5% in March (see Chart 10). Annual growth of earnings in the euro area was 2.4% in 1998 Q4, up from 2.3% in 1998 Q3. In Germany, whole-economy hourly wage growth increased from 1.7% in November to 2.5% in January. In late February, the IG Metall union agreed a 3.2% increase in wages for 3.2 million workers (with effect from 1 March). There was also a bonus payment worth 1% of earnings.

Chart 11 Japanese private and public investment



Chart 12 Japanese business sentiment and industrial production



(a) Tankan survey of business sentiment.

Chart 13 Japanese labour market



Japanese output fell in 1998 Q4 for the fifth quarter in succession. The fall in output in 1998 as a whole was the sharpest since 1955. Unemployment reached a new high in 1999 Q1; other data also suggest continued recession.

In Japan, GDP fell by 0.8% in Q4, the fifth consecutive quarterly fall. GDP fell by 2.9% in 1998 as a whole, the largest fall since national accounts were first compiled in 1955. The most recent fall in output reflected a sharp fall in exports, while private consumption fell modestly. Investment fell less sharply than in previous quarters, because public investment picked up strongly (up by 10.6% in the quarter), probably reflecting the effects of last April's fiscal stimulus (see Chart 11). The 14% appreciation of the yen against the US dollar in October may have contributed to the Q4 fall in exports, which was the sharpest quarterly fall since 1986.

Indicators for the first quarter of 1999 show little sign of recovery. Industrial production increased in January, but fell back in February to a level 5.2% lower than a year earlier (see Chart 12). The March Tankan survey suggested that among 'principal' enterprises, the current economic situation had not improved for manufacturers, though non-manufacturers did report some improvement. Nevertheless, replies from both types of firm still suggested falling output. Both manufacturing and non-manufacturing enterprises reported a small improvement in expectations for output three months ahead. However, as Chart 12 shows, the Tankan survey has tended to lag official data in the past, so the upturn in the Tankan may simply reflect the upturn in official data in mid 1998.

Unemployment in Japan increased to 4.6% in February, from 4.4% in January. In the year to February 1999, the population aged over 15 increased by 640,000. Over the same period, employment fell by 770,000 and unemployment increased by 670,000. This implies that inactivity increased by 740,000 over the period (although that figure also includes the number of people retiring). In the 1990s there has been a strong correlation between changes in inactivity and changes in unemployment (see Chart 13). This suggests that as employment conditions deteriorate, some potential workers have been leaving the workforce, although they actually want to work. If this is the case, the official unemployment measure may not fully capture the effect of worsening labour market conditions on household confidence.

Wages have been broadly flat in Japan over the past year. And with deteriorating job prospects, consumer confidence in Japan has continued to decline. Retail sales in the first quarter of 1999 were down by 2.7% on a year earlier. Concerns about the banking sector depressed consumer confidence last year. But recapitalisation of Japanese banks has been continuing, and by 31 March they had received ¥7.45 trillion in public funds. The Japanese government is now confident that all of the major banks meet the appropriate capital adequacy standards.

Japanese annual consumer price inflation fell to -0.1% in February. Core inflation has been close to zero since 1995, but one-off factors, such as an increase in consumption tax in March 1997 and a temporary increase in food prices in November 1998, have made the headline series more erratic (see Chart 14). Prices have fallen quite strongly further up the distribution chain. In January, wholesale prices fell by 3.9% on a year earlier.

Chart 14 **Japanese prices**







Forecasts for GDP growth

Per cent

	IMF (a	ı)	Consen Econon	sus nics (b)	<i>The Economist</i> poll of forecasters (c)	
	1999	2000	1999	2000	1999	2000
United States Japan Germany France Italy	3.3 -1.4 1.5 2.2 1.5	2.2 0.3 2.8 2.9 2.4	3.4 -1.2 1.6 2.3 1.5	2.3 0.1 2.6 2.7 2.4	3.6 -1.1 1.5 2.2 1.6	2.4 0.0 2.4 2.6 2.4

World Economic Outlook (April 1999). Consensus Economics, Consensus forecasts (April 1999). The Economist, poll of forecasters (24 April–30 April 1999).

The uneven pattern of growth in the major industrial countries has led to widening current account imbalances.

As discussed in the February Quarterly Bulletin, financial crises since 1997 have severely reduced the flow of funds into emerging market economies. This has forced the economies affected to reduce their current account deficits, which should be balanced by a shift towards current account deficit in the industrial economies as a whole.

As Chart 15 shows, the United States current account has moved more sharply into deficit since 1997. In contrast, the Japanese current account surplus increased, and Germany's current account remained close to balance. In 1998 Q4, there was some reduction in these imbalances, but that may have been erratic. The US current account deficit fell from -3.1% of GDP to -2.9%, and there were sharp falls in exports in Japan, France and Germany, which were reflected to varying degrees in their current accounts. However, monthly trade data in the first quarter of 1999 show a sharp increase in the US trade deficit, and Japan's trade surplus also rose strongly.

One cause of the widening trade imbalances is the uneven pattern of growth across the major industrial countries. Most forecasters expect this to continue in 1999. For example, the table shows forecasts from the IMF spring World Economic Outlook, and also two surveys of private sector forecasts. In 1999, growth is expected to be considerably stronger in the United States than in Japan, Germany or France, and so the trade imbalances between the major industrialised countries are likely to increase.

Forecasters generally expect that US growth will moderate in 2000, while growth in Germany, Italy and France will pick up. Outside forecasts for Japan have been revised down, with continued sharp falls in output projected in 1999, and virtually no growth in 2000. This suggests that, other things being equal, the US trade deficit with Japan could continue to increase next year.

Chart 16 shows IMF data and forecasts for world GDP and trade. With growth expected to slow in the euro area and the United States, world GDP growth is forecast to be slightly lower this year than last, but to move back towards trend in 2000. Growth in trade slowed markedly in 1998, but is expected to strengthen in 1999 and 2000. However, the IMF does not expect trade to grow at the extremely rapid rates seen between 1994-97.

Partly as a result of weaker growth in world demand, but also because of increases in supply and a mild winter in the northern hemisphere, the price of oil halved between October 1997 and December 1998. But it increased to \$16.80 by 30 April, a rise of more than 60% since 1 January. This was largely because OPEC reached a new production agreement in March, with plans to reduce supply by 7%. But it is not yet clear whether OPEC will manage to achieve their planned production cuts. Meanwhile, other commodity prices continued to fall.

Since the previous Quarterly Bulletin, there has been positive news for some emerging market economies. Brazil agreed a new IMF programme on 31 March, and the Bank of Brazil has been able to reduce official interest rates without prompting a renewal of capital

Chart 16 World trade and GDP growth







Chart 18 Official interest rates



outflows. This partly reflects a weaker-than-expected impact on inflation from the depreciation of the real to date. Although the economy remains in recession, the more positive news on inflation, interest rates and the exchange rate (which has appreciated by about 30% since its trough in early March), has contributed to a more stable situation.

Output in the Asian countries most affected by past financial crises has shown some signs of recovery. In particular, industrial production has increased in Korea and has stopped falling in Thailand and Malaysia. The Chinese economy has continued to grow strongly, with output up by 8.3% in Q1 compared with a year earlier. In Russia, consumer demand and gross fixed investment are still falling sharply, although industrial output has recovered slightly. The IMF reached a framework agreement with Russia on 29 March, though discussions are continuing on the form of a new programme.

Growth in broad money aggregates fell slightly in the United States and Japan, but increased in the euro area.

In the United States, broad money grew by 8.4% on a year earlier in February, down from an average of 8.8% in 1998. But growth was still high relative to nominal GDP growth. The implicit fall in velocity may have been linked to lower nominal interest rates. But it could also have reflected financial conditions last autumn, which have caused investors to move out of riskier assets and into money.

In the euro area, annual growth in M3 in March was 5.1%, down from 5.4% in January, compared with the ECB's reference value of 4.5%. But the ECB issued a note of caution that the data in January may have been distorted by the launch of the euro and a change in measurement.

In Japan, unadjusted broad money grew in March by 3.7% on a year earlier, up from 3.5% in February. Annual growth of narrow money (M1) increased more strongly, from 5.8% in February to 8.1% in March, reflecting the Bank of Japan's continued easing of monetary conditions.

The ECB cut its main refinancing rate by half a percentage point on 8 April, and the Bank of Japan lowered the call rate by about a quarter percentage point during February. The Federal Reserve left rates unchanged.

On 8 April, the ECB cut its main refinancing rate by 50 basis points to 2.5%. It noted that the euro-area harmonised index for consumer prices had shown inflation below 1% for some months, and that the prospects for euro-area growth had weakened, with slower GDP growth in 1998 Q4 and continued falls in industrial confidence.

The official discount rate set by the Bank of Japan (BoJ) has been unchanged at 0.5% for several years. In order to further loosen monetary conditions, the BoJ has been targeting the rate for unsecured overnight call money. On 12 February, it lowered the target for the call rate from 0.25% to 0.15%. Later in February, the BoJ encouraged the rate to fall as low as possible (see Chart 18).

Chart 19 US dollar, euro and yen nominal effective exchange rates



Chart 20 Equity prices^(a)







Official rates in the United States were left unchanged. In the Federal Reserve Bank's biannual report on monetary policy, Chairman Greenspan said that he expected GDP growth to slow to a more sustainable level by the end of 1999, and for inflation to remain below 2.5%. But he noted the risks from labour market tightness, and said that 'equity prices are high enough to raise questions about whether shares are overvalued'.

The euro declined against other currencies over the quarter. Stock markets generally rose, with the Japanese Nikkei showing the strongest increases.

The Bank of England's new euro effective exchange rate index⁽¹⁾ showed that the euro fell by 6.4% against a trade-weighted basket of currencies between 1 January and 30 April (see Chart 19). The depreciation of the euro reflected a deteriorating economic outlook for the euro area, anticipation of the ECB's cut in interest rates on 8 April, and the negative impact of NATO military action in the Federal Republic of Yugoslavia.

The dollar effective exchange rate has appreciated by 4.1% since 1 January. After falling to a 26-month low against the yen on 11 January, the dollar started appreciating, after reports of intervention by the BoJ. It increased further after the BoJ lowered the call rate on 12 February.

Equity prices in the major industrial economies were broadly stable in January and February, but then increased fairly sharply in March and April (see Chart 20). The Japanese Nikkei showed the strongest increase (up 20.7% between 1 January and 30 April). This may have reflected news of corporate restructurings, mergers and acquisitions activity, and an improving outlook for the banking sector. US equity prices continued to rise (up 17.4% since 1 January). The Dow closed above 10,000 on 31 March and continued to increase in April. Since the start of the year, the German DAX index increased by 1.3% and the French CAC rose by 6.2%.

Chart 21 shows movements in ten-year government bond yields since the start of the year. In general, yields were quite stable in January. US yields increased in late February, following strong US output data and the Federal Reserve Chairman Alan Greenspan's Humphrey-Hawkins testimony, which markets interpreted as suggesting that official rates might rise. In March, markets interpreted US data as suggesting weaker inflationary pressure, and yields fell by 20 basis points. German yields were less volatile, and on 30 April were little changed from the start of the year. In Japan, yields peaked in early February, but gradually fell back after the BoJ's easing of monetary policy.

The spreads on emerging market bonds over ten-year US Treasury bills—one measure of the risk premium associated with lending to emerging markets—increased sharply in January 1999, in response to the Brazilian devaluation (see Chart 22). Earlier in 1998, spreads had increased in response to the Russian debt moratorium and risks from Brazil. But since the peak in January, spreads have fallen by around 500 basis points, to a point where they are now

⁽¹⁾ See 'An effective exchange rate index for the euro area', pages 190-94.





about 500 basis points above their level in the first half of 1998. But there are strong differences within the average measure, reflecting the relative performance of the different economies.

Emerging markets suffered some pressure on exchange rates and stock markets at the time of the first announcement of Brazil's devaluation. But exchange rates in emerging markets strengthened and some stock markets recovered, following the decision by the Brazilian authorities to float the real. Russian equity prices have shown no sign of a similar revival.

Summary

The outlook for the world economy has improved slightly since the previous *Quarterly Bulletin*. Domestic demand in the United States remains strong, and there has been little sign of any pick-up in inflation. Growth has continued to decline in the euro area, and industrial sentiment has weakened further. In response to these developments, the ECB has cut its main refinancing rate by 50 basis points. Japan is still in recession and, with record levels of unemployment, there is little sign of a revival in consumer confidence. Events in Kosovo have led to greater uncertainty for the world economy, and have caused the euro to weaken. But there has been evidence of recovery in some of the emerging market economies most affected by past financial crises.

The transmission mechanism of monetary policy

This report⁽¹⁾ has been prepared by Bank of England staff under the guidance of the Monetary Policy Committee in response to suggestions by the Treasury Committee of the House of Commons and the House of Lords Select Committee on the Monetary Policy Committee of the Bank of England.

Introduction and summary

The Monetary Policy Committee (MPC) sets the short-term interest rate at which the Bank of England deals with the money markets. Decisions about that official interest rate affect economic activity and inflation through several channels, which are known collectively as the 'transmission mechanism' of monetary policy.

The purpose of this paper is to describe the MPC's view of the transmission mechanism. The key links in that mechanism are illustrated in the figure below.

First, official interest rate decisions affect market interest rates (such as mortgage rates and bank deposit rates), to varying degrees. At the same time, policy actions and announcements affect expectations about the future course of the economy and the confidence with which these expectations are held, as well as affecting asset prices and the exchange rate.

Second, these changes in turn affect the spending, saving and investment behaviour of individuals and firms in the economy. For example, other things being equal, higher interest rates tend to encourage saving rather than spending, and a higher value of sterling in foreign exchange markets,

The transmission mechanism of monetary policy

which makes foreign goods less expensive relative to goods produced at home. So changes in the official interest rate affect the demand for goods and services produced in the United Kingdom.

Third, the level of demand relative to domestic supply capacity—in the labour market and elsewhere—is a key influence on domestic inflationary pressure. For example, if demand for labour exceeds the supply available, there will tend to be upward pressure on wage increases, which some firms may be able to pass through into higher prices charged to consumers.

Fourth, exchange rate movements have a direct effect, though often delayed, on the domestic prices of imported goods and services, and an indirect effect on the prices of those goods and services that compete with imports or use imported inputs, and hence on the component of overall inflation that is imported.

Part I of this paper describes in more detail these and other links from official interest rate decisions to economic activity and inflation. It discusses important aspects that have been glossed over in the summary account above such as the distinction between real and nominal interest rates, the role of expectations, and the interlinking of



Note: For simplicity, this figure does not show all interactions between variables, but these can be important.

⁽¹⁾ This report is also available on the Bank's web site: www.bankofengland.co.uk.

many of the effects mentioned. There is also a discussion of the role of monetary aggregates in the transmission mechanism.

Part II provides some broad quantification of the effects of official interest rate changes under particular assumptions. There is inevitably great uncertainty about both the timing and size of these effects. As to timing, in the Bank's macroeconometric model (used to generate the simulations shown at the end of this paper), official interest rate decisions have their fullest effect on output with a lag of around one year, and their fullest effect on inflation with a lag of around two years. As to size, depending on the circumstances, the same model suggests that temporarily raising rates relative to a base case by 1 percentage point for one year might be expected to lower output by something of the order of 0.2% to 0.35% after about a year, and to reduce inflation by around 0.2 percentage points to 0.4 percentage points a year or so after that, all relative to the base case.

I Links in the chain

Monetary policy works largely via its influence on aggregate demand in the economy. It has little direct effect on the trend path of supply capacity. Rather, in the long run, monetary policy determines the nominal or money values of goods and services—that is, the general price level. An equivalent way of making the same point is to say that in the long run, monetary policy in essence determines the value of money—movements in the general price level indicate how much the purchasing power of money has changed over time. Inflation, in this sense, is a monetary phenomenon.

However, monetary policy changes do have an effect on real activity in the short to medium term. And though monetary policy is the dominant determinant of the price level in the long run, there are many other potential influences on price-level movements at shorter horizons. There are several links in the chain of causation running from monetary policy changes to their ultimate effects on the economy.

From a change in the official rate to other financial and asset markets

A central bank derives the power to determine a specific interest rate in the wholesale money markets from the fact that it is the monopoly supplier of 'high-powered' money, which is also known as 'base money'.⁽¹⁾ The operating procedure of the Bank of England is similar to that of many other central banks, though institutional details differ slightly from country to country. The key point is that the Bank chooses the price at which it will lend high-powered money to private sector institutions. In the United Kingdom, the Bank lends predominantly through gilt sale and repurchase agreements (repo) at the two-week maturity. This repo rate is the 'official rate' mentioned above. The box opposite outlines how the Bank implements an official rate decision in the money markets. The quantitative effect of a change in the official rate on other interest rates, and on financial markets in general, will depend on the extent to which the policy change was anticipated and how the change affects expectations of future policy. We assume here for simplicity that changes in the official rate are not expected to be reversed quickly, and that no further future changes are anticipated as a result of the change. This is a reasonable assumption for purposes of illustration, but it should be borne in mind that some of the effects described may occur when market expectations about policy change, rather than when the official rate itself changes.

Short-term interest rates

A change in the official rate is immediately transmitted to other short-term sterling wholesale money-market rates, both to money-market instruments of different maturity (such as rates on repo contracts of maturities other than two weeks) and to other short-term rates, such as interbank deposits. But these rates may not always move by the exact amount of the official rate change. Soon after the official rate change (typically the same day), banks adjust their standard lending rates (base rates), usually by the exact amount of the policy change. This quickly affects the interest rates that banks charge their customers for variable-rate loans, including overdrafts. Rates on standard variable-rate mortgages may also be changed, though this is not automatic and may be delayed. Rates offered to savers also change, in order to preserve the margin between deposit and loan rates. This margin can vary over time, according to, for example, changing competitive conditions in the markets involved, but it does not normally change in response to policy changes alone.

Long-term interest rates

Though a change in the official rate unambiguously moves other short-term rates in the same direction (even if some are slow to adjust), the impact on longer-term interest rates can go either way. This is because long-term interest rates are influenced by an average of current and expected future short-term rates, so the outcome depends upon the direction and extent of the impact of the official rate change on expectations of the future path of interest rates. A rise in the official rate could, for example, generate an expectation of lower future interest rates, in which case long rates might fall in response to an official rate rise. The actual effect on long rates of an official rate change will partly depend on the impact of the policy change on inflation expectations. The role of inflation expectations is discussed more fully below.

Asset prices

Changes in the official rate also affect the market value of securities, such as bonds and equities. The price of bonds is inversely related to the long-term interest rate, so a rise in long-term interest rates lowers bond prices, and *vice versa*

⁽¹⁾ The monetary base, M0, consists of notes and coin plus bankers' deposits at the Bank of England.

How the Bank sets interest rates

The Bank implements monetary policy by lending to the money market at the official repo rate chosen by the MPC. The Bank's dealing rate changes only when the MPC decides that it should. Arbitrage between markets ensures that the MPC's decisions are reflected across the spectrum of short-term sterling markets.

The Bank holds on its balance sheet assets acquired from its counterparties in its money-market operations. These are mostly private sector obligations; they are short-term, and a proportion of them matures every business day. This means that at the start of each day, the private sector is due to pay money to the Bank to redeem these obligations. However, in order to do so, the Bank's counterparties typically have to borrow additional funds from the Bank. This gives the Bank the opportunity to provide the necessary finance once more, at its official repo rate. The fact that this 'stock of refinancing' is turning over regularly is the main factor creating the demand for base money (the 'shortage') in the market each day.

The panel below shows the announcements that the Bank's dealers made to the market on 8 April, a day on which rates were changed. At 9.45 am, the Bank announced the estimated size of that day's shortage and the main factors behind it. At 12 noon, it published the outcome of the MPC meeting, and market rates adjusted immediately. The first round of operations was not conducted until 12.15 pm, but the knowledge that the dealing rate would be 5.25%, down from 5.5%, moved market rates ahead of that. The bulk of the day's

shortage was financed at 12.15 pm, and the (downwardly revised) remainder in a further round of operations at 2.30 pm.

In its open market operations, the Bank deals with a small group of counterparties who are active in the money market: banks, securities dealers and building societies are eligible to take on this role. Finance is provided primarily in the form of repo, which is short for 'sale and repurchase agreement'. Counterparties sell assets to the Bank with an agreement to buy them back in about a fortnight's time, and the repo rate is the (annualised) rate of interest implied by the difference between the sale and repurchase price in these transactions. The assets eligible for repo are gilts and sterling Treasury bills, UK government foreign-currency debt, eligible bank and local authority bills, and certain sterling bonds issued by supranational organisations and by governments in the European Economic Area. The Bank also buys outright Treasury bills and other eligible bills.

On non-MPC days, the first round of operations is held at 9.45 am rather than 12.15 pm. The timetable is otherwise the same. If the remaining shortage is not entirely relieved at 2.30 pm, the Bank holds a round of overnight operations at 3.30 pm. If the system is still short at 4.20 pm, the Bank deals directly with the settlement banks, whose accounts at the Bank of England need to be in credit at the end of the day. But on 8 April, no operations were needed at 3.30 pm or 4.20 pm.

Bank of E	ngland messages to money markets via screen services on 8 April 1999
9.45 am	Initial liquidity forecast Stg 1150 mn shortagePrincipal factors in the forecastTreasury bills and maturing outright purchases-596Maturing bill/gilt repo-216Bank/Exchequer transactions-180Rise in note circulation-105Maturing settlement bank late repo facility-39Bankers' balances below target-20
12.00 pm	BANK OF ENGLAND REDUCES INTEREST RATES BY 0.25% TO 5.25% The Bank of England's Monetary Policy Committee today voted to reduce the Bank's repo rate by 0.25% to 5.25%. The minutes of the meeting will be published at 9.30 am on Wednesday 21 April.
12.15 pm	Liquidity forecast revision—Stg 1100 mn A round of fixed-rate operations is invited. The Bank's repo rate is 5.25%. The operations will comprise repos to 22 and 23 April and outright offers of bills maturing on or before 23 April.
12.24 pm	Total amount allotted—Stg 900 mn of which—outright Stg 57 mn, repo Stg 843 mn
2.30 pm	Liquidity forecast revision—Stg 1000 mn. Residual shortage—Stg 100 mn A round of fixed-rate operations is invited. The Bank's reportate is 5.25%. The operations will comprise repos to 22 and 23 April and outright offers of bills maturing on or before 23 April.
2.35 pm	Total amount allotted—Stg 100 mn of which—outright Stg 16 mn, repo Stg 84 mn
3.30 pm	No residual shortage No further operations invited
4.20 pm	No liquidity forecast revision No residual shortage The settlement bank late repo facility will not operate today
for a fall in long rates. If other things are equal (especially inflation expectations), higher interest rates also lower other securities prices, such as equities. This is because expected future returns are discounted by a larger factor, so the present value of any given future income stream falls. Other things may not be equal—for example, policy changes may have indirect effects on expectations or confidence—but these are considered separately below. The effect on prices of physical assets, such as housing, is discussed later.

The exchange rate

Policy-induced changes in interest rates can also affect the exchange rate. The exchange rate is the relative price of domestic and foreign money, so it depends on both domestic and foreign monetary conditions. The precise impact on exchange rates of an official rate change is uncertain, as it will depend on expectations about domestic and foreign interest rates and inflation, which may themselves be affected by a policy change. However, other things being equal, an unexpected rise in the official rate will probably lead to an immediate appreciation of the domestic currency in foreign exchange markets, and vice versa for a similar rate fall. The exchange rate appreciation follows from the fact that higher domestic interest rates, relative to interest rates on equivalent foreign-currency assets, make sterling assets more attractive to international investors. The exchange rate should move to a level where investors expect a future depreciation just large enough to make them indifferent between holding sterling and foreign-currency assets. (At this point, the corresponding interest differential at any maturity is approximately equal to the expected rate of change of the exchange rate up to the same time-horizon.)

Exchange rate changes lead to changes in the relative prices of domestic and foreign goods and services, at least for a while, though some of these price changes may take many months to work their way through to the domestic economy, and even longer to affect the pattern of spending.

Expectations and confidence

Official rate changes can influence expectations about the future course of real activity in the economy, and the confidence with which those expectations are held (in addition to the inflation expectations already mentioned). Such changes in perception will affect participants in financial markets, and they may also affect other parts of the economy via, for example, changes in expected future labour income, unemployment, sales and profits. The direction in which such effects work is hard to predict, and can vary from time to time. A rate rise could, for example, be interpreted as indicating that the MPC believes that the economy is likely to be growing faster than previously thought, giving a boost to expectations of future growth and confidence in general. However, it is also possible that a rate rise would be interpreted as signalling that the MPC perceives the need to slow the growth in the economy in order to hit the inflation target, and this could dent expectations of future growth and lower confidence.

The possibility of such effects contributes to the uncertainty of the impact of any policy change, and increases the importance of having a credible and transparent monetary policy regime. We return to these issues below.

In summary, though monetary policy-makers have direct control over only a specific short-term interest rate, changes in the official rate affect market interest rates, asset prices, and the exchange rate. The response of all these will vary considerably from time to time, as the external environment, policy regime and market sentiment are not constant. However, monetary policy changes (relative to interest rate expectations) normally affect financial markets as described above.

From financial markets to spending behaviour

We now consider how the spending decisions of individuals and firms respond to the changes in interest rates, asset prices and the exchange rate just discussed. Here, we focus on the immediate effects of a monetary policy change. Those resulting from subsequent changes in aggregate income, employment and inflation are considered below. Since the effects of policy changes on expectations and confidence are ambiguous, we proceed on the basis of a given level of expectations about the future course of real activity and inflation, and a given degree of confidence with which those expectations are held. We also assume an unchanged fiscal policy stance by the government in response to the change in monetary policy.

Individuals

Individuals are affected by a monetary policy change in several ways. There are three direct effects. First, they face new rates of interest on their savings and debts. So the disposable incomes of savers and borrowers alter, as does the incentive to save rather than consume now. Second, the value of individuals' financial wealth changes as a result of changes in asset prices. Third, any exchange rate adjustment changes the relative prices of goods and services priced in domestic and foreign currency. Of these three effects, the one felt most acutely and directly by a significant number of individuals is that working through the interest rate charged on personal debt, especially mortgages, and the interest rate paid on their savings. We focus first on those with significant debts, and return to those with net savings below.

Loans secured on houses make up about 80% of personal debt, and most mortgages in the United Kingdom are still floating-rate. Any rise in the mortgage rate reduces the remaining disposable income of those affected and so, for any given gross income, reduces the flow of funds available to spend on goods and services. Higher interest rates on unsecured loans have a similar effect. Previous spending levels cannot be sustained without incurring further debts (or running down savings), so a fall in consumer spending is likely to follow. Those with fixed-rate mortgages will not face higher payments until their fixed term expires, but all new borrowers taking out such loans will be affected by rate

changes from the start of their loan (though the fixed interest rate will be linked to interest rates of the relevant term, rather than short rates).

Wealth effects will also be likely to work in the same direction. Higher interest rates (current and expected) tend to reduce asset values, and lower wealth leads to lower spending. Securities prices were mentioned above; another important personal asset is houses. Higher interest rates generally increase the cost of financing house purchase, and so reduce demand. A fall in demand will lower the rate of increase of house prices, and sometimes house prices may even fall. Houses are a major component of (gross) personal wealth. Changes in the value of housing wealth affect consumer spending in the same direction as changes in financial wealth, but not necessarily by the same amount. Part of this effect comes from the fact that individuals may feel poorer when the market value of their house falls, and another part results from the fact that houses are used as collateral for loans, so lower net worth in housing makes it harder to borrow. As an example of this, the house-price boom of the late 1980s was linked to rapid consumption growth, and declining house prices in the early 1990s exerted a major restraint on consumer spending.

Some individuals have neither mortgage debt nor significant financial and housing wealth. They may, however, have credit card debts or bank loans. Monetary policy affects interest rates charged on these, and higher rates will tend to discourage borrowing to finance consumption. Even for those with no debts, higher interest rates may make returns on savings products more attractive, encouraging some individuals to save more—and so to spend less. In essence, higher interest rates (for given inflation expectations) encourage the postponement of consumption, by increasing the amount of future consumption that can be achieved by sacrificing a given amount of consumption today. Future consumption is substituted for current consumption.

Another influence on consumer spending arises from the effects of an official rate change on consumer confidence and expectations of future employment and earnings prospects. Such effects vary with the circumstances of the time, but where a policy change is expected to stimulate economic activity, this is likely to increase confidence and expectations of future employment and earnings growth, leading to higher spending. The reverse will follow a policy change expected to slow the growth of activity.

So far, the effects mentioned all normally work in the same direction, so that higher interest rates, other things being equal, lead to a reduction in consumer spending, and lower interest rates tend to encourage it. However, this is not true for all individuals. For example, a person living off income from savings deposits, or someone about to purchase an annuity, would receive a larger money income if interest rates were higher than if they were lower. This higher income could sustain a higher level of spending than would otherwise be possible. So interest rate rises (falls) have redistributional effects—net borrowers are made worse (better) off and net savers are made better (worse) off. And to complicate matters further, the spending of these different groups may respond differently to their respective changes in disposable income.

However, the MPC sets one interest rate for the economy as a whole, and can only take account of the impact of official rate changes on the aggregate of individuals in the economy. From this perspective, the overall impact of the effects mentioned above on consumers appears to be that higher interest rates tend to reduce total current consumption spending, and lower interest rates tend to increase it.

Exchange rate changes can also affect the level of spending by individuals. This could happen, for example, if significant levels of wealth (or debt) were denominated in foreign currency, so that an exchange rate change caused a change in net wealth-though this is probably not an important factor for most individuals in the United Kingdom. But there will be effects on the composition of spending, even if there are none on its level. An exchange rate rise makes imported goods and services relatively cheaper than before. This affects the competitiveness of domestic producers of exports and of import-competing goods, and it also affects service industries such as tourism, as foreign holidays become relatively cheaper. Such a change in relative prices is likely to encourage a switch of spending away from home-produced goods and services towards those produced overseas. Of course, official rate changes are not the only influence on exchange rates-the appreciation of sterling in 1996, for example, appears to have been driven to a significant extent by other factors.

In summary, a rise in the official interest rate, other things (notably expectations and confidence) being equal, leads to a reduction in spending by consumers overall and, via an exchange rate rise, to a shift of spending away from home-produced towards foreign-produced goods and services. A reduction in the official rate has the opposite effect. The size—and even the direction—of these effects could be altered by changes in expectations and confidence brought about by a policy change, and these influences vary with the particular circumstances.

Firms

The other main group of private sector agents in the economy is firms. They combine capital, labour and purchased inputs in some production process in order to make and sell goods or services for profit. Firms are affected by the changes in market interest rates, asset prices and the exchange rate that may follow a monetary policy change. However, the importance of the impact will vary depending on the nature of the business, the size of the firm and its sources of finance. Again, we focus first on the direct effects of a monetary policy change, holding all other influences constant, and discuss indirect effects working through aggregate demand later (though these indirect effects may be more important). An increase in the official interest rate will have a direct effect on all firms that rely on bank borrowing or on loans of any kind linked to short-term money-market interest rates. A rise in interest rates increases borrowing costs (and *vice versa* for a fall). The rise in interest costs reduces the profits of such firms and increases the return that firms will require from new investment projects, making it less likely that they will start them. Interest costs affect the cost of holding inventories, which are often financed by bank loans. Higher interest costs also make it less likely that the affected firms will hire more staff, and more likely that they will reduce employment or hours worked. In contrast, when interest rates are falling, it is cheaper for firms to finance investment in new plant and equipment, and more likely that they will expand their labour force.

Of course, not all firms are adversely affected by interest rate rises. Cash-rich firms will receive a higher income from funds deposited with banks or placed in the money markets, thus improving their cash flow. This improved cash flow could help them to invest in more capacity or increase employment, but it is also possible that it will encourage them to shift resources into financial assets, or to pay higher dividends to shareholders.

Some firms may be less affected by the direct impact of short-term interest rate changes. This could be either because they have minimal short-term borrowing and/or liquid assets, or because their short-term liquid assets and liabilities are roughly matched, so that changes in the level of short rates leave their cash flow largely unaffected. Even here, however, they may be affected by the impact of policy on long-term interest rates whenever they use capital markets in order to fund long-term investments.

The cost of capital is an important determinant of investment for all firms. We have mentioned that monetary policy changes have only indirect effects on interest rates on long-term bonds. The effects on the costs of equity finance are also indirect and hard to predict. This means that there is no simple link from official rate changes to the cost of capital. This is particularly true for large and multinational firms with access to international capital markets, whose financing costs may therefore be little affected by changes in domestic short-term interest rates.

Changes in asset prices also affect firms' behaviour in other ways. Bank loans to firms (especially small firms) are often secured on assets, so a fall in asset prices can make it harder for them to borrow, since low asset prices reduce the net worth of the firm. This is sometimes called a 'financial accelerator' effect. Equity finance for listed companies is also generally easier to raise when interest rates are low and asset valuations are high, so that firms' balance sheets are healthy.

Exchange rate changes also have an important impact on many firms, though official rate changes explain only a small proportion of exchange rate variation. A firm producing in the United Kingdom, for example, would have many of its costs fixed (at least temporarily) in sterling terms, but might face competition from firms whose costs were fixed in other currencies. An appreciation of sterling in the foreign exchange market would then worsen the competitive position of the UK-based firm for some time, generating lower profit margins or lower sales, or both. This effect is likely to be felt acutely by many manufacturing firms, because they tend to be most exposed to foreign competition. Producers of exports and import-competing goods would certainly both be affected. However, significant parts of other sectors, such as agriculture, may also feel the effects of such changes in the exchange rate, as would parts of the service sector, such as hotels, restaurants, shops and theatres reliant on the tourist trade, financial and business services, and consultancy.

The impact of monetary policy changes on firms' expectations about the future course of the economy and the confidence with which these expectations are held affects business investment decisions. Once made, investments in fixed capital are difficult, or impossible, to reverse, so projections of future demand and risk assessments are an important input into investment appraisals. A fall (rise) in the expected future path of demand will tend to lead to a fall (rise) in spending on capital projects. The confidence with which expectations are held is also important, as greater uncertainty about the future is likely to encourage at least postponement of investment spending until prospects seem clearer. Again, it is hard to predict the effect of any official rate change on firms' expectations and confidence, but there can be little doubt that such effects are a potentially important influence on business investment.

In summary, many firms depend on sterling bank finance or short-term money-market borrowing, and they are sensitive to the direct effects of interest rates changes. Higher interest rates worsen the financial position of firms dependent on such short-term borrowing (other things being equal) and lower rates improve their financial position. Changes in firms' financial position in turn may lead to changes in their investment and employment plans. More generally, by altering required rates of return, higher interest rates encourage postponement of investment spending and reduced inventories, whereas lower rates encourage an expansion of activity. Policy changes also alter expectations about the future course of the economy and the confidence with which those expectations are held, thereby affecting investment spending, in addition to the direct effect of changes in interest rates, asset prices, and the exchange rate.

From changes in spending behaviour to GDP and inflation

All of the changes in individuals' and firms' behaviour discussed above, when added up across the whole economy, generate changes in aggregate spending. Total domestic expenditure in the economy is equal by definition to the sum of private consumption expenditure, government consumption expenditure and investment spending. Total domestic expenditure plus the balance of trade in goods and services (net exports) reflects aggregate demand in the economy, and is equal to gross domestic product at market prices (GDP).

Second-round effects

We have set out above how a change in the official interest rate affects the spending behaviour of individuals and firms. The resulting change in spending in aggregate will then have further effects on other agents, even if these agents were unaffected by the direct financial effects of the monetary policy change. So a firm that was not affected directly by changes in interest rates, securities prices or the exchange rate could nonetheless be affected by changes in consumer spending or by other firms' demand for produced inputs-a steel-maker, for example, would be affected by changes in demand from a car manufacturer. Moreover, the fact that these indirect effects can be anticipated by others means that there can be a large impact on expectations and confidence. So any induced change in aggregate spending is likely to affect most parts of the private sector producing for the home market, and these effects in turn can create further effects on their suppliers. Indeed, it is in the nature of business cycles that in upturns many sectors of the economy expand together and there is a general rise in confidence, which further feeds into spending. In downturns, many suffer a similar slowdown and confidence is generally low, reinforcing the cautious attitude to spending. This means that the individuals and firms most directly affected by changes in the official rate are not necessarily those most affected by its full repercussions.

Time-lags

Any change in the official rate takes time to have its full impact on the economy. It was stated above that a monetary policy change affects other wholesale money-market interest rates and sterling financial asset prices very quickly, but the impact on some retail interest rates may be much slower. In some cases, it may be several months before higher official rates affect the payments made by some mortgage-holders (or received by savings deposit-holders). It may be even longer before changes in their mortgage payments (or income from savings) lead to changes in their spending in the shops. Changes in consumer spending not fully anticipated by firms affect retailers' inventories, and this then leads to changes in orders from distributors. Changes in distributors' orders then affect producers' inventories, and when these become unusually large or small, production changes follow, which in turn lead to employment and earnings changes. These then feed into further consumer spending changes. All this takes time.

The empirical evidence is that on average it takes up to about one year in this and other industrial economies for the response to a monetary policy change to have its peak effect on demand and production, and that it takes up to a further year for these activity changes to have their fullest impact on the inflation rate. However, there is a great deal of variation and uncertainty around these average time-lags. In particular, the precise effect will depend on many other factors such as the state of business and consumer confidence and how this responds to the policy change, the stage of the business cycle, events in the world economy, and expectations about future inflation. These other influences are beyond the direct control of the monetary authorities, but combine with slow adjustments to ensure that the impact of monetary policy is subject to long, variable and uncertain lags. This slow adjustment involves both delays in changing real spending decisions, as discussed above, and delays in adjusting wages and prices, to which we turn next. A quantitative estimate of the lags derived from the Bank's macroeconometric model appears below.

GDP and inflation

In the long run, real GDP grows as a result of supply-side factors in the economy, such as technical progress, capital accumulation, and the size and quality of the labour force. Some government policies may be able to influence these supply-side factors, but monetary policy generally cannot do so directly, at least not to raise trend growth in the economy. There is always some level of national output at which firms in the economy would be working at their normal-capacity output, and would be under no pressure to change output or product prices faster than at the expected rate of inflation. This is called the 'potential' level of GDP. When actual GDP is at potential, production levels are such as to impart no upward or downward pressures on output price inflation in goods markets, and employment levels are such that there is no upward pressure on unit cost growth from earnings growth in labour markets. There is a broad balance between the demand for, and supply of, domestic output.

The difference between actual GDP and potential GDP is known as the 'output gap'. When there is a positive output gap, a high level of aggregate demand has taken actual output to a level above its sustainable level, and firms are working above their normal-capacity levels. Excess demand may partly be reflected in a balance of payments deficit on the current account, but it is also likely to increase domestic inflationary pressures. For some firms, unit cost growth will rise, as they are working above their most efficient output level. Some firms may also feel the need to attract more employees, and/or increase hours worked by existing employees, to support their extra production. This extra demand for labour and improved employment prospects will be associated with upward pressure on money wage growth and price inflation. Some firms may also take the opportunity of periods of high demand to raise their profit margins, and so to increase their prices more than in proportion to increases in unit costs. When there is a negative output gap, the reverse is generally true. So booms in the economy that take the level of output significantly above its potential level are usually followed by a pick-up of inflation, and recessions that take the level of output below its potential are generally associated with a reduction in inflationary pressure.

The output gap cannot be measured with much precision. For example, changes in the pattern of labour supply and industrial structure, and labour market reforms, mean that the point at which producers reach capacity is uncertain and subject to change. There are many heterogeneous sectors in the economy, and different industries start to hit bottlenecks at different stages of an upturn and are likely to lay off workers at different stages of a downturn. No two business cycles are exactly alike, so some industries expand more in one cycle than another. And the (trend) rate of growth of productivity can vary over time. The latter is particularly hard to measure except long after the event. So the concept of an output gap—even if it could be estimated with any precision—is not one that has a unique numerical link to inflationary pressure. Rather, it is helpful in indicating that in order to keep inflation under control, there is some level of aggregate activity at which aggregate demand and aggregate supply are broadly in balance. This is its potential level.

Holding real GDP at its potential level would in theory (in the absence of external shocks) be sufficient to maintain the inflation rate at its target level only if this were the inflation rate expected to occur by the agents in the economy. The absence of an output gap is consistent with any constant inflation rate that is expected. This is because holding aggregate demand at a level consistent with potential output only delivers the rate of inflation that agents expect-as it is these expectations that are reflected in wage settlements and are in turn passed on in some product prices. So holding output at its potential level, if maintained, could in theory be consistent with a high and stable inflation rate, as well as a low and stable one. The level at which inflation ultimately stabilises is determined by the monetary policy actions of the central bank and the credibility of the inflation target. In the shorter run, the level of inflation when output is at potential will depend on the level of inflation expectations, and other factors that impart inertia to the inflation rate.

Inflation expectations and real interest rates

In discussing the impact of monetary policy changes on individuals and firms, one of the important variables that we explicitly held constant was the expected rate of inflation. Inflation expectations matter in two important areas. First, they influence the level of real interest rates and so determine the impact of any specific nominal interest rate. Second, they influence price and money wage-setting and so feed through into actual inflation in subsequent periods. We discuss each of these in turn.

The real interest rate is approximately equal to the nominal interest rate minus the expected inflation rate. The real interest rate matters because rational agents who are not credit-constrained will typically base their investment and saving decisions on real rather than nominal interest rates. This is because they are making comparisons between what they consume today and what they hope to consume in the future. For credit-constrained individuals, who cannot borrow as much today as they would like to finance activities today, nominal interest rates also matter, as they affect their cash flow. It is only by considering the level of real interest rates that it is possible, even in principle, to assess whether any given nominal interest rate represents a relatively tight or loose monetary policy stance. For example, if expected inflation were 10%, then a nominal interest rate of 10% would represent a real interest rate of zero, whereas if expected inflation were 3%, a nominal interest rate of 10% would imply a real interest rate of 7%. So for given inflation expectations, changes in nominal and real interest rates are equivalent; but if inflation expectations are changing, the distinction becomes important. Moreover, these calculations should be done on an after-tax basis so that the interaction between inflation and the tax burden is taken into account, but such complications are not considered further here.

Money wage increases in excess of the rate of growth of labour productivity reflect the combined effect of a positive expected rate of inflation and a (positive or negative) component resulting from pressure of demand in labour markets. Wage increases that do not exceed productivity growth do not increase unit labour costs of production, and so are unlikely to be passed on in the prices charged by firms for their outputs. However, wage increases reflecting inflation expectations or demand pressures do raise unit labour costs, and firms may attempt to pass them on in their prices. So even if there is no excess demand for labour, unit costs will tend to increase by the expected rate of inflation simply because workers and firms bargain about real wages. This increase in unit costs-to a greater or lesser extentwill be passed on in goods prices. It is for this reason that, when GDP is at its potential level and there is no significant excess demand or supply of labour, the coincidence of actual and potential GDP delivers the inflation rate that was expected. This will only equal the inflation target once the target is credible (and so is expected to be hit).

Imported inflation

So far, this paper has set out how changes in the official rate lead to changes in the demand for domestic output, and how the balance of domestic demand relative to potential supply determines the degree of inflationary pressure. In doing so, it considered the impact of exchange rate changes on net exports, via the effects of changes in the competitive position of domestic firms vis à vis overseas firms on the relative demand for domestic-produced goods and services. There is also a more direct effect of exchange rate changes on domestic inflation. This arises because exchange rate changes affect the sterling prices of imported goods, which are important determinants of many firms' costs and of the retail prices of many goods and services. An appreciation of sterling lowers the sterling price of imported goods, and a depreciation raises it. The effects may take many months to work their way fully through the pricing chain. The link between the exchange rate and domestic prices is not uni-directional-for example, an exchange rate change resulting from a change in foreign monetary policy will lead to domestic price changes, and domestic price rises caused by, say, a domestic demand increase will have exchange rate

implications. Indeed, both the exchange rate and the domestic price level are related indicators of the same thing—the value of domestic money. The exchange rate is the value of domestic money against other currencies, and the price level measures the value of domestic money in terms of a basket of goods and services.

The role of money

So far, we have discussed how monetary policy changes affect output and inflation, with barely a mention of the quantity of money. (The entire discussion has been about the price of borrowing or lending money, ie the interest rate.) This may seem to be at variance with the well known dictum that 'inflation is always and everywhere a monetary phenomenon'. It is also rather different from the expositions found in many textbooks that explain the transmission mechanism as working through policy-induced changes in the money supply, which then create excess demand or supply of money that in turn leads, via changes in short-term interest rates, to spending and price-level changes.

The money supply does play an important role in the transmission mechanism but it is not, under the United Kingdom's monetary arrangements, a policy instrument. It could be a target of policy, but it need not be so. In the United Kingdom it is not, as we have an inflation target, and so monetary aggregates are indicators only. However, for each path of the official rate given by the decisions of the MPC, there is an implied path for the monetary aggregates. And in some circumstances, monetary aggregates might be a better indicator than interest rates of the stance of monetary policy. In the long run, there is a positive relationship between each monetary aggregate and the general level of prices. Sustained increases in prices cannot occur without accompanying increases in the monetary aggregates. It is in this sense that money is the nominal anchor of the system. In the current policy framework, where the official interest rate is the policy instrument, both the money stock and inflation are jointly caused by other variables.

Monetary adjustment normally fits into the transmission mechanism in the following way. Suppose that monetary policy has been relaxed by the implementation of a cut in the official interest rate. Commercial banks correspondingly reduce the interest rates they charge on their loans. This is likely to lead to an increased demand for loans (partly to finance the extra spending discussed above), and an increased extension of loans by banks creates new bank deposits that will be measured as an increase in the broad money supply (M4). So the change in spending by individuals and firms that results from a monetary policy change will also be accompanied by a change in both bank lending and bank deposits. Increases in retail sales are also likely to be associated with an increased demand for notes and coin in circulation. Data on monetary aggregateslending, deposits, and cash—are helpful in the formation of

monetary policy, as they provide corroborative, or sometimes leading, indicators of the course of spending behaviour, and they are available in advance of much of the national accounts data.

In the long run, monetary and credit aggregates must be willingly held by agents in the economy. Monetary growth persistently in excess of that warranted by growth in the real economy will inevitably be the reflection of an interest rate policy that is inconsistent with stable inflation. So control of inflation always ultimately implies control of the monetary growth rate. However, the relationship between the monetary aggregates and nominal GDP in the United Kingdom appears to be insufficiently stable (partly owing to financial innovation) for the monetary aggregates to provide a robust indicator of likely future inflation developments in the near term. It is for this reason that an inflation-targeting regime is thought to be superior to one of monetary targeting when the intention is to control inflation itself. In other words, money matters, but not in such a precise way as to provide a reliable quantitative guide for monetary policy in the short to medium term.

Another reason why monetary policy-makers need to monitor developments in monetary aggregates and bank lending closely is that shocks to spending can have their origin in the banking system. From time to time, there may be effects running from the banking sector to spending behaviour that are not directly caused by changes in interest rates.⁽¹⁾ There could, for example, be a fall in bank lending caused by losses of capital on bad loans or by a tightening of the regulatory environment. Negative shocks of this kind are sometimes referred to as a 'credit crunch'. Positive shocks (such as followed from the removal of the 'Corset' and consumer-credit controls in the early 1980s) may by contrast induce a credit boom that has inflationary consequences. The potential existence of shocks originating in the monetary system complicates the task of monetary policy-makers, as it makes it much more difficult to judge the quantitative effects of monetary policy on the economy in any specific period. But this is only one of many uncertainties affecting this assessment.

II The impact of a policy change on GDP and inflation: orders of magnitude

We now illustrate the broad orders of magnitude involved when changes in monetary policy affect GDP and the inflation rate. Two major caveats are necessary at this point. First, we have talked above as if monetary policy changes were causing a perturbation in the economy relative to some equilibrium state. For the purposes of exposition, this is how the impact of a change in monetary policy is illustrated below. But in reality, the economy is continually being affected by a variety of disturbances, and the aim of monetary policy is to return the economy to some equilibrium, rather than to disturb it. Disentangling the

(1) This is sometimes referred to as the 'bank lending channel'. Another aspect of what is more generally called the 'credit channel' is the financial accelerator effect, which was mentioned above in the context of the effect of firms' asset values on their ability to borrow. The financial accelerator effect is a normal part of the monetary transmission mechanism, but the bank lending channel is not.

effects of monetary policy from those of the initial shocks is often very difficult. Second, at many points above we have talked about the effect of a policy change 'other things being equal'. Other things are rarely equal between episodes of policy tightening or loosening. The actual outcome of any policy change will depend on factors such as the extent to which it was anticipated, business and consumer confidence at home and abroad, the path of fiscal policy, the state of the world economy, and the credibility of the monetary policy regime itself.

In order to give some broad idea of the size and time-path of the responses involved, we illustrate a simulation range using the Bank's macroeconometric model (see Charts 1 and 2). There is no sense in which this represents a forecast of what would happen in any real situation (as this would require, among other things, forecasts of many exogenous variables, such as world trade, which are here held at their

Chart 1

Effect on real GDP, relative to base, of 100 basis point increase in the official rate maintained for one year





base level). Nor is there any probability assigned to the outcome being within this range. Rather, this band is constructed from two alternative simulations, making different assumptions about monetary and fiscal policy reaction functions. Other simulations could give paths outside this range.⁽¹⁾ The upper limit of the bands in both the charts is derived from a simulation that assumes a price-level targeting rule for monetary policy, with government consumption spending fixed in money terms. The lower limit assumes a monetary policy rule that feeds back from both the output gap and deviations of inflation from target, with government consumption fixed as a proportion of GDP.

The charts show the response of real GDP and inflation (relative to a base projection) to an unexpected 1 percentage point rise in the official rate that lasts for one year. In both the upper and lower example, real GDP starts to fall quite quickly after the initial policy change. It reaches a maximum fall of between 0.2% and 0.35% of GDP after around five quarters. From the fifth quarter onwards, GDP returns smoothly to base, as a result both of the effects of the equilibrating forces within the model and of the reversal of policy.

Chart 2

Effect on inflation rate, relative to base, of 100 basis point increase in the official rate maintained for one year



The course of inflation, in contrast, is little changed during the first year under either of the simulations reported. But in the second year, inflation falls sharply, and the maximum effect is felt after about nine quarters. In one case, the fall is about 0.2 percentage points at its largest, and in the other, it is around 0.4 percentage points. In both cases, the impact on inflation then starts to diminish, but it has not returned to base three years after the initial policy change, even though policy was reversed after one year. It should be stressed that this simulation is only illustrative, and the explicit assumption that the hypothetical policy change is reversed after one year means that this chart cannot be used to infer how much interest rates would need to be changed on a sustained basis to achieve any given reduction in inflation. The key point to note is that monetary policy changes affect output and inflation with lags.

A final issue that needs clarification is whether the response of the economy to official rate changes is symmetric. The Bank's macroeconometric model used to generate the simulations discussed above is approximately linear, so rises and falls in the official rate of equal size would have effects of similar magnitude but opposite sign. But for some changes in official interest rates, where expectations and confidence effects are particularly important, the quantitative impact and the lags involved may exhibit considerable variation. This is as true for moves at different times in the same direction as it is for moves in the opposite direction.

(1) More details and an additional simulation that falls within the band, plus the full model-listing used to generate these charts, are reported in Chapter 2 of *Economic Models at the Bank of England*, Bank of England, April 1999.

Monetary policy and the yield curve

By Andrew Haldane of the Bank's International Finance Division and Vicky Read of the Bank's Foreign Exchange Division.

This article examines and interprets movements in the yield curve at the time of changes in monetary policy. These responses provide a measure of the degree of transparency and credibility of a monetary regime. There is evidence of yield-curve responses having been dampened since the introduction of inflation targeting in the United Kingdom in 1992—consistent with greater transparency and credibility of this monetary regime.

Changes in monetary policy in the United Kingdom are enacted by the Bank of England altering the rate at which it lends to the money markets. Typically, the Bank lends money for a two-week maturity and so directly affects short-term interest rates. Central banks in other developed countries also operate on short-term interest rates. But following changes in monetary policy, long as well as short-term interest rates tend to adjust. There is usually a 'jump' in the entire term structure of interest rates.⁽¹⁾

Chart 1 plots the yield curve—the spectrum of interest rates running from short to long maturities—on the two days on either side of the upward adjustment in UK official interest rates on 4 June 1998. The short end of the yield curve tilted upwards in response to this change in monetary policy, though the long end remained largely unchanged. Chart 2 plots the yield curve on the two days on either side of the cut in official interest rates on 4 February 1999. On this occasion, the whole yield curve pivoted, with the short end shifting down and the long end up. Though the pattern of yield-curve responses is different, in both cases the change in monetary policy clearly revealed 'news'—at least in the eyes of the market—about the path of short and long-term interest rates, thus causing the yield curve to adjust.⁽²⁾

This article documents and interprets movements in the yield curve at the time of changes in monetary policy. What explains these yield-curve shifts? Why might responses be different at long and short maturities? And why might they differ across time and across different monetary regimes? We first set out a conceptual framework that allows us to address these questions. We then discuss some empirical evidence, drawn from the United Kingdom and from other developed countries, which illustrates some of the key implications of this framework. This evidence highlights some of the benefits brought about by improved monetary policy transparency and credibility, since these benefits can be inferred directly from adjustments in the term structure at the time of monetary policy changes.

Chart 1





Chart 2

Yield curve: 50 basis point cut in interest rates on 4 February 1999



(1) Empirical evidence on these adjustments in the yield curve at the time of monetary policy changes is provided in Cook and Hahn (1989) for the United States, Dale (1993) for the United Kingdom, Hardy (1996) for Germany, and Buttiglione, Giovane and Gaiotti (1997) for a range of

European countries.
 Assuming that there was no other macroeconomic news affecting the yield curve significantly over the two days.

A stylised model

It is useful to begin with a simple model of monetary policy. The central bank is assumed to implement monetary policy by setting a short-maturity interest rate—the rate at which the central bank lends to the money markets. For simplicity, assume that the central bank sets one-month maturity interest rates, and re-sets these official rates once every month on a known date.

The central bank sets official interest rates according to a monetary policy rule. This rule or reaction function for the monetary authorities describes how interest rate decisions are linked to the state of the economy—for example, to the inflation rate and the level of output relative to potential. For simplicity, assume that official interest rates depend only on current inflation outcomes.⁽¹⁾ The monetary policy rule is then given by equation (1):

$$i_t = \beta \left(\pi_t - \pi_t^* \right) \tag{1}$$

where i_t is the official interest rate in the current period, time t; π_t is the inflation rate in the current period; π_t^* is the inflation target; and β is a (positive) feedback coefficient determining the strength of the monetary authorities' response to a deviation of inflation from target.

Participants in the money market lend to each other, at both long and short maturities. These money-market interest rates adjust to reflect the actual and expected path of official interest rates, because banks will not make loans to one another at rates that are very different from those at which they can borrow from the central bank. Consider, for example, the behaviour of one-month money-market interest rates. The day before official interest rates are re-set, one-month money-market rates will reflect expectations of the level at which official interest rates will be set for the forthcoming month. To the extent that these guesses about official interest rates are roughly correct, any change in official rates will be anticipated, and reflected in one-month money-market rates ahead of the policy change.

The same type of behaviour affects longer-maturity interest rates, which reflect expectations about the future path of official interest rates over the term of the loan. For example, one-year money-market interest rates will reflect expectations about the path of official interest rates over the next twelve months. Put slightly differently, the *j*-period forward interest rate—the spot rate expected to prevail *j* periods in the future—will depend on expectations of what official interest rates will be *j* periods hence.

This relationship linking forward interest rates to the expected path of future official rates is described by equation (2):

$$i_{t,j} = \mathcal{E}_t \left(i_{t+j} \right) \tag{2}$$

where $i_{t,j}$ is the *j*-period forward interest rate (the spot rate expected *j* periods in the future), E_t denotes the expectations of private sector agents based on information up to time period *t*, and i_{t+j} is the official interest rate prevailing at time t+j.

In this pure form, equation (2) embodies what is known as the 'expectations theory' of the term structure. According to this theory, forward interest rates are determined by expectations of the future path of short-term spot interest rates, which in turn are set by the central bank. In other words, longer-maturity interest rates embody expectations of future short rates at all dates up to the maturity of the loan.⁽²⁾

So the yield curve depends on the markets' guess about the actual and expected path of official rates, as in equation (2). And official rates depend on the monetary policy rule, given by equation (1). Given this, the markets will tend to form their guesses about future official rates based on their knowledge and understanding of the monetary authorities' policy rule. If some of the terms in that rule alter, so too will the markets' expectations about the future path of monetary policy. The yield curve will jump. For example, news about the authorities' inflation target (π_t^*) or the current inflation rate (π_t) would be expected to induce yield-curve responses, because these are factors entering the authorities' policy rule.

Consider as a benchmark a highly stylised model in which the monetary authorities' policy rule is perfectly understood and perfectly credible. The variables entering the rule inflation (π_t), the feedback coefficient (β) and the inflation target (π_t^*)—are all common knowledge, and the rule itself is fully credible. In effect, the transparency and credibility of the monetary rule are perfect.

In this highly simplified setting, unexpected inflation outcomes—inflation 'news'—will still affect actual and expected monetary policy choices. Through the policy rule, these will in turn result in adjustments in the yield curve. But changes in official interest rates will now be perfectly anticipated: all of the arguments in the policy rule will be transparent and understood ahead of any policy change. So in a world of fully transparent, perfectly credible monetary policy, there will be no news in monetary policy itself. Monetary policy actions will not be a source of yield-curve instability in their own right. Only news about the macroeconomy will matter.

A less stylised model

Charts 1 and 2 suggest that, in practice, the yield curve does shift following official interest rate changes. Typically, there is news in monetary policy announcements. How can these yield-curve shifts be explained? Relaxing some of the restrictions on the simple model outlined above provides one explanation. Indeed, the components of the policy rule can

⁽¹⁾ In practice, under the United Kingdom's inflation-targeting regime, official interest rates are related to *expected* inflation outcomes (see Batini and Haldane (1999)).

rational (1999). (2) More complicated versions of the expectations theory would embody premia of various kinds, which are not considered here (see Anderson et al (1996)).

be disentangled by gauging the different response of the yield curve at long and short maturities.

There are two components of the monetary policy rule about which the private sector may have different information from the monetary authorities:

(a) Private information on macroeconomic outcomes-for example, in equation (1), inflation outcomes. This is information to which the monetary authorities may have privileged or more timely access. Or the monetary authorities may interpret the implications of this data for the macroeconomic outlook differently-for example, because of their understanding of the monetary policy transmission mechanism. In either case, the monetary authorities may have different information from the private sector about the near-term macroeconomic outlook.

This source of monetary policy news might be termed 'private information about macroeconomic variables'. It is information that the monetary authorities would reveal in the course of following their monetary policy rule. Interest rate changes reveal information about the monetary authorities' interpretation of recent data and their view of the near-term macroeconomic outlook.

(b) Private information on policy targets—for example, in equation (1), the inflation target. This may arise because the markets do not completely believe that the monetary authorities will adhere to their announced targets-there is a problem of imperfect credibility. Alternatively, the targets themselves may be imprecisely specified. In both cases, monetary policy embodies news, because the public are learning about the true targets of the monetary authorities through their monetary policy actions.

This second source of monetary policy news might be termed 'private information about macroeconomic preferences'. Again, it is information that the authorities would reveal in the course of following their monetary policy rule. But the greater the credibility of the monetary authorities in the first place and the more transparent their policy targets, the less monetary policy news will come from this source. For example, the better the inflation track-record of the monetary authorities, the greater their credibility is likely to be-and so the less monetary policy news will come from private information on policy targets.

Both of these types of private information, about macroeconomic variables and about macroeconomic preferences, would be expected to influence the yield curve. But their effects are likely to show up at different points along the term structure. For example, private information about macroeconomic variables is likely to be shorter-term, probably no more than a few months ahead.

Private information about the monetary transmission mechanism is likely to be longer-lasting, but would still be a source of news only up to a maximum of two or three years ahead. So if there is monetary policy news about macroeconomic variables, this is most likely to show up in movements in shorter-maturity interest rates following a change in official rates.

Conversely, private information about policy targets or objectives is likely to be longer-term. If monetary policy is credible, long-run expectations are anchored. But if it is non-credible, then long-run expectations will tend to shift around. So if there is monetary policy news about macroeconomic preferences, this is most likely to show up in movements in longer-maturity interest rates, following a change in official interest rates.(1)

This framework provides a simple decomposition of monetary policy news when a policy change is implemented.⁽²⁾ The key implications of this framework can be summarised as follows:

(a) In a world of perfect monetary policy transparency and full credibility, there would be little or no adjustment in the yield curve following a change in official interest rates.

(b) Adjustments in the yield curve can be traced to two sources of private information on the part of the monetary authorities: information about macroeconomic variables (imperfect transparency), and information about macroeconomic preferences (imperfect credibility).

(c) News about macroeconomic variables is most likely to show up in movements at the short end of the yield curve following a monetary policy change; news about macroeconomic preferences is most likely to show up in longer-maturity interest rate movements.

(d) The effects of greater monetary policy transparency (for example, about the inflation outlook) are likely to show up in smaller movements in short-maturity interest rates. Transparency dampens yield-curve volatility at the short end.

(e) The effects of greater monetary policy credibility (for example, belief in the inflation target) are likely to show up in smaller movements in longer-maturity interest rates. Credibility dampens yield-curve volatility at the long end.

The last two of these implications make clear some of the benefits of greater monetary policy transparency and credibility. Both will reduce the yield-curve shifts arising from monetary policy actions.⁽³⁾ The next two sections aim to illustrate empirically some of these implications, and their relation to the transparency and credibility of a monetary

This distinction between short-run information on macroeconomic variables and long-run information on macroeconomic preferences is likely to be imperfect in practice. For example, information on some macroeconomic variables, such as the long-term real interest rate, may have an influence along the entire term structure. Conversely, information on the authorities' macroeconomic preferences, for example their preferred degree of output stabilisation, may have an influence at the short end of the yield curve. Haldane and Read (1999) provide a mathematical framework that captures these effects and attempts to calibrate them. There are other potential benefits of greater monetary policy transparency and credibility. For example, transparency plays an important role in ensuring that an appropriate degree of accountability is exercised over the monetary authorities, and credibility serves to reduce the output costs of bringing inflation back to target following a shock. See King (1995) on both of these points. (1)

regime, by looking at policy experience in a number of developed countries.

A case study: the United Kingdom's inflation-targeting regime

Since October 1992, the United Kingdom has been operating monetary policy with reference to an inflation target. In this period, there have been a number of far-reaching institutional reforms in the United Kingdom that have increased the transparency and credibility of the new regime. These measures have included: the formal scheduling and publicising of the monthly monetary policy decision-making process (the dates of meetings, the timing of policy announcements etc); the publication of the Bank's quarterly Inflation Report; the publication of press releases at the time of each monetary policy meeting; and the publication of the minutes of the monthly monetary policy meetings. Before May 1997, the monthly monetary policy meetings took place between the Chancellor of the Exchequer and the Governor of the Bank. Since May 1997 and the announcement of the Bank's operational independence, these have been replaced by monthly meetings of the nine members of the Bank's Monetary Policy Committee (MPC). The minutes of the MPC meetings are published two weeks afterwards, together with a record of the votes.

Using the framework discussed above, it should be possible to assess the effects of some of these institutional changes by examining shifts in the yield curve at the time of monetary policy changes. In particular, we consider the influence on yield-curve responses of the introduction of the United Kingdom's inflation-targeting regime for the period January 1984 to May 1997 (ie before the announcement of the Bank's operational independence and the establishment of the MPC).(1)

Table A summarises the empirical results.⁽²⁾ The columns show the estimated response of different-maturity (forward) interest rates⁽³⁾ to a 1 percentage point change in official UK interest rates.⁽⁴⁾ These interest rates run from short (one-month) to long (20-year) maturities. For example, the first column gives the average percentage point response in each maturity interest rate over the full sample period (January 1984 to May 1997). The second column gives the change in these average responses since the introduction of the inflation-targeting regime in the United Kingdom in October 1992. So the average response of the yield curve during the inflation-targeting period, which is shown in the final column, is the sum of the responses in the first two columns.

There are several key findings. First, a number of the average yield-curve responses (column 1) are statistically and behaviourally significant over the entire period. Yield-curve 'jumps' following changes in official interest rates were significantly different from zero between 1984–97. Using our earlier framework, that would be interpreted as evidence of imperfect transparency and/or credibility on the part of the UK monetary authorities. On average, monetary policy was itself a significant source of yield-curve news between 1984-97.

Second, yield-curve responses tended to be larger and more significant among short-maturity interest rates over the period. For example, on average around one third of any change in official rates had not been fully anticipated by short-maturity market interest rates. This too is evidence that the monetary authorities' policy rule was less than perfectly transparent between 1984-97, particularly regarding the macroeconomic outlook and its effect on near-term interest rate setting.

Third, the responses from longer-maturity interest rates are often negative. For example, the response from forward rates beyond five years is negative. In effect, the yield curve pivots: higher official rates raise short-maturity interest rates, but lower them at longer maturities. This is as we might expect if unexpectedly tighter monetary policy is successfully lowering inflation expectations and nominal interest rates at more distant horizons.

Fourth, the second column of Table A gives the change in these yield-curve responses since the introduction of the United Kingdom's inflation-targeting regime. These changes have generally tended to be significant (at least up to two years), statistically and economically. They are also typically of the opposite sign to the average yield-curve responses over the entire period. This indicates that the inflation-targeting regime has tended to reduce the size of yield-curve responses to changes in monetary policy. Indeed, the size of these changes is little different from the size of the average response over the entire period. So adding together the first two columns, the final column suggests that monetary policy news over the inflation-targeting period has tended to be insignificantly different from zero. Yield-curve shifts following official interest rate changes have been dampened considerably since October 1992.

Table A

Yield-curve responses (January 1984–May 1997)

Forward interest rate maturity:	Average interest rate response 1984–97	Change in response since October 1992	Average interest rate response 1992–97
1 month	0.32 (a)	-0.38 (a)	-0.06
3 months	0.25 (a)	-0.34 (a)	-0.09
6 months	0.27 (a)	-0.21 (a)	0.06
2 years	0.25 (a)	-0.24 (a)	0.01
5 years	0.09	-0.11	-0.02
10 years	-0.06	0.03	-0.03
15 years	-0.10	-0.04	-0.14
20 years	-0.13	0.04	-0.09

(a) Significant at the 95% confidence level.

This is the period for which the original exercise was run in Haldane and Read (1999). The same paper conducts a similar exercise for the United States, before and after February 1994. This was the date after which all FOMC monetary policy decisions were immediately disclosed to the market. In addition, all but two monetary policy decisions since then have occurred following a scheduled meeting of the FOMC, rather than at irregular intervals between meetings. Haldane and Read (1999) find that these institutional changes have significantly dampened yield-curve volatility in the United States. The econometric methodology is described in Haldane and Read (1999). Measured here from the term structure of interest rates from UK government bonds, using the methodology described in Deacon and Derry (1994). Measured here by banks' base rate. (1)

This greater stability in the yield curve under the inflation-targeting regime shows up much more clearly at the short end of the yield curve. This suggests that the United Kingdom's new monetary regime has provided much greater transparency about influences on near-term interest rate decisions. This is consistent with the institutional changes that were put in place following the introduction of inflation targeting in the United Kingdom—for example, the publication of the Bank's inflation forecasts in its quarterly *Inflation Report* and the scheduling of regular monthly monetary policy meetings. The evidence here suggests that the United Kingdom's post-1992 monetary framework has secured a far more transparent monetary policy rule than under earlier regimes.

Cross-country yield-curve responses

Table A compares yield-curve responses in the United Kingdom across time. Table B does the same across four developed countries: the United Kingdom, the United States, Germany and Italy.⁽¹⁾ These countries' monetary regimes have quite different degrees of transparency and credibility. For example, the inflation track-record of the United States and Germany during the 1970s and 1980s was much better than that of the United Kingdom and Italy. These differences in the transparency and credibility of these countries' monetary regimes should be discernible in different yield-curve responses following monetary policy changes.

Table B suggests that, on average, yield-curve responses have been larger and more significant in the United Kingdom and Italy than in the United States and Germany. For example, the response of short-maturity interest rates to a 1 percentage point rise in official rates was 35–45 basis points in Italy and around 15–30 basis points in the United Kingdom, but only around 5–15 basis points in the United States and Germany. This suggests that the monetary policy regimes in the United States and Germany were, on average, better defined and understood over the period 1990–97 than

Table B

Cross-country yield-curve responses

rate maturity:	United Kingdom	United States	Germany	Italy
1 month	0.17 (a)	0.16 (a)	0.12 (a)	0.45 (a)
3 months	0.28 (a)	0.07	0.08 (a)	0.35
6 months	0.22 (a)	0.14 (a)	0.09	0.33
2 years	0.15 (a)	0.03	0.08	0.23
5 years	0.03	0.005	0.09	0.38
10 years	0.16 (a)	0.08	0.17	-0.05
15 years	-0.23 (a)	0.13 (a)	0.11	0.32
20 years	-0.33 (a)	0.16	-0.02	-0.19

those in the United Kingdom and Italy. This is not surprising, since monetary regimes in the United States and in Germany did not undergo any major transitions in this period, whereas those in the United Kingdom and Italy changed on several occasions.

The same pattern is generally evident at the longer end of the term structure, though the differences in yield-curve responses between the countries are less statistically significant. Responses at the long end of the yield curve are small and often insignificant in Germany and the United States. This reflects the credibility of these countries' monetary regimes. Inflationary expectations—and hence long rates—are anchored following monetary policy adjustments (provided that monetary policy is not responding to, or inducing, changes in the long-term real interest rate). Monetary policy credibility is manifest in a more stable yield curve.

In the past, there has been less evidence of this in the United Kingdom and Italy. Yield-curve responses at longer maturities have tended to be larger and negative. This is how we would expect monetary policy to operate during the process of building up credibility. For example, monetary policy tightenings in these two countries have tended to depress inflation expectations and hence long rates. The lesser credibility of the monetary regimes in Italy and the United Kingdom is consistent with these countries' historically higher inflation rates and with their monetary regimes being newer.

Summary

A perfectly transparent, fully credible monetary policy will insulate the yield curve from jumps at the time of monetary policy changes. Indeed, stability of the yield curve around the time of monetary policy changes provides one measure of the degree of transparency and credibility of a monetary regime.

Most monetary regimes are less than perfectly transparent and credible. Typically, the yield curve does jump at the time of official rate changes. But evidence in the United Kingdom suggests that these yield-curve shifts have been dampened considerably since the introduction of inflation targeting and the transparency reforms that have accompanied it. Greater transparency has manifested itself in greater stability in the yield curve, especially at the short end. As the credibility of the inflation-targeting regime grows, longer-maturity yields might also be expected to be more stable following policy changes.

 For each of these countries we use slightly different sample periods, depending on data availability: for the United Kingdom, January 1990–March 1997; for the United States, January 1990–March 1997; for Germany, May 1990–March 1997; and for Italy, March 1992–March 1997.

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The Bank's use of survey data

By Erik Britton of the Bank's Structural Economic Analysis Division, and Joanne Cutler and Andrew Wardlow of the Bank's Conjunctural Assessment and Projections Division.

The Monetary Policy Committee (MPC) has access to around thirty 'state-of-trade' surveys, containing hundreds of different pieces of information. This article provides a brief outline of how surveys are used to inform the MPC's economic assessment and policy decisions, describing the techniques employed to compare surveys with official data, and to extract the 'news' from surveys.

Introduction

The Bank of England's Monetary Policy Committee (MPC) is charged with the task of achieving the Government's inflation target. A central part of this task involves interpreting information about the current state of the UK economy, and assessing its medium-term prospects. Surveys form part of the broad range of information available to the MPC, along with official statistics, data from financial markets, and the information provided by the Bank's regional Agencies. In this sense, surveys complement other sources of information. But importantly, the forward-looking nature of many survey responses means that they often provide information that is additional to official and other sources of data.

Surveys are numerous and varied, so it is important to use the information as systematically as possible, to ensure a consistent approach to identifying the important news in survey information and to avoid 'cherry-picking' survey results. This article explains how survey information has been used at the Bank in the past few years; it follows an earlier Bulletin article on the quantification of survey data (see Cunningham (1997)),⁽¹⁾ and parallels work that has been done elsewhere.⁽²⁾ The first section discusses the nature of survey information; the second explains how survey information is used at the Bank: how survey information is transformed into quantitative estimates and how the 'news' in surveys can be identified. The third section offers some conclusions about the use of survey information for monetary policy.

The nature of survey information

In this article, the term 'surveys' refers mainly to state-of-trade type surveys, such as the CBI Industrial Trends survey or the Federation of Recruitment and Employment Services (FRES) survey.⁽³⁾ Strictly speaking, most official statistical series published by the Office for National Statistics (ONS) are also surveys insofar as they are based on samples of firms, households or individuals, rather than a full census. But ONS data are normally quantitative-for example, sales in company A were £100 million in a particular period. State-of-trade surveys are normally qualitative-for example, sales in company B were above normal in a particular period, or were higher than in a previous period.

State-of-trade surveys typically provide responses from companies (or individuals) to a range of questions relating to current business (or household) conditions: for example, questions on output, orders, employment, optimism, cash flow, investment and prices. The Bank, like others, is usually interested in how survey responses change over time,⁽⁴⁾ what light they might shed on key aspects of economic behaviour, and how they inform its understanding of economic conditions. Survey responses can be divided into two broad groups: first, those that have direct parallels in official statistical series (eg on output, exports and employment); and second, those that complement other sources of information (eg on orders, skill shortages, capacity utilisation, and expectations about prices, employment or output in the near future).

Survey responses that correspond directly with official data may be useful if they are available on a more timely basis, or as a cross-check on ONS estimates (which necessarily tend to be revised over time as more information becomes available). Survey responses that give mainly additional information may be useful if they can capture or act as proxies for something that is either not well measured statistically, or is not directly observable (eg confidence, capacity utilisation or skill shortages). In both cases, survey responses may also provide forward-looking information. For example, responses about current order-books may contain information about future output, and responses about

⁽¹⁾ See Cunningham, A (1997), 'Quantifying survey data', Quarterly Bulletin, Vol 37(3), pages 292-300, which discusses estimation problems

See Sentance, A and Robson, P (1997), 'Interpreting the CBI Industrial Trends Survey', Centre for Economic Forecasting, London Business (2)

See Sentance, A and Kobson, P (1997), 'Interpreting the CBI industrial Trends Survey', Centre for Economic Forecasting, London Business School, *Discussion Paper No 31–97*, December. Other surveys include those by the British Chambers of Commerce (BCC) and the Chartered Institute of Purchasing and Supply (CIPS). Of course, companies may change the way they answer questions over time, so long-run comparisons of survey responses will need, as far as possible, to take such changes into account. See '40 years on: how do companies respond to the CBI's Industrial Trends survey?', *CBI Economic Situation Report*, November 1998, pages 16–21.

investment intentions may be indicative of future capital expenditure.

The Bank has regular access to more than 30 state-of-trade surveys, providing hundreds of pieces of information. The Bank's use of this information varies, according to the timeliness, track-record and coverage of the survey. The main focus is on surveys with a broad sectoral coverage, such as manufacturing and services, though surveys covering sectors such as engineering, distribution and financial services are also regularly considered. Other surveys cover particular economic groupings, such as small and medium-sized enterprises. Surveys of labour market behaviour also have an important role, supplementing official data on employment and recruitment trends, and providing insights on the prevalence of skill shortages. Surveys with a long track-record, such as the CBI Industrial Trends survey, may be useful in assessing and analysing the cyclical position of the economy.

Using and quantifying the information in surveys

Surveys sometimes provide direct numerical estimates of variables. For example, the British Retail Consortium's (BRC) survey provides a direct estimate of annual growth in retail sales values based on data provided by BRC members. This is published a few weeks ahead of the ONS retail sales release.

Sometimes, surveys provide numerical estimates for which there is no official data counterpart; for example, various surveys of inflation expectations (such as the Barclays Basix survey) ask respondents for their expectations of annual retail price inflation over specific periods. These supplement inflation expectations measures derived from the yield curve in two ways. First, the survey expectations typically cover short horizons (one to two years); the market-based inflation term structure implied by the yield curve is not well defined at these maturities. Second, whereas the inflation term structure only captures the expectations of financial market participants, the surveys capture the expectations of a broader range of groups, including the general public and trade unions.

The Bank also uses survey-based inflation expectations to derive various measures of short-term real interest rates. In addition, some survey-based expectations are available at medium-term horizons. These can provide information on monetary policy credibility. In conjunction with the inflation term structure data, they may also provide an indication of the size of the inflation risk premium.

More typically, survey information has to be manipulated in some way, either to be compared with its official data counterparts or to undertake other kinds of data analysis. Three general approaches are described below. The first two approaches try to match qualitative survey information with quantitative official data. However, as with any economic data, the 'news' (ie the additional information) in survey responses needs to be identified. The third approach describes how this can be addressed.

(i) Observing the data

A typical approach to interpreting survey information is to observe a time series of a balance statistic (for example, the difference between the proportion of firms reporting a rise in optimism and those reporting a fall), and try to assess the significance of recent changes. Large movements in a series that normally changes by small degrees clearly warrant closer examination, by comparing the latest observation with, for example, the average over time or, where possible, similar points in previous cycles. A further consideration might be whether a pattern or recent trend in the survey is comparable with other data. If so, a change in the direction of survey responses, for example from rising to falling balances, may be indicative of a turning-point in the related series. We might then ask how this observation squares with the broader economic picture and, in particular, with the MPC's current assessment and projections.

Chart 1 shows the business optimism balance from the quarterly CBI Industrial Trends survey and the annual growth in GDP. There is a much-publicised relationship between them, which became a focus of media and financial market attention in 1998 after the balance of manufacturing firms reporting lower optimism about future prospects increased sharply. Other surveys covering the manufacturing sector—such as the BCC survey—conveyed a similar message.

Chart 1 CBI optimism and annual GDP growth



Based on the previous observed relationship between the CBI series and GDP growth, the deterioration in survey balances in autumn 1998 could have been consistent with a sharp fall in GDP growth some time thereafter. But the relationship appears to have been weaker since the mid 1990s, which prompted the question of how large a fall in GDP growth the confidence indicator should lead us to expect. And was confidence in the manufacturing sector likely to be typical of the wider economy at this particular time?

Responses to a survey covering the manufacturing sector were expected to show business optimism deteriorating more than confidence across the economy as a whole, given the probable effect of sterling's appreciation in 1996-97 and the impact of the crises in East Asia and other regions in 1997-98 on manufacturing firms. So there were plausible reasons why manufacturers' optimism might prove less indicative of total GDP than in the past. This reasoning, though intuitively appealing, inevitably involved uncertainty. In its November Inflation Report forecast, the MPC's central projection was for annual GDP growth to fall quite sharply over the forthcoming year, though not to become negative. However, the risks to the projection were skewed downwards, ie it was considered more likely that GDP growth would be below than above the central projection. This projection reflected the MPC's best assessment of all the information available to it, including survey information.

(ii) Matching survey information with official data

To make the best use of qualitative survey data, they need to be converted into quantitative estimates of comparable official data, for example correlating output or orders responses with official measures of output. This is often done by estimating regression equations of survey data against official data. It is better to use 'up' and 'down' survey responses, if available, rather than survey balances in such regressions, because of the potential bias and inefficiency of the estimation process.⁽¹⁾ These simple bivariate regressions generate survey-based estimates of growth rates of official series such as manufacturing output, export volumes, retail sales, investment and employment. The estimates make it possible to gauge systematically the significance of a change in survey responses, and to compare them directly with the official data.

Backward-looking survey-based estimates of official data

The simplest use of the data-matching technique is where survey data are backward-looking (for example, reporting output over the most recent three or four months), and clearly comparable official data are available. A simple illustrative regression for this kind of data-matching is shown below:

Output growth_t = $\alpha + \beta_1 UPS_t + \beta_2 DOWNS_t + \varepsilon_t$

Chart 2 plots a survey-based estimate of manufacturing output alongside ONS data. As Cunningham (1997) observed, these derived estimates tend to follow a smoother path than the actual ONS data, and so the regression equations have large standard errors. But they allow us to map a piece of survey information onto a quantitative estimate of a related variable. For example, we are able to say that a balance of *n* firms reporting higher output is consistent with growth of x%. This can help us to determine whether, for example, a fall (rise) in the balance (or the 'up' or 'down' responses) suggests a sharp or

(1) See Cunningham (1997), op cit.

Chart 2 Manufacturing output: official data and survey-based estimate



moderate slowdown (upturn) in output. We may, of course, be interested in apparent discrepancies between official and survey data: for example, the weakness in official manufacturing output data in 1995 contrasted with stronger survey information.

Survey-based estimates, however approximate, are a useful tool, allowing survey information to inform and contribute to the MPC's economic assessment and policy decisions, in a way that is consistent with other economic data. This may be particularly valuable at economic turning-points, when there may be conflicting signals about the economic conjuncture.

Forward-looking estimates of official data: sectoral output and GDP estimates

As some official data are likely to be available for the immediate or recent period, in practice we tend to be more interested in forward-looking survey data. This may, of course, only be duplicating other forward-looking information, and contain little news in addition to the information captured in existing data and the relationships embodied in the MPC's projections (ie forward-looking survey information may simply be confirming aspects of existing MPC projections). But given the uncertainties surrounding economic forecasts, forward-looking survey information is likely to be valuable as a timely and independent cross-check on other information.

The same matching techniques can be applied to forward-looking information that has some form of leading relationship with, for example, output (such as domestic and export orders), or with firms' or individuals' expectations about, say, future output or investment. Chart 3 plots an estimate of manufacturing output derived from CBI domestic orders balances. This transformation allows us to generate an estimate of manufacturing output for, say, the quarter ahead, consistent with the survey information, that can be compared with estimates based on other surveys, such as the BCC survey (shown in Chart 3).⁽¹⁾

Chart 3





Similarly derived estimates are produced for output in other sectors. Survey data with a long track-record covering the service sector are less common. The BCC survey is used to generate forward estimates of services output. Chart 4 shows an estimate of services output derived from the BCC home orders balance.

Chart 4 Survey-based estimates of service sector output: BCC home orders



It is possible to weight the survey-based sectoral output estimates together to generate a survey-based estimate of GDP. It is not possible to capture all sectors of the economy, but established surveys for the manufacturing, construction and private services sectors collectively account for around three quarters of GDP. This allows us to present an estimate of GDP growth that is consistent with a range of current survey information. We may wish to incorporate other subsequently available information to generate a more accurate projection of output growth (for example, the monthly index of production and retail sales data) to compare with existing MPC projections. But the absence of monthly service sector output indices means that survey data remain an important indicator for a large part of the economy until GDP estimates are published.

These survey-based estimates of output growth, based on orders responses, can be produced ahead of official ONS estimates, depending on what lags are employed when using forward-looking information. This can help the MPC to assess its projections (and balance of risks). Recently, it has been possible to say approximately whether or not survey information on orders pointed to a sharper slowdown in GDP growth than incorporated in the MPC's inflation forecast. Using the CBI survey resulted in a sharper projected decline in manufacturing output than that derived from the BCC survey. So it was necessary to judge how much weight to place on each of the surveys.

This use of survey information is not the only way to generate estimates of current or next-quarter GDP to supplement model-based forecasts. Another example is the approach adopted by the National Institute of Economic and Social Research (NIESR). The NIESR estimates use available and extrapolated values of official data, such as the index of production and retail sales.⁽²⁾ The NIESR does not use any independent survey information.

Forward-looking survey-based forecasts of official data: investment intentions and investment

Some surveys ask questions not only about the next month or quarter, but also about the following year. The data-matching techniques described above can be modified to use this information to construct a survey-derived forecast of official data up to the relevant horizon. This has been done at the Bank for investment and investment intentions (see Charts 5 and 6). The survey questions on investment intentions tend to ask firms what their plans are for investment over the next twelve months, compared with the most recent twelve months. Responses to these questions



Chart 5 Service sector investment in plant and machinery

(1) Combining different surveys or series from the same survey does not greatly improve these estimates. In any case, the purpose here is not to model manufacturing output or other series using surveys, but to transform survey information.

(1) Combining under the series using surveys, but to transform survey information.
 (2) See Salazar, E, Smith, R, Weale, M and Wright, S (1997), 'A monthly indicator of GDP', *NIESR Review*, July

can be used to generate forecasts for investment at all horizons between one quarter and four quarters ahead.





(iii) Identifying news in surveys

Even when survey information is forward-looking or more timely than official data, data-matching techniques do not identify the news in survey information relative to other data available at the time of its publication. They do not answer the question of how much of the fall in confidence, for example, was already captured in other known data. Work at the Bank has assessed how far survey data provide information not available elsewhere. For example, consumer confidence indicators can be thought of as summary statistics of the factors influencing household spending (and saving), such as income, wealth and employment prospects, which will be embodied in consumption forecast equations. Only some of these factors are observed and measured in other data series. So an important consideration in interpreting confidence indicators is whether changes in confidence reflect known factors, or contain extra information. The same is true of business optimism, which can be thought of as a summary statistic of the factors influencing business investment, as well as reflecting broader considerations such as demand conditions. Examples of both of these are set out below.

Consumer confidence and consumption

There are two main surveys of consumer confidence in the United Kingdom, conducted by GfK and MORI. The GfK survey asks individuals about their perceptions of the general economic situation and their own finances and spending plans, both over the past year and for the year ahead. The MORI survey asks a single question about perceptions of the general economic situation. Confidence indicators are published monthly, and are available ahead of the quarterly national accounts estimates of household spending. They are also published ahead of monthly official retail sales estimates. There is a reasonably good correlation between the level of consumer confidence (as measured by

(1) MPC minutes, November 1998, published in the February 1999 Inflation Report.

the GfK index) and ONS estimates of household spending growth (see Chart 7). So consumer confidence indicators might be useful as proxies for currently unobserved household spending.

Chart 7

GfK consumer confidence and quarterly household spending growth



Consumer confidence indicators may also contain information not directly measured in official data. particularly on individuals' expectations about their income. Theory suggests that the level of current consumption depends on individuals' expectations about their future labour income ('human wealth'), as well as their current labour income and non-human wealth, such as housing and financial wealth. The GfK survey asks individuals each month whether they are more or less optimistic about their finances over the year ahead. Since income from employment is the most important component of the income of most households, it is likely that changes in optimism about finances largely reflect perceptions about future labour income. Bank research has found that consumer confidence measures have explanatory power for household spending over and above official estimates of income, wealth and real interest rates, which is consistent with the role of consumer confidence as a proxy for income expectations. This analysis was used in 1998 to assess the risk of a sharper slowdown in household spending growth than was incorporated in the central Inflation Report projection.

This use of confidence indicators requires judgment. There is no mechanistic mapping from changes in consumer confidence to the MPC's central projection or assessment of risks surrounding the forecast of household spending. In the above example, there was a clear puzzle about weaker-than-expected official estimates of household spending growth in 1998 (beyond what was explained by erratic factors). This prompted a search for explanations of why consumer spending had been weaker than expected. The fall in consumer confidence was one of a number of potential explanations considered by the MPC.⁽¹⁾

Business optimism and investment

The corporate sector counterpart to consumer confidence is business optimism. A number of surveys ask firms how optimistic they are about the state of the economy. As noted in the first section, business optimism responses from the quarterly CBI Industrial Trends survey have in the past been closely correlated with GDP growth. Business optimism is likely to reflect all the factors that influence the particular sector of the economy that the survey covers. But current business optimism might also contain 'news' specifically for current and future investment, just as consumer confidence contains news for consumption. Some analysis has recently been undertaken at the Bank to determine whether measures of business optimism do indeed contain news for current or future investment, relative to other known information.

In particular, news in the CBI business optimism balance can be identified by regressing the optimism balance on its own lag and a set of other variables, including those on the right-hand side of an econometric equation for business investment (for example, GDP and the real cost of capital). The residual from this regression can be thought of as the news in business optimism. This news can then be shown to have significant incremental explanatory power in the equation for business investment. Indeed, because the optimism balance reflects firms' expectations, the news in optimism is significant for investment up to three quarters ahead.

The results of regressions of this sort reveal the average news for investment contained in the optimism balance, reflecting all shocks to the economy over the sample period. There may be—and in this case there clearly are—reasons for thinking that, given recent shocks, this average does not provide an accurate way of quantifying the news for investment in the current optimism figures. First, the CBI survey covers only manufacturing firms, and manufacturing investment has progressively become a smaller component of business investment, accounting for 19% of business investment during 1998, compared with 26% in 1986. Second, as argued above, the manufacturing sector is more vulnerable than other sectors to changes in the value of sterling, so the recent appreciation of sterling is likely to have had a disproportionately negative effect on the CBI optimism balance, relative to business optimism across all sectors.

This analysis is reported in the Annex to the December 1998 MPC minutes.⁽¹⁾ The Annex also reports discussion of the relationship between investment intentions and the official data on investment, mentioned above. The survey evidence on investment overall was mixed. The news in the business optimism indicators, taken at face value, pointed to very weak prospects for investment. But survey evidence on investment intentions, for services as well as manufacturing, pointed to a stronger picture. Taken together, the survey information suggested that underlying business investment would remain broadly unchanged after the third quarter of 1998.

Conclusions: surveys and monetary policy

This article has outlined how Bank staff use state-of-trade type surveys: as a timely indicator of forthcoming official data; as an independent cross-check on official data and other information; as forward-looking information on the economy, particularly up to the short-term horizon; and to provide additional information to explain economic behaviour. It has discussed a variety of approaches the Bank uses to assess survey information, and to identify news about the economy. The article has outlined how simple observation can be useful, and has explained how qualitative survey information is transformed into quantitative estimates and how incremental news might be extracted from surveys. The approaches described illustrate how surveys help the MPC to interpret economic conditions, and resolve puzzles and uncertainties about the economic outlook.

Surveys complement official and other information; they are not a substitute for it. Many surveys are based on smaller, and less representative, samples than the official statistics. So they may be subject to bias, or to a higher degree of measurement error than the official data. The MPC has to form a judgment based on all available information, of which survey evidence is one valuable source. The techniques described above reflect the Bank's aim to use this evidence as systematically as possible to inform the MPC's policy decisions.

Monetary policy and uncertainty

By Nicoletta Batini, Ben Martin and Chris Salmon of the Bank's Monetary Assessment and Strategy Division.

This article describes various types of uncertainty that policy-makers may face. It summarises analysis, including recent work by Bank staff, that shows how different forms of uncertainty could lead to different policy responses.

Introduction

Monetary policy-makers take decisions in an uncertain world. This has been long recognised by policy-makers and is reflected in the *Inflation Report* fan charts, for example, which display the many uncertainties surrounding the inflation and growth projections. But academic studies often assume that policy-makers act as if certain when determining policy. This rests on the notion that policy-makers' uncertainty about the economy is only of one particular form.

Recent research has begun to explore the implications for monetary policy of a wider range of uncertainties facing policy-makers (for example, Sack (1998), Sargent (1998) and Aoki (1999)). One strand of this, on which Bank of England staff have worked, has been the analysis of whether uncertainty about the relationship between economic variables in the economy (for example, between nominal interest rates and the demand for money) could entail a slower, or smoother, policy response to shocks to the economy than otherwise. This analysis, which follows a proposition first put forward by Brainard (1967), is based on the premise that uncertainty about the relationship between the official interest rate and the rest of the economy (a form of 'parameter uncertainty') creates a trade-off for policy-makers: the parameter uncertainty may mean that movements in the official interest rate themselves increase uncertainty about the future path of the economy. This could lead policy-makers to use their policy instruments more cautiously, even if this is likely to result in a worse outcome on average, in order to reduce the chance of missing the target significantly.

The next section of this article describes the relationship between monetary policy and uncertainty. It discusses in detail the parameter-uncertainty effect identified by Brainard, and reviews other forms of uncertainty. The third section summarises the results from two empirical studies carried out at the Bank, which, by focusing only on the parameter-uncertainty effect identified by Brainard, explore in a preliminary way the quantitative importance of uncertainty for the United Kingdom.

Uncertainty and monetary policy: theoretical considerations

A standard approach to analysing monetary policy is to specify an objective for policy-makers, and a model of the economy, and then to determine how monetary policy should be operated in response to disturbances or 'shocks' to the economy.

How uncertainty is supposed to affect monetary policy will depend on how the model is specified. Researchers have generally specified models in which uncertainty is independent of the policy-maker's behaviour. In these models, the only uncertainty is whether the economy will deviate from the path policy-makers expect on account of what are known as 'additive shocks'.⁽¹⁾ As Theil (1958) showed, the best that policy-makers could do in this case would be to ignore the effects of uncertainty upon the economy. This is known as 'certainty-equivalence'.

But this restrictive approach does not take account of many of the uncertainties faced by policy-makers. As outlined below, a number of recent papers have explored the implications for policy of allowing more general treatments of uncertainty.

The certainty-equivalence approach and the recent generalisations can be illustrated using a simple model of inflation targeting, based on Svensson (1996). The core of the model is a simple two-equation system. The first equation (a form of Phillips curve) links inflation to the output gap, ie:

$$\pi_{t+1} = a\pi_t + y_{t+1} \tag{1}$$

where π_t is the inflation rate and y_t is the output gap.

The second equation (a form of IS curve) links the output gap to nominal interest rates. The output gap is inversely

⁽¹⁾ Additive shocks cause a variable to deviate from the path implied by its identified determinants. For example, in the following equation, additive shocks (ε) cause variable x (say, exports) to deviate from the level implied by its identified determinants—the previous-period outcomes for x and y (say, world demand) given the multipliers, α and β , that relate x to its determinants: $x_{t+1} = \alpha x_t + \beta y_t + \varepsilon_{t+1}$.

related to previous changes in the short-term nominal interest rate, i_t , and is subject to additive shocks, ε_{t+1} , which average zero, and have a variance of $\sigma_{\varepsilon}^{2:(1)}$

$$y_{t+1} = -bi_t + \varepsilon_{t+1} \tag{2}$$

Substituting (2) into (1) gives the following reduced form for inflation:

$$\pi_{t+1} = a\pi_t - bi_t + \varepsilon_{t+1} \tag{3}$$

Policy-makers set nominal interest rates, i_t , with the aim of meeting the inflation target. Specifically, it is assumed that their objective is to minimise the expected squared deviations of inflation from target (normalised to zero).⁽²⁾ This objective can be interpreted as saying that the policy-maker is concerned with minimising expected future deviations of inflation from target (the bias in future inflation), and uncertainty about future inflation (the variance of inflation).⁽³⁾ This concern about both bias and variance is vital to understanding Brainard's insight.

The only uncertainty in this version of the model arises from the additive disturbance entering the IS curve (2). Policy-makers are assumed to know with certainty: (i) the parameter values linking variables in the economy; (ii) the state of the economy (so that the output gap and inflation are measured with certainty); and (iii) most basically, the functional form of the economy (ie how inflation and the output gap are actually related). An optimal rule can then be determined, which, in this hypothetical world, would enable policy-makers to minimise expected deviations of inflation from target:

$$i_t = \frac{a}{b}\pi_t \tag{4}$$

The rule is certainty-equivalent: the same interest rate rule would be optimal in a world with no uncertainty about additive shocks. If policy-makers followed this rule, they would completely offset the effects of shocks to inflation, so that the expectation at time t of next period's inflation would always be equal to target. Hence, although policy-makers cannot prevent temporary deviations of inflation from target, they can ensure that the effects of such shocks do not persist. The reason why the model implies that policy-makers can control inflation so accurately is because assumptions (i) to (iii) imply that they can unambiguously identify a shock to inflation from inflation outturns, and know by exactly how much they need to move the instrument to offset the effects of the shock on subsequent inflation.

Of course, in the real world, policy-makers cannot identify shocks or best responses so clearly. So we need to consider how the optimal rule varies as conditions (i) to (iii) are relaxed.

(i) Parameter uncertainty

Parameter uncertainty arises where policy-makers are unsure how changes in one variable will affect another. In (2), for example, if policy-makers did not know the value of the parameter b, they would be unsure how changes in interest rates would feed through to the output gap and hence inflation.

To understand how policy-makers might best act in this situation, we need to make an assumption about precisely what policy-makers are unsure about. The first, and most influential, analysis of parameter uncertainty was provided by Brainard (1967). He assumed that policy-makers were uncertain about the actual value of parameters in the model, but knew the distribution from which they were drawn.

The effect of this form of parameter uncertainty can be illustrated in the model developed above. Assume that the policy-makers know that the parameters a and b in the reduced-form equation for inflation (3) are drawn from independent normal distributions, with means \overline{a} and \overline{b} , and variances σ_a^2 and σ_b^2 respectively. In this case, the optimal rule becomes:

$$\dot{i}_{t} = \left[\frac{\bar{a}\bar{b}}{\bar{b}^{2} + \sigma_{b}^{2}}\right] \pi_{t}$$
(5)

This seems more complicated than (4). But in fact it is closely related, and reflects Brainard's insight that the optimal policy response should be modified to take account of any uncertainty about parameters in the transmission mechanism: as uncertainty increases about how inflation will respond to changes in the monetary policy instrument (ie as σ_b^2 becomes larger), so the interest rate response to inflation deviations from target becomes smaller, with the result that inflation is not returned to target straight away. This is what Blinder (1998) called 'Brainard conservatism'.(4)

The trade-off between returning inflation to target and increasing uncertainty about inflation depends on the size of the variance σ_b^2 of the policy multiplier b relative to its average level \overline{b} . This policy multiplier measures how effectively interest rates reduce the bias in inflation, while its variance σ_b^2 , measures how much uncertainty is injected by the policy-maker. The ratio of the standard deviation to the mean, $\frac{\sigma_b}{\overline{b}}$, is known as the 'coefficient of variation' and summarises this trade-off. For example, a large coefficient of variation means that for a small reduction in the inflation

A more sophisticated model would relate the output gap to real interest rates, and real interest rates to nominal rates, via the Fisher identity. Martin and Salmon (1999) present a version of the model that makes this distinction.
 For simplicity, this objective implies that policy-makers have no regard for the variability of output. This is not the case in practice, as is recognised in the empirical models discussed in the third section.
 This is a consequence of Jensen's inequality, which arises in many applications, and implies that the expected squared value of a variable equals the square of the bias plus the variance: E(π²) = [E(π)]² + var(π).
 Brainard himself noted examples where the conservatism principle may fail to hold, even in a model as simple as the one presented here. This may occur if parameters co-vary in a certain way.

bias, the policy-maker injects a lot of variance into future inflation, and implies that (5) would result in a different policy response from (4).(1)

Given that policy-makers are assumed in this particular model to be able to control inflation speedily and accurately, why would they not offset inflationary shocks completely and immediately? Recall the assumption that policy-makers wish to minimise the expected bias and variance of inflation. If the parameters of the model are known with certainty, the variance of inflation is independent of monetary policy-the only source of uncertainty is the additive disturbance (ε_{t+1}) , which is outside the policy-makers' control. So interest rates can be set with the aim of putting expected inflation back on target, or completely eliminating the bias in inflation, as in (4). But once account is taken of the uncertainty about the parameters of the model, the variance of inflation also depends on the level of interest rates, and so the policy-makers' actions affect uncertainty about future inflation. In this model, large movements in interest rates in response to shocks increase the variance of inflation. So the quicker a policy-maker attempts to return inflation to target, the higher will be the probability of missing the target by a long way. This conflict between the bias and uncertainty about future inflation underlies Brainard's prescription that the optimal policy response cannot ignore uncertainty about parameters in the transmission of monetary policy.

If policy-makers choose to follow (5), because of parameter uncertainty, a more sustained interest rate reaction will be required than if policy were set according to the certainty-equivalent rule, (4). This is because (5) does not offset the entire inflation shock when it occurs, so that policy in the next period will have to react to the residual consequences of the initial shock to inflation. Under (4), the whole of the shock to inflation is offset immediately. Spreading out a policy response has been labelled 'gradualism'.(2)

Several studies have sought to examine the quantitative importance of the Brainard effect. In particular, Sack (1998) has examined how sensitive the optimal monetary policy rule in the United States is to this form of uncertainty. He finds that an optimal rule that assumes no parameter uncertainty leads to a larger, or more 'aggressive', policy response to shocks than has been observed in the past couple of decades. The optimal rule allowing for uncertainty implies a somewhat smaller, or more 'conservative', response to shocks. The first of the Bank studies described in the third section applies Sack's method to the United Kingdom.

(ii) Knowledge of the current economic state

The assumption that the true state of the economy can be measured ignores a potentially serious form of uncertainty for the policy-maker: measurement error. This can arise

because many important variables like GDP are only available with a lag, and are subject to revision; moreover, some variables, such as the output gap, cannot be directly measured at all.

Chow (1977) showed that if the measurement error can be treated as another additive error, it should not affect policy. In the simple model described above, this will be the case if it is assumed that the output gap is measured with error. Instead of (2), policy-makers would then use (2'), where y_t is their measure of the output gap and η_t^y is the difference between the actual output gap and that estimate:

$$\hat{y}_{t+1} = -bi_t + \varepsilon_{t+1} + \eta_{t+1}^{y}$$
(2')

The policy-maker would not be able to distinguish between the contributions of the additive error (ε_{t+1}) and the measurement error (η_{t+1}^y) to their estimate of the output gap. Nevertheless, the optimal rule given (1) and (2') would remain (4).

But this will not always be so. In particular, in models where there are different kinds of additive shock, which require a different policy response, measurement error can make it harder for policy-makers to identify what additive shocks have occurred. In these circumstances, the optimal policy response may be more 'conservative' than when there is no measurement error.

For example, policy-makers whose objective was to prevent large fluctuations of inflation from target and fluctuations in the output gap would typically raise interest rates in response to a demand shock that increased inflation and output. Conversely, they might cut interest rates in response to a supply shock that raised inflation but lowered output. But if output could initially only be measured with uncertainty, it might not be clear whether a measured increase in output and inflation reflected a supply or demand shock, or simply measurement error. Then to assume, for example, that the measured rise in output is wholly accounted for by a demand shock, and to raise the interest rate, could be a significant policy mistake. The best that policy-makers could do would be to respond to their estimate of the state of the economy, which would reflect each of the possibilities that there had been a demand or supply shock, and that the observed change in output was entirely due to measurement error. The optimal policy response would depend on the severity of measurement error in the economy, and the weight placed on each possibility. Aoki (1999) shows how this strategy could lead to a more conservative (ie lesser) response than if there were no measurement error. The intuition is that policymakers benefit by not 'putting all their eggs in one basket' when interpreting the data.

Recent studies, for example by Smets (1998) and Rudebusch (1998) have analysed whether measurement error of the output gap (Smets) and of output and inflation

Conversely, as the variance of *b* tends to zero, (5) collapses to (4). A third consideration is whether or not the gradual policy response implied by (5) will result in policy-makers cumulatively moving interest rates by more, in order to offset the shock. This will be determined by the persistence of the additive shock. See Martin (1999) for more details.

(Rudebusch) might significantly affect the optimal response to developments in the US economy. Both studies assume that policy is set according to a form of the 'Taylor rule', which relates interest rates to developments in output and inflation.⁽¹⁾ They first calculate the optimal form for the Taylor rule, conditional on a model that assumes no measurement error, and then recalculate this rule allowing for measurement error. Both studies show that the optimal policy response could decline markedly if measurement error is significant.

(iii) Model uncertainty

The analysis described above still assumes that the policy-makers know precisely how uncertain they are: to calculate rule (5), policy-makers must know the variance of the uncertain parameters and additive disturbances to the economy. Similarly, the studies by Aoki, Rudebusch and Smets assume that the variance of any measurement error is known.

A more realistic assumption may be that uncertainty is more pervasive than this. In particular, and fundamentally, policy-makers are uncertain about the basic form of the 'true' model of the economy. This would be the case, for example, if it was unclear which variables to omit or include in the model.

Theorists have considered how policy should be set, given such 'model uncertainty'. One idea is that policy rules could be designed that perform well across a range of plausible models of the economy. Such 'robust' policy rules would not, by definition, perform as well as an optimal rule designed for a particular model. But they would be designed to perform quite well both with this model and a range of similar models, whereas the optimal rule might perform poorly with other models.

This analysis is still evolving, and a consensus on how to identify robust rules has yet to emerge. McCallum (1988 and subsequent papers) investigated whether particular policy rules performed credibly across a small range of models, on the basis of qualitative criteria. More recent contributions (for example, Sargent (1998) and Onatski and Stock (1999)) have used formal mathematical criteria to investigate robustness. Sargent takes an open-economy variant of the model set out above (due to Ball (1998)) and calculates a policy rule robust to small mis-specifications around this model.⁽²⁾ Unlike the Brainard conservatism result for parameter uncertainty, Sargent finds that the robust rule for Ball's model may

be more aggressive than the certainty-equivalent optimal rule in the model.⁽³⁾ For the simple model presented above in (1) to (3), it is possible to show that a 'Sargent robust rule' coincides with the certainty-equivalent optimal rule.(4)

To summarise, this section has discussed a range of theoretical approaches to studying the uncertainty faced by monetary policy-makers. The most common approach to uncertainty, where only additive uncertainty is considered, is theoretically attractive and implies certainty-equivalent policy responses. But this approach is restrictive: once more uncertainties are allowed for, it becomes apparent that the dictum that policy-makers can act as if the world is certain is unlikely to be appropriate. Beyond this, it is hard to draw general lessons. It seems likely that parameter uncertainty and measurement error are both likely to reduce the size of the optimal response to shocks, but more generic model uncertainty could imply a need for a more aggressive policy response.

Parameter uncertainty in the United Kingdom

This section focuses on a particular form of uncertainty, namely parameter uncertainty as defined by Brainard. It summarises two empirical studies by Bank staff. The first paper (Martin and Salmon (1999)) takes a vector autoregressive (VAR) model of the economy, and calculates optimal rules under alternative assumptions about the presence of parameter uncertainty. The second (Hall, Salmon, Yates and Batini (1999)) analyses the effectiveness of different degrees of policy responsiveness (as in the first paper, under alternative assumptions about the presence of parameter uncertainty) on the assumption that policy is set according to a simple policy rule.⁽⁵⁾

(i) Policy rules with and without parameter uncertainty

The approach of the Martin and Salmon study mirrors that described in the previous section: a model is specified, objectives for policy-makers are hypothesised, and optimal rules are calculated. The model is solved under alternative assumptions about parameter uncertainty, and the optimal rules are compared.

The model is a VAR that relates developments in inflation, output, the exchange rate and the official interest rate to each other. It is estimated between 1980 Q2 and 1997 Q2.⁽⁶⁾ It is assumed that the primary objective of policy is to minimise expected squared deviations of RPIX inflation from target.(7)

See Stuart (1996) for a fuller description of the Taylor rule. Sargent's method is complex, but its essence is that model uncertainty can be introduced by assuming that the policy-maker does not know the properties of the shocks to the model. If these can take a variety of forms, then in effect the properties of the entire model are uncertain. As long as a limit is put on the possible types of behaviour that shocks can exhibit, it is possible to work out how a policy rule would perform in each shock 'world'. Sargent identifies the robust rule as the rule that results in the least-bad possible outcome. The particular assumption that Sargent makes is that the autocorrelation, or persistence, of additive disturbances to the model is uncertain. In this case, the main risk to policy is that shocks will affect inflation for longer than anticipated. It is possible, for a given baseline model and characterisation of uncertainty around it, that the robust rule smore conservative responses than a certainty-equivalent rule. Onatski and Stock (1999) found examples of this in their paper, though the robust rules they identified were mainly aggressive, relative to a certainty-equivalent rule.

⁽³⁾ (4)

Others have focused on parameter uncertainty in an attempt to understand the historical behaviour of official interest rates in the major industrialised countries. Charles Goodhart's 1998 Keynes lecture summarises this analysis, and shows how the optimal rules described here can be (5) ed in that context

Using estimated coefficients from the VAR to construct the optimal rule leads to potential criticism from the Lucas critique: the rule is optimal given the VAR coefficients, but if the rule were applied to the VAR model, then the VAR coefficients might change. See the forthcoming *Working Paper* for a detailed discussion of the policy objectives. (6)

⁽⁷⁾

The econometric estimates of the VAR can be used to compute optimal rules for nominal interest rates that relate interest rates to current and past outcomes of all of the model variables. The authors calculate two rules: one assuming that parameters are certain, and one allowing for parameter uncertainty. These rules are generalisations of (4) and (5). As Brainard showed, the coefficients in the optimal rule that allows for parameter uncertainty depend on the variances of the parameters in the VAR model. Brainard suggested that parameter uncertainty could arise either if the underlying model was uncertain, or if the 'true' model was deterministic but the policy-maker had to estimate it. Econometric estimation techniques such as ordinary least-squares (used here to estimate the VAR model) provide estimates not only of the parameters themselves, but also of the variances and covariances between the parameters. The authors follow the second interpretation of parameter uncertainty, and treat the econometric measures of parameter variance and covariance as measures of the policy-maker's uncertainty about parameters. The paper investigates the practical importance of the conservatism and gradualism effects upon the rule identified in the previous section.

Hypothetical paths for interest rates can be calculated for the sample period, on the assumption that policy was set according to each of the two rules, and that the economy was subject to the same set of shocks as historically occurred. These hypothetical paths suggest that the additive-uncertainty rule, calculated on the assumption that policy-makers act as if they know the true parameter values in the economy, would have resulted in more aggressive responses to shocks than the parameter-uncertainty rule, which assumes that policy-makers are uncertain about parameters. This can be seen from the table, which reports summary statistics on the volatility of interest rates implied by each rule. The maximum and minimum deviations and standard errors of interest rates from trend according to the additive-uncertainty rule are larger than those for the parameter-uncertainty rule.(1)

Deviations of interest rates from trend

Percentage	points

	Additive-uncertainty rule	Parameter-uncertainty rule
Mean	-0.10	-0.06
Standard error	0.98	0.60
Minimum	-2.85	-1.66
Maximum	2.46	1.91

Impulse response functions, which show the optimal path for interest rates in response to a hypothetical shock, provide evidence on both the immediate response to a shock, and how interest rates evolve in subsequent periods.

The chart shows the impulse responses of rates under the optimal rules to an (additive) shock to output identified from the VAR model. The initial response of the additive-uncertainty rule is around 1.5 times larger than the

Interest rate responses to an output shock



initial parameter-uncertainty response, which is consistent with conservatism affecting the latter. And the parameter-uncertainty response is more drawn-out thereafter, which is consistent with the effect of gradualism. More detailed analysis of the cumulative total response to the shock in the quarters after it occurs suggests that gradualism is important for the first two or three quarters only. Thereafter, the cumulative response implied by each rule is similar.⁽²⁾

Interpreted narrowly, these results suggest that a policy-maker who took account of uncertainty about parameters would choose to act differently from a policy-maker who did not. In particular, the initial response to developments would be less, but two or three quarters after the shock, the cumulative policy responses of the two policy-makers would be similar. But the results rely on many auxiliary assumptions-for example, it is assumed that the economy can be accurately represented by a rather simple VAR model—and so provide only indicative evidence.

(ii) Simple policy rules with and without parameter uncertainty

In a recent paper, Hall, Salmon, Yates and Batini (1999) analysed how additive and parameter uncertainty might affect policy, on the assumption that policy is set according to a simple rule. The paper makes use of an existing model, due to Haldane, McCallum and Salmon (1996), which was developed before the new monetary arrangements were put in place, and does not reflect current institutional structures. It therefore provides only indirect evidence for the United Kingdom.⁽³⁾ But it acts as a cross-check on the findings from the Martin and Salmon paper.

The paper addresses the following three questions.

First, does the optimal degree of feedback (the feedback in the simple rule that delivers the best

The *Working Paper* describes how each of the data in the VAR, including interest rates, are de-trended. The *Working Paper* analyses the impulse response functions to shocks to each variable in the VAR model. The results are broadly similar, though the other impulse responses are harder to interpret. See the forthcoming *Working Paper* for details of the modelling approach used.

⁽³⁾

stabilisation properties) fall when additive uncertainty is introduced into the model of the economy?

- Second, does this optimal degree of feedback fall when parameter uncertainty is introduced into the model?
- Finally, how does uncertainty about particular parameters in the model influence the optimal degree of feedback in the policy rule? In other words, is uncertainty about some specific relationship in the economy more important for the operation of monetary policy than uncertainty about others (in terms of optimal degree of reaction to news)?

The final question is interesting because discussions of the merits of a gradualist monetary policy have often been couched with reference to uncertainties about particular aspects of the economy.⁽¹⁾

The paper shows that the optimal degree of feedback to developments in the economy is largely unchanged by the size of additive shocks to the economy. This is not surprising, and accords with the certainty-equivalence result described earlier.

If parameter uncertainty is introduced, the picture changes. In this case, the optimal degree of feedback varies inversely with the extent of uncertainty: optimal policy is more conservative in an uncertain world.

To address the issue of uncertainty about specific parameters in the model, the paper analyses the effect of assuming that there is uncertainty either about the policy multipliers in the model or about the relationship between the output gap and inflation. It shows that uncertainty about the policy multipliers has a more significant impact upon policy-makers' optimal degree of reactiveness than uncertainty about the output gap.

In the estimated model underlying the analysis, the coefficients of variation on the policy multipliers in the

model are greater than those for the output gap parameters. As discussed earlier, a higher coefficient of variation, other things being equal, implies that the variance costs of policy reaction will increase relative to gains from attempted stabilisation, such that it will become optimal to respond less actively to policy shocks. Once again, the empirical results accord with the theoretical predictions.

Summary

This article has reviewed how economic theory suggests that monetary policy-makers should take account of different types of uncertainty. This is an area where economic theory lags behind practice. Policy-makers have always had to make allowances for all the uncertainties that they perceive.

Theoretical analysis has tended to consider only very specific and tightly defined forms of uncertainty. A key result—that policy-makers should act as if certain—is applicable only when policy-makers have considerable information about the structure and state of the economy. The second section of this article showed how this certainty-equivalence result breaks down once it is assumed that policy-makers are unsure about the relationship between variables in the economy or, in some circumstances, on account of measurement error, about the current state of the economy. Such uncertainties by themselves are likely to result in smaller policy responses to economic developments. The results from the studies summarised in the third section provide some evidence of this effect.

But these studies take account only of the effect of parameter uncertainty. In practice, policy-makers' uncertainty is likely to be deep-seated, not least because they are unsure about the basic structure of the 'true' economy. Neither these studies, nor other empirical work, provide a unified analysis of the effects of all forms of uncertainty upon policy. In short, a consensus view has yet to emerge from the academic literature as to how policy-makers should deal with uncertainty.

(1) For instance, there has been much recent debate in the United Kingdom and in the United States about both the level of the NAIRU and the output gap and their relation to inflation. Wieland (1998) shows how this can lead to parameter uncertainty.

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An effective exchange rate index for the euro area

By Roy Cromb of the Bank's Structural Economic Analysis Division.

Since 11 May, the Bank of England has published a daily effective exchange rate index for the euro area. The index is calculated using close-of-business rates in London, and is supplied to agencies such as Datastream, Reuters, Bloomberg and the Financial Times. It is compiled on the basis developed and used by the International Monetary Fund (IMF), as with the other effective exchange rate series published by the Bank.

This article describes the calculation of the index since the initial value of the euro was set on 31 December 1998, and also for the preceding period. The index is calculated by weighting together the individual exchange rates of the eleven euro-area countries against non euro area currencies; so it represents an effective index for the eleven countries as a group, rather than for the euro as a currency. The base year for the series is 1990, the same as the other effective exchange rate series published by the Bank and the IMF.

The article compares the Bank's euro-area index with recent movements of the euro against the US dollar, sterling, the Japanese yen and the Swiss franc; with the Bank for International Settlements (BIS) index provisionally used by the European Central Bank (ECB); and with the IMF's 'broad' euro-area index, which has a greater country coverage. It also notes how the introduction of the euro has affected the exchange rate indices for individual countries.

Country effective exchange rates

An 'effective exchange rate' for a country is a measure of the value of that country's currency against a basket of other currencies. It is calculated as a weighted average of exchange rates, expressed as an index relative to a base date. The weights are often based on trade flows, reflecting the relative importance of each of the other countries for the country's competitiveness.

The Bank currently publishes exchange rate indices for sterling and the currencies of 20 other countries, using the IMF's method and weights, derived from trade flows in manufactured goods from 1989–91.⁽¹⁾ The sterling index is published hourly during the London business day. The other indices are published daily, at close of business in the London market. The IMF itself does not publish daily effective rate indices.

Implications of the euro for the country indices

The introduction of the euro on 31 December 1998 has not affected these country exchange rate indices. The same

21 country rates are still published, including indices for all the euro-area countries, which are now best thought of as indicators of national competitiveness. There are no discontinuities in the indices-the underlying calculations are the same.⁽²⁾ The trade weights used for both 'in' and 'out' countries are unchanged, and the exchange rates for the 'legacy currencies' (such as DM or FFr) continue to be input for countries where the euro has been adopted.

From the beginning of 1999, these legacy currency exchange rates are calculated using the conversion rates irrevocably fixed on 31 December 1998. For example, the Deutsche Mark's value against the US dollar is calculated by multiplying the current euro rate against the US dollar by the Deutsche Mark/euro fixed conversion rate.⁽³⁾

The individual country indices for the euro-area countries will continue to provide useful and timely information for the assessment of national competitiveness. They differ from the index for the euro area as a whole for two reasons. First, the national indices tend to be more stable, because a large proportion of each country's trade will be with other

⁽¹⁾ The basic formula for the exchange rate index (ERI) of country *j* is: $ERI_j = \prod_{i=1}^{20} \left(\frac{curr_i}{curr_j} \right)$ where each bilateral exchange rate series is indexed

to 1990 = 100 (or equivalently, since the formulation uses geometric weights, the final index is indexed to 1990 = 100). See the note on the calculation of effective exchange rates on page 24 of the February 1995 *Quarterly Bulletin* for further details.
 As explained in the IMF's October 1998 *World Economic Outlook* (Box 5.5, 'The euro area and effective exchange rates').
 That is, DM/USS₁ = (euro/USS)₁ • (DM/euro)_{1 Dec} 9₈. Note that DM/USS = number of DM per USS, and similarly for other exchange rates. Market convention is to refer to this rate as US\$/DM.

euro-area countries at the fixed conversion rates (see below). This proportion will vary across countries. Second, the geographical composition of the trade weights differs for each euro-area country. For example, Ireland has a higher weight than the euro area as a whole for trade with the United Kingdom.

The euro-area index

The new euro-area effective rate index (EERI) is calculated in the same way as for an individual country, treating the euro-area countries as a bloc. Trade within the euro area is excluded, so the weights are based solely on trade with countries outside the euro area. The method and weights are those used by the IMF. The box on page 192 summarises the approach, which allows the index to be calculated for the period before the introduction of the euro.

The Bank's index is calculated on the same basis as the index published monthly by the IMF, but is based on close-of-business rates in London, and is available daily. Figures for the index are made available to data agencies such as Reuters, Bloomberg and Datastream. Monthly and quarterly figures will be published in the Bank's Monetary and Financial Statistics ('BankStats'), starting with the May 1999 edition. Longer runs of historical data are available on request from the Bank's statistics division.⁽¹⁾ The IMF figures are published in International Financial Statistics, together with other data for the euro area, and in the World Economic Outlook.⁽²⁾

The Bank's euro-area index has been calculated as far back as January 1975, the same starting-date as for the other country effective rates published by the Bank (the IMF's index is available back to 1957). Following standard IMF and Bank practice, the base year for the published index will be 1990, reflecting the use of weights based on manufacturing trade between 1989–91.⁽³⁾ But the choice of base period is arbitrary, and in this article the index has been rescaled where this makes it easier to compare with other series.

Chart 1 compares movements in the EERI with changes in the euro against other currencies since 4 January 1999. The euro has depreciated substantially against the US dollar, but the fall in the euro-area index has been less, close to the depreciation against sterling (which has the highest weight in the index—see Table A). The euro has been relatively strong against the Japanese yen and the Swiss franc. Taken together, sterling, the US dollar, the Japanese yen and the Swiss franc amount to 83% of the index weight.

Though the EERI will, as an average, be more stable than many of the individual bilateral euro exchange rates, it will tend to be more volatile than the individual country competitiveness indicators (eg for Germany). This is

Chart 1 The EERI and the euro against other currencies



Table A

Euro-area effective exchange rate weights^(a) Per cent

	Bank/IMF	BIS
Australia	0.4	0.9
Canada	2.0	1.9
Denmark	3.3	3.3
Greece	1.3	1.6
Japan	14.4	16.9
New Zealand	0.2	0.1
Norway	2.0	1.8
Sweden	7.8	6.6
Switzerland	12.6	10.6
United Kingdom	30.4	23.1
United States	25.6	23.0
Hong Kong SAR	0.0	1.8
Singapore	0.0	2.2
South Korea	0.0	3.2
Taiwan	0.0	2.9
Total	100.0	100.0
(a) The weights shown	are rounded.	

because a high proportion of country trade is with other members of the euro area at fixed nominal exchange rates, damping down movements in the country indices.

This relative volatility of the euro-area index was evident even before the introduction of the euro. As Chart 2 shows,

Chart 2 The EERI and the German competitiveness indicator



From John Henderson of the Bank's Monetary and Financial Statistics Division, on 0171 601 4342.

The IMF's index was first published in the April 1999 issue of International Financial Statistics. A preliminary series, based on a slightly different method, was published in the October 1998 World Economic Outlook. These weights are periodically reviewed and updated by the IMF. But unless the country coverage changes, new weights tend not to lead to major changes in the movements of an index, as trade patterns change quite slowly over time. (3)

Method for calculating the euro-area effective exchange rate index

The method and weighting scheme used to calculate the euro-area effective exchange rate index (EERI) is that developed and used by the IMF, as with the individual country exchange rate indices published by the Bank.⁽¹⁾

Weights

The country weights for the competitor countries to the euro area, for example the United States relative to the United Kingdom (see Table A on page 191), are based on the same figures as the country indices (trade in manufacturing in 1989–91), but with the euro area treated as a unit, ie excluding trade within the euro area.

The weights are based on the relative extent of competition from firms based in the United States, Japan, United Kingdom etc in the markets where euro-area firms are active. For example, the weight for Japan will be determined by the relative importance of Japanese firms:

- in the euro-area home market (for which import shares are used); and
- in the euro-area's export markets.

Japanese firms are likely to dominate the Japanese home market, but may also compete strongly with euro-area firms' exports in other markets such as the United States. The IMF method allows for this competition in 'third markets', rather than using simple export shares.⁽²⁾ For example, even if exports to Japan represent a low share of euro-area exports, the weight of the Japanese yen will be boosted if Japanese firms compete strongly with euro-area firms in key markets such as the United States.

From 31 December 1998

For the period since the external value of the euro was set on 31 December 1998, the EERI is calculated by averaging quotes for the euro against the US dollar, sterling, the Japanese yen etc, weighted by the relative importance of these countries for euro-area external trade, as discussed above.

The index is a geometric weighted average, ie:

$$EERI = \frac{UK, Jap, US, \dots}{\prod_{i}} \left(\frac{curr_i}{euro}\right)^{Wi}$$
(i)

or equivalently,⁽³⁾ using US dollar quotes:

$$EERI = \frac{\$}{euro} \frac{UK, Japan, \dots}{\prod_{i}} \left(\frac{curr_{i}}{\$}\right)^{w_{i}}$$
(ii)

Before 31 December 1998

It is possible to calculate an EERI for the period prior to the euro, by averaging the bilateral exchange rates of the eleven euro-area countries. The relative weights for the US dollar, sterling etc are the same as for the period since 31 December 1998. In addition, weights are required to reflect the relative importance of each euro-area country's exchange rates (such as the relative importance of the Deutsche Mark/US dollar compared with the French franc/US dollar). These 'internal weights' are based on the country shares of trade outside the euro area, as shown in the table below.

Internal weights^(a) used in the EERI

Per cent		
Germany	33.2	
France	19.7	
taly	14.8	
Belgium/Luxembourg	9.2	
Netherlands	8.2	
Spain	6.7	
Austria	4.4	
Finland	1.5	
Portugal	1.3	
reland	1.1	
fotal	100.0	
\ 771 11. 1		

(a) The weights shown are rounded.

The IMF method uses these internal weights to construct a geometrically weighted basket of the 'in' countries' exchange rates against the US dollar, giving a 'synthetic' value for the euro.⁽⁴⁾ This is then used in place of the actual euro exchange rates (using formula (ii) above). This synthetic US dollar/euro rate is shown in the chart below. The synthetic index is similar to that published by the Financial Times; the main difference is that the Financial Times series was GDP-weighted, using arithmetic weights (Datastream also publishes a similar index).

As the chart shows, the overall effective exchange rate moves closely with the synthetic US dollar/euro rate, except for the mid 1980s, when the US dollar was particularly strong.





Details are given in the IMF's *Survey* publication, Vol 28, No 8, April 1999
 See Zanello and Desruelle, *IMF Working Paper* 97/71, May 1997.

(3) Since w_i sum to 1. This can be derived as follows: $EERI = \prod_{i}^{UK, Japan,...} \left(\frac{curr_i}{\$} \bullet \frac{\$}{euro}\right)^{w_i} = \prod_{i}^{UK, Japan,...} \left(\frac{\$}{euro}\right)^{w_i} \left(\frac{curr_i}{\$}\right)^{w_i}$

(4) An equivalent method is to calculate effective exchange rates for each euro-area country, based only on trade outside the euro area, and then to weight these by their importance to total trade outside the euro area. since January 1997, the EERI has been more volatile than the German index, reflecting the high weight in the German index of the other euro-area countries, whose currencies were relatively stable against the Deutsche Mark before the rates were fixed on 31 December 1998.

Other euro-area effective exchange rate indices

Other organisations have also developed methods of calculating effective exchange rate indices for the euro area. The main differences relate to the countries included and the weights used, though the basic philosophy is very similar. The ECB currently publishes an index, calculated by the BIS, in its *Monthly Bulletin*. The ECB plans to publish its own index shortly. The European Commission also publishes an index.⁽¹⁾

Table A compares the Bank/IMF weights with those of the BIS, which uses a slightly wider coverage. Both the IMF and BIS weights are calculated from trade flows of manufactured goods, allowing not only for bilateral trade but also for third-country effects (see the box on page 192).⁽²⁾ In both indices, the largest weight is for the United Kingdom.

As the underlying method and coverage used by the BIS are similar to those of the Bank/IMF, the two indices move closely together, as Chart 3 shows.

Chart 3 Bank of England and BIS effective exchange rate indices for the euro area



Complementary indices

Real indices

The indices published by the Bank are nominal, ie they are simple weighted averages of actual bilateral exchange rates. Such averages can in themselves be useful, for example when thinking about the overall impact of an interest rate change on a currency. But for analysing competitiveness, real indices are more appropriate. These adjust for differential movements in price or cost inflation. They give an average measure of a country's prices or costs relative to those of other countries, expressed in a common currency.⁽³⁾

Real exchange rate measures can change even when the nominal exchange rate is fixed. If country A's costs or prices rise more quickly than country B's, with the nominal exchange rate unchanged, country A's real exchange rate against country B would appreciate.

Broad indices

The Bank's EERI is 'narrow', covering a core of countries that account for around 55% of trade with countries outside the euro area. For a comprehensive measure of competitiveness, the exchange rate index should include as many countries as possible, given data availability. This suggests that the ideal exchange rate measure should be a broad real index.

But there are a number of reasons why it is useful to consider a number of exchange rate indicators, rather than focusing on only one. Table B summarises some of these reasons, which are discussed below in the context of the euro area.

Table B

Advantages (+) and disadvantages (-) of different effective exchange rate indices

Broad	Nominal + Coverage – Inflation leads to strong trends + Can be available daily	Real + Coverage + Adjusts for inflation - Measurement problems - Not timely
Narrow	 Coverage Narrow countries cover most trade Even modest inflation can matter Exchange rate movements more volatile than inflation Available hourly Useful average of market rates for assessing monetary policy 	 Not available daily Coverage Adjusts for inflation Narrow countries cover most trade Similar to broad real in practice Not available daily

Real and broad euro-area indices

The IMF produces a real effective exchange rate for the euro area, consistent with its nominal index and constructed using unit labour costs in manufacturing. It also produces a broad real index with a wider country coverage (the ECB intends to do so as well).⁽⁴⁾ The IMF's broad real index includes a further twelve countries and uses consumer prices, as unit labour costs in manufacturing are not easily available for all these countries. The weights include trade in tourism as well as in manufacturing.

The European Commission's index is available from the EC web site at europa.eu.int/comm/off/rep/pccr.
 The BIS index is based on manufacturing trade in 1990, and includes third-country effects on exports, but uses a slightly different method to estimate the size of markets.

(3) For country *j*: $real ERI_j = \prod_{i=1}^{20} \left[\frac{curr_i / P_i}{curr_j / P_j} \right]^{W_i} = \prod_{i=1}^{20} \left[\frac{P_j}{P_i} \times \frac{curr_i}{curr_j} \right]^{W_i}$ where *P* is a price (or cost) index, based on 1990 = 100.

(4) The Bank does not publish a broad index for the euro area (all the Bank's published effective rates are on the narrow basis and in nominal terms, though broad and real indices are routinely monitored). See Chart 1.18 in the February 1999 Inflation Report for the broad sterling index.

As part of the calculation of the broad real index, the IMF computes a broad nominal series, shown in Chart 4a with its real equivalent. The chart illustrates the strong trend in the broad nominal index over the period since 1980, reflecting very high inflation rates in some of the countries.

Chart 4a





By contrast, the standard (ie 'narrow') nominal IMF index moves closely in line with its real equivalent (as shown in Chart 4b). This reflects the relative variability of exchange rates and inflation rates for the countries included in the index (for individual countries, though the short-term movements are close, the longer-term trends diverge; for example, over the past few decades, the nominal index for Italy has trended down relative to the real index).

Chart 4b



Narrow nominal and real effective IMF exchange rates for the euro area

Analysing nominal indices can help to explain the recent economic conjuncture, before the price and cost data needed to compute the real indices are available. For some countries, reliable up-to-date price or cost indices are not easily available. But care needs to be taken to allow explicitly for likely differences in inflation. This applies particularly to broader indices.

For the euro area, the narrow nominal measure has been a reasonably good proxy for changes in the narrow real rate. It also has the advantage of being available almost instantly, whereas cost and price indicators are only available monthly. And, arguably, the nominal index has a more straightforward interpretation—real rate movements can reflect price or cost movements that may not be well measured (eg because of index number biases).

The narrow real index has the advantage of tracking the broad real index reasonably closely (see Chart 5). This reflects the overlap between the indices when the countries are weighted for their importance to trade. The narrow-index countries represent nearly 80% of the broad index, with none of the additional countries having a weight of more than 3% (South Korea, People's Republic of China, Brazil, Taiwan and Hong Kong SAR have weights of more than 2%).





But a wider coverage does give a more comprehensive picture of relative competitiveness. This is particularly useful when there are large changes in the real exchange rate with particular countries that are not included in the narrow indices. With the large depreciations of East Asian currencies in 1997, indices with a wider coverage have been very useful (one of the largest divergences between the narrow and broad real indices has been over this period, as Chart 5 shows).

1980

83

Note: ULC = unit labour costs

86

89

92

95

98

The financing of small firms in the United Kingdom

By Melanie Lund and Jane Wright of the Bank's Domestic Finance Division.

Economists have often argued that imperfections in the financing of small firms arise because of information asymmetries: the small business owner generally has much better information than the bank on his firm's performance. This is fundamentally different from the situation with large companies. This article examines the developments over the past decade in the financing of small businesses in the United Kingdom. It notes the sector's reduced dependence on external funds and increased use of a range of financing products. The article also assesses the current risks faced by the small firms sector and its providers of finance, suggesting that this sector is now more resilient to a downturn in the economy than in the early 1990s, thus reducing the likelihood of a recurrence of the high levels of business failures experienced in that recession.⁽¹⁾

Introduction

The small firms sector makes a significant contribution to the UK economy. In 1997, firms with 49 or fewer employees accounted for around 40% of total turnover in the United Kingdom and 45% of total employment.⁽²⁾

The sector offers banks profitable opportunities, though not without risk. In the recession of the early 1990s, for example, the banking sector suffered large losses from its loans to the small business sector. The major clearing banks had to make provisions of around £3 billion against this part of their loan book. The problems experienced by the banks were intensified by the collapse of the residential property market, against which a high proportion of their lending was secured. Though these losses did not amount to a threat to the financial system as a whole, they did represent a reputational risk to the banks and reduced their profitability. Moreover, these problems served to highlight the fact that many firms in this sector had been inappropriately financed in the past.

More recent trends in small firms financing suggest that there has been a steady improvement in how finance providers service the market. However, against a background of sustained economic growth, it is difficult to distinguish improvements resulting from structural changes in the financing of these firms from those resulting from better trading conditions. The recent slowdown in the growth of economic activity will test the robustness of the improvements.

This article looks at the economic theory on the provision of finance to the small firms sector, underlining the problems of risk assessment of these firms by banks, the main providers. It then reviews how the patterns of small

firms financing have changed over the past decade, making it less likely that the high levels of business failures in the previous recession will recur. It also focuses on competition in this market as a means of facilitating improvements. One area where improvement in the provision of finance is less evident is in the supply of risk capital for technology-based small firms.

The economics of small firms financing

Economists have often argued that market imperfections in the financing of small firms arise mainly because of information asymmetries-the owner of a small business generally has much better information than the bank on his firm's performance,⁽³⁾ and has more control of the outcome. This is fundamentally different from a large company, whose shares are publicly traded and whose performance is regularly assessed by market analysts. According to economic theory, information asymmetries may lead to: (i) adverse selection, where banks, lacking information to identify firms with the highest expected returns relative to the degree of risk, find it difficult to use the price mechanism to distinguish between firms; and (ii) moral hazard, where (in the absence of collateral) use of higher interest rates by banks to offset risk would give firms receiving bank finance an incentive to alter their behaviour to adopt more risky projects. Banks may require collateral in response to these potential problems. However, this may then exclude entrepreneurs with viable business plans but who lack collateral, in particular technology-based firms.

It has frequently been argued in the economics literature that such problems can lead to credit-rationing for small and medium-sized enterprises (SMEs)-that is, finance is not made available to all firms with viable projects whose net present value is positive. The central hypothesis is that the

See also the Governor's speech, 'Developments in small business finance', on pages 207–9.
 DTI figures covering all private sector businesses; employment is measured as the number of employees plus the number of self-employed persons. Turnover refers to the value (excluding VAT) of sales, work done and services rendered.
 See Williamson, O E (1975), Markets and Hierarchies: Analysis and Anti-trust Implications, Free Press, New York.

market is not cleared through price adjustments, because of the asymmetry of information between banks and SMEs. So banks have an incentive to respond to an increased demand for loans by rationing credit further rather than by raising interest rates.(1)

The empirical evidence⁽²⁾ provides little conclusive support for the existence of such market imperfections in the financing of SMEs in the United Kingdom in general. It must be noted, however, that this conclusion is based on an analysis of surviving firms; it has not been easy to determine whether shortcomings in the provision of finance have contributed to business closures, or at least takeovers or other major restructurings. So it is difficult to assess properly the existence of credit-rationing. What evidence there is suggests that the most finance-constrained businesses are relatively small and young, located in the manufacturing sector, and of below-average profitability. But these same characteristics would make financing such firms relatively risky, and it is unclear whether the terms attached to such lending are unreasonable in relation to the extra risk.

Changes in small firms finance

To compare the current risks to banks from their small business portfolio with those faced in the previous recession, it is necessary to assess the main changes in small firms financing patterns since the early 1990s. One change has been that, with the subsequent recovery, small firms, in aggregate, have become markedly less dependent on external finance. Recently published research has shown that only 39% of small businesses sought external financing of any kind between 1995–97,⁽³⁾ compared with 65% between 1987–90.(4)

Within external financing, the proportion accounted for by traditional bank borrowing has declined. This partly reflects shifts towards factoring and asset-based finance,⁽⁵⁾ of which a large proportion is provided by finance subsidiaries of the main clearing banks (see Charts 1 and 2). It also reflects a more cautious approach by small businesses, which has resulted in an absolute decline in the net indebtedness of the sector. Total small business deposits at banks amounted to 86% of total borrowing from banks by small businesses(6) in December 1998, compared with 56% at the end of 1992.

The general trend in levels of indebtedness of small, privately held firms⁽⁷⁾ has recently been investigated by the Manchester Business School (see Chart 3).⁽⁸⁾ Their research showed that the strong inverse relationship between capital-gearing levels⁽⁹⁾ and GDP growth from 1988-93 has since been much less clear-cut. Average gearing levels of

Chart 1 Sources of external finance for SMEs, 1987–90



Source: Small Business Research Centre (1992), University of Cambridge, The State of British Enterprise

Chart 2 Sources of external finance for SMEs, 1995–97



Source: ESRC Centre for Business Research, Cambridge, Enterprise Britain 1994-97.

small, privately owned firms continued to fall between 1994–96, despite some moderation in GDP growth. It was suggested that this might reflect the impact of the previous recession on borrowing and/or lending behaviour. However, other research has indicated that the borrowing behaviour of the 1980s was atypical for small firms (traditionally net creditors of the banking industry). On this basis, present behaviour indicates a return to the norm. Both of these possible explanations suggest that the current economic slowdown might not result in an increase in the indebtedness of the small firms sector on the scale of that experienced in the recession of the early 1990s. Reflecting these trends, the stock of total bank lending to the small firms sector has declined, from £39.5 billion at end 1992 to £36 billion by end 1998.

⁽¹⁾

The hypothesis, in the context of SME financing, is associated with Stiglitz, J E and Weiss, A (1981), 'Credit rationing in markets with imperfect information', *American Economic Review*. Aston Business School (1991), *Constraints on the Growth of Small Firms*, Department of Trade and Industry, HMSO, London; Cosh, A and Hughes, A (1994), 'Size, financial structure and profitability: UK companies in the 1980s', in Hughes, A and Storey, D J (ed), *Finance and the Small Firm*, Routledge, London. ESRC Centre for Business Research (1998), Cambridge, *Enterprise Britain 1994–97*. Small Business Research Centre (1992), University of Cambridge, *The State of British Enterprise*. ESRC Centre for Business Research (1998), Cambridge, *Enterprise Britain 1994–97*. British Bankers' Association figures, based on businesses with a debit turnover of less than £1 million. A panel database of 3,500 firms with fewer than 200 employees. Poutziouris, Chittenden and Michaelas (1998), Manchester Business School, *The Financial Affairs of Private Companies*. (2)

⁽⁸⁾ (9) Gearing is defined as the ratio of total debt to total assets

Chart 3 Gearing ratios of private companies over the economic cycle



The structure of bank lending has also shifted, away from short-term variable-rate lending and towards more term (and to some extent fixed-rate) finance (see Chart 4). The ratio of overdraft to term lending has fallen significantly, from 49:51 in 1992 to 31:69 in 1998, and fixed-rate lending has risen from 28% to 33% of term lending since 1996. This has addressed one of the problems highlighted by the early 1990s recession-small firms' over-reliance on the overdraft facility to finance anything from working capital to long-term investment projects-and has reduced the vulnerability of small firms to the economic cycle.

Chart 4





This changing structure of small business finance has also altered the profile of banks' exposure. Banks now have more committed funds than in the previous recession (term loans have risen from £20.1 billion to £24.8 billion since 1996). Most (63%) of these committed funds have residual maturities of more than five years, and more than one third

(36%) have residual maturities of more than ten years. So banks are more locked into the provision of finance to the small firms sector throughout the economic cycle, though they have built terms and conditions into term loans to protect their exposure.

The risk of business failure

The main concern of the clearing banks in providing finance to the small firms sector is that businesses will fail and default on outstanding commitments. Given that approximately 35%-40% of banks' income is from fees and charges, a reduction in the number of small businesses adversely affects the banks' profitability even if the closures do not result in bad debts.

Evidence has shown that small business closures occur throughout the economic cycle, with slightly fewer than half of small businesses closing in their first three years, irrespective of the economic conditions. In most cases, small businesses will close without banks and other finance providers incurring any loss owing to the non-repayment of a loan or overdraft.⁽¹⁾ The number of failures that do result in losses to creditors fluctuates, and the trend in bankruptcies⁽²⁾ and company liquidations is clearly linked to the state of the economic cycle (see Chart 5).(3)



It is important to consider the absolute number of business failures against the business stock. DTI figures reported that there were 3.7 million enterprises in the United Kingdom in 1997, compared with 2.4 million in 1980. The impact of the increase in the number of businesses can be removed by considering the percentage change in business failures.⁽⁴⁾ The data show that the year-on-year percentage change in business failures has been fairly constant over the previous three recessions.

It has been shown that business closure was twelve times more likely than 'entrepreneurial bankruptcy'. See Storey, D J, *Firm Size and Performance* in Acs and Audretsch (ed) *The Economics of Small Firms: A European Challenge*, Kluwer Academic Publishers.
 Bankruptcies of partnerships, associates and sole traders.
 Storey, D J (1994), *Understanding the Small Business Sector*. The results were sensitive to the definitions of business failure used.
 Chrystal, K A and Lipsey, R G (1997), 'Economics for business and management', *Oxford University Press*, page 19.

It is likely that the number of small business closures will increase if the economy slows, but probably by less than in the early 1990s, for a number of reasons:

- Business start-ups rose rapidly in the 1980s, as a result of a combination of government schemes(1) and deregulation of credit controls. These policy changes encouraged the formation of a large number of businesses, many of which were not economically viable and had a high probability of failure. In addition, the credit boom encouraged many small businesses that were traditionally net lenders to the banking sector to take on debt finance. This further increased the banks' exposure to small firms. As trading conditions deteriorated and collateral values slumped, the banks started to call in uncommitted funds, which in turn increased the number of failures.
- As noted above, small businesses are now more appropriately financed than in the 1980s, using a wider range of financing sources. They are no longer so dependent on overdraft financing, and rely more on committed funds, with fixed repayment streams.
- Individual small business banking codes of practice and the Statement of Principles: Banks and Businesses Working Together⁽²⁾ have led to a more open, two-way relationship between banks and small businesses. This has benefited small businessesresearch by the Forum of Private Business shows that SMEs that had developed a more participative relationship with banks were obtaining lower charges and collateral requirements. Banks now have better warning systems in place to detect at an early stage whether businesses are encountering trading difficulties. Small firms are more prepared to share information with their banks. Better relations and a greater degree of co-operation should help to avoid some of the strains of the previous recession, which contributed to increased business failures and seriously affected the reputation of the banks.
- Small firms are now assisted by a wider network of training and support agencies, such as Business Links, TECs and Chambers of Commerce.

Competition in the provision of finance to small firms

The Bank's latest annual report on finance for small firms⁽³⁾ refers to research by the Federation of Small Businesses, which reported that some 34% of small firms considered changing their bank in 1998, although only 4% actually switched (15% in the past five years). This raises the issue

of the degree of competition in the provision of finance for small firms.(4)

The providers of bank finance to small businesses operate in a concentrated industry. The four main English clearing banks account for 84% of the market, with NatWest and Barclays together accounting for 48% of the total (see Chart 6). However, though the overall market share of the Big Four has remained fairly stable, the market shares of the individual clearing banks have changed significantly over the 1990s: NatWest and Barclays have lost market share to Lloyds-TSB and, to a lesser extent, Midland (see Chart 7). This trend is even clearer in market shares of lending to finance start-ups. The Bank's work suggests that the English clearing banks may face more competition in the future from the smaller banks, finance houses and building societies aiming to capitalise on their extensive branch networks. New lenders, together with developments

Chart 6 **Bank market shares, January 1999**



Source: Taylor Nelson Business Line

Chart 7

Bank market shares, 1992–99



(1)The Enterprise Allowance Scheme encouraged unemployed people to become self-employed, and small firms' corporation tax was reduced from

Statement of Principles: Banks and Busnesses Working Together (March 1997) was developed by the British Bankers' Association and has be adopted by all the major banks. Finance for Small Firms: Sixth Report, Bank of England, January 1999. Don Cruickshank is conducting a review of the banking industry for the Treasury. This review will focus on four areas where the review team considered that there was prima facie evidence of lack of competition: money transmission, credit cards, joint supply and credit for SMEs. The review team is due to report to the Treasury in November 1999. A progress report was released in April, announcing that the review would be widened to include the development of e-money.

^{42%} to 25%. Statement of Principles: Banks and Businesses Working Together (March 1997) was developed by the British Bankers' Association and has been (2)

in risk-modelling, should lead to more competitive pricing of financial products. This should be facilitated by the development of new delivery and information channels, such as the Internet and computer banking. The Post Office is also well placed to extend a range of banking services to SMEs, given its large number of branches nationally, more than half of which are in rural areas.

Equity finance for small firms

Information on the use of equity finance by small businesses is limited. However, survey data suggest that venture capital finance accounted for only 3% of all SMEs' external finance in 1995-97, and was used as an additional source of finance by only 5.2% of respondents.⁽¹⁾ These proportions have remained fairly stable over the past ten years. This indicates that external equity finance plays only a small role in the financing of small business activity.

This could, of course, reflect demand as well as supply factors. Some recent research⁽²⁾ suggests that UK entrepreneurs establish their own businesses partly because of a desire for independence. This contrasts with a more overt wealth-creation motive in the United States, and the desire for expansion in Europe. Consequently, it is suggested that UK entrepreneurs are more reluctant than their US and continental European counterparts to give up a proportion of ownership in return for equity finance. This attitude was highlighted in a survey carried out by the British Chambers of Commerce,⁽³⁾ which reported that only one third of UK businesses were prepared even to consider using external equity finance. Research by Manchester Business School on private companies showed that the

Chart 8 Would you consider using external equity?



Source: The Financial Affairs of Private Companies, Manchester Business School

desire to maintain ownership is particularly evident among family-owned businesses (see Chart 8).⁽⁴⁾

These figures provide some support to the 'pecking-order hypothesis' of finance (see Cosh and Hughes (1994)). According to this, equity finance tends only be sought when internal resources and debt finance have been exhausted (perhaps leading to over-gearing). At this point, businesses will decide whether they would rather remain at their current size and maintain complete ownership, or give up a degree of ownership in return for further growth.

Financing of technology-based small firms

On the supply side, it is important to establish whether companies have access to appropriate amounts of equity, ie whether there is an 'equity gap'. The existence or otherwise of such a gap has preoccupied official enquiries⁽⁵⁾ since the Macmillan Report in the 1930s. The possibility of an equity gap is attributed to the fact that the costs of assessing and monitoring investment projects tend, to some extent, to be invariant to the size of the project, leading many venture capitalists to prefer to invest in a smaller number of larger projects.

A key issue in SME finance is whether an equity gap exists in relation to the financing of technology-based small firms.⁽⁶⁾ To establish this, it is necessary to consider the range and amount of finance available in the market. There are two main types of equity finance, private and public equity.

The key type of private equity finance available for technology-based firms at the start-up and early stages is venture capital finance, which can be split into informal and formal venture capital. Some smaller firms are not adequately prepared for venture capital investment, and so potential investors are required to dedicate significant resources to undertake due diligence. This increases the costs of investing in smaller companies, making them less attractive. To reduce this barrier, it has been suggested that 'venture catalysts', ie advisers who assist smaller companies in their preparations for obtaining venture capital investment, could play an important role.(7)

The informal venture capital market consists of 'business angels', private individuals who invest risk capital in smaller unquoted companies. This market is largely invisible. Activity taking place through business angel networks can be monitored (see Chart 9), but this undoubtedly accounts for only a small proportion of the overall activity. Business angels help to fill the gap between debt finance and formal venture capital

⁽³⁾ (4)

ESRC Centre for Business Research (1998), Cambridge, Enterprise Britain 1994–97. Grant Thornton International (1996), Business Strategies Ltd, European Business Survey. British Chambers of Commerce Survey No 24 (1997): Finance, July. However, it must be borne in mind that the many firms that do not have growth aspirations and so respond negatively to raising equity are not likely candidates for such funding. (5)

⁽⁶⁾

candidates for such funding. Bolton, J E (1971), Report of the Committee of Inquiry on Small Firms, Cmnd 4811, HMSO, London; Wilson Committee (1979), The Financing of Small Firms, Interim Report of the Committee to Review the Functioning of the Financial Institutions, Cmnd 7503, HMSO, London. There is no single definition of a 'technology-based firm'. John Allen suggests in Starting a Technology Business, (1992), Pitman Professional Publishing, that a technology-based firm' is a business whose products or services depend to a significant extent on the application of scientific or technological skills or knowledge (whether it be a novel application of advanced technology to provide a totally new product or service, or an oreliant of a viction technology. ication of existing technology in an innovative man

Colin Mason, Department of Geography, University of Southampton. (7)




investments, and are more likely to invest in early-stage or start-up businesses, which together accounted for 50% of total business angel investment in 1998. This investment is provided in smaller tranches—typically between £10,000 and £50,000—than is economic for venture capital funds, and so plays an important role in reducing the impact of any equity gap.

Though technology-based firms receive the highest proportion of investments, business angels still appear to play a considerably less prominent role in the financing of technology-based firms in the United Kingdom than in the United States. The main barrier to business angel investment, which applies to all firms, is the lack of information on investment opportunities. Business angels operate most effectively through local networks (so geographical considerations are important), and adopt a hands-on approach to their investment, offering the benefit of their expertise as well as their financial commitment. However, some locally based business angel networks cannot achieve sufficient critical mass to become viable. Commentators have therefore suggested that further co-operation and coordination between the business angel networks in the United Kingdom could result in an increasing flow of informal venture capital to SMEs. With this objective in mind, a new National Business Angel Network was launched in February 1999.

Formal venture capital is often inaccessible to small high-technology businesses. Early-stage investments accounted for 20% of all companies financed by venture capitalists in 1997, but represented only 5% of the total amount of finance, compared with 65% of venture capital (or private equity) finance going to management buy-outs (MBOs) and management buy-ins (MBIs) and 30% to development capital (financing expansion/growth rather than start-up). These figures suggest that venture capitalists and, in particular, the institutional investors on whose behalf they act, have only very limited interest in small investments in start-up and early-stage companies. This is partly because investment management, including appraisal and monitoring, is likely to be more expensive, for a given rate of return, than for larger-scale investments. The buoyant UK MBO/MBI market of the past few years has ensured that the institutions can gain high returns on relatively straightforward investments, permitting early exit routes if required. This has further reduced the attractiveness of investing small amounts in high-risk early-stage projects, especially if exit routes are not available for many years. This is a particular issue for technology-based firms, because they tend to be more dependent on equity capital than more traditional businesses with readier access to bank finance.





These are important areas of concern, and suggest a need for further research to quantify any market failure in the financing of technology-based SMEs. The Bank will be taking two initiatives this year to improve knowledge of the issues. First, as recommended in the Williams Report,⁽¹⁾ the Bank hosted a forum in April, designed to bring together institutional investors, venture capitalists and representatives of the high-technology company sector, to investigate the barriers to investment in this sector. Second, the Bank will be working on a follow-up to its October 1996 report The Financing of Technology-Based Small Firms, which will take a quantitative approach to an evaluation of the risk-reward relationship involved in investing in high-technology firms in the United Kingdom. It is hoped that this research will shed more light on the existence or otherwise of market failures in this crucial area of financing.

Although the capital markets are not a realistic option for small technology-based firms in their early stages of development, the presence of a liquid, easily accessible

⁽¹⁾ Financing of High Technology Businesses: A Report to the Paymaster General (November 1998)

public market is an important factor in the development of a healthy private equity industry. Venture capitalists would be reluctant to commit funds to a project if they were unable to see the exit route—this could, of course, be a trade sale, but an active public market in smaller companies ensures that the private stakeholders can support the company until it reaches a size suitable for a public listing, and then realise their investment. At this stage, the venture capitalist is free to reinvest in more early-stage firms. It has therefore been suggested that the lack of a large, liquid pan-European market, focused on the needs of smaller companies, is a barrier to the development of early-stage risk capital in Europe. This has been less so in the United States, where Nasdaq presents an obvious exit route, and this may be reflected in the more active US venture capital industry.

In practice, smaller quoted companies (SOCs) should not face difficulties in attracting finance, since the evidence suggests that, in the long run, such companies have outperformed the market in both the United Kingdom and United States, when measured by returns on equity. Between 1965–90, for example, the Hoare Govett Small Companies Index outperformed the FT-SE All-Share Index by an average of nearly 4% per annum. However, more recently, SQCs have underperformed the market. Since early 1996, for example, the FT-SE SmallCap Index has fallen by nearly 30% relative to the FT-SE All-Share Index. There appears to be a significant inverse statistical relationship between movements in GDP and the performance of small companies relative to large companies: in the past, smaller firms have tended to underperform in economic slowdowns. Furthermore, the composition of the FT-SE SmallCap Index is heavily weighted toward sectors that are more affected by the current world economic slowdown and the recent strength of sterling ('general industrials' make up 22% of the FT-SE SmallCap Index, but only 5% of the FT-SE 100). Finally, an increase in the risk premium attached to SQCs may reflect investor preferences for well researched companies at times of uncertainty, because of a greater concern that investments in less well researched companies may lead to losses.

If the disappointing recent performance of smaller quoted companies reflects purely cyclical factors, it might be expected that when economic growth returns to trend, investor interest will revive. But if the decline in performance partly reflects structural factors, such as the consolidation of the fund management industry, the prominence of tracker funds, and the cross-border sectoral (rather than country-specific) approach to investments, this may well continue.⁽¹⁾

Conclusions

This article has looked at the economic theory on the provision of finance in the small firms sector, indicating how market failures in the financing of small firms could arise from information asymmetries, leading to problems of adverse selection and moral hazard. Empirical evidence provides little conclusive support for the existence of such imperfections, but the theory highlights banks' problems in undertaking risk assessment of these firms.

The article examined how the patterns of small firms financing have changed over the past decade, making it less likely that the high levels of business failures and bank losses experienced in the previous recession will recur. It was noted that small businesses are now more appropriately financed than in the early 1990s. They are more dependent on internal sources of finance—with many of the smallest businesses being net creditors to the banking sector—and businesses that do require external finance now use a wider range of finance products. Traditional bank finance does, however, remain the most important source of external finance for small businesses.

Market competition in the provision of finance to small firms was identified as a means of facilitating and maintaining the momentum for improvement. The providers of bank finance to small businesses operate in a concentrated industry, but the degree of competition in this market is increasing, because of technological changes and new entrants.

One area where improvement in the provision of finance is less evident is in the supply of risk capital for technology-based small firms. Problems appear to arise at the start-up stage, where supplies of 'seedcorn' and early-stage equity finance are limited. Many formal venture capital firms tend not to invest in small enough amounts for these companies, and the informal venture capital market (business angels) is still underdeveloped compared with that in the United States.

 A range of reports have been published on the issue of investment in smaller quoted companies: see Smaller Quoted Companies: A Report to the Paymaster General (November 1998).

Structural changes in exchange-traded markets

By Claire Williamson of the Bank's Market Infrastructure Division.

This article outlines the main recent structural changes in exchange-traded markets—mergers between equity and derivatives exchanges, new international links between exchanges, and changes in exchanges' ownership structure. It analyses the factors that have prompted these developments, and reviews the implications that the changes may have for market-users, other types of infrastructure and the authorities.

Introduction

The structure of exchange-traded markets continues to change. Three distinctive-and linked-trends are: mergers between equity and derivative exchanges within countries, new types of links between exchanges in different countries, and demutualisation. Links between exchanges are not new, and exchanges have been undertaking cross-listing links for a number of years. For example, the Chicago Mercantile Exchange (CME) and the Singapore International Financial Futures Exchange (SIMEX) have linked to cross-list the CME's eurodollar contract since 1984.⁽¹⁾ What makes the current trends particularly significant is the nature of the economic forces driving change, particularly those arising from technological development, and the implications for market-users, other types of infrastructure and the authorities. The Bank's interest in this arises from its purpose of maintaining the stability of the financial system, and the effectiveness of UK financial services.

The current changes in market structure are comparable in scope to the changes that have happened to regional equity markets within countries. These regional markets gradually consolidated as communications improved, leaving most business being done in one national exchange in most countries. For example, the UK regional stock exchanges consolidated as long ago as 1973. This article describes three of the more recent trends in market structure and analyses the key factors driving these changes. It focuses on supply-side factors, though demand-side factors, such as changes in the demand for instruments resulting from EMU, are clearly also important.

Structural changes

One clear trend is mergers between equity and derivatives markets within countries. Such mergers happened in Switzerland in 1993, in Germany in 1994, in the Netherlands, Finland, France and Austria in 1997, and in Sweden in 1998. In Denmark, the Copenhagen Stock Exchange (which also offered derivatives trading) merged with the derivatives clearing-house (the FUTOB clearing centre) in 1997. In addition, merger plans have been announced between the Singapore Stock Exchange and SIMEX, between the Hong Kong Stock Exchange and the Hong Kong Futures Exchange, and between the Australian Stock Exchange and the Sydney Futures Exchange. Other stock exchanges, such as the US Philadelphia and Pacific exchanges, have for many years been including options trading in their business.

In parallel, there are new types of links between exchanges that list similar products. For example, Sweden's OM Stockholm/OMLX⁽²⁾ and Norway's Oslo Stock Exchange developed a shared trading-platform for equity derivative products in February 1997;⁽³⁾ and in September 1998, the German DTB and Swiss SOFFEX formed the EUREX common trading-platform for derivatives. The Stockholm and Copenhagen stock exchanges aim to achieve a joint trading-system for equities ('SAX 2000') from May 1999. The CME and the French derivatives exchanges, MATIF/MONEP, have a GLOBEX alliance, which allows members of each exchange access to products on these exchanges from NSC trading terminals. In February 1999, the Singaporean SIMEX signed an agreement to join this alliance.

Other exchanges, such as the Brussels, Luxembourg and Amsterdam stock exchanges, have cross-membership agreements, under which exchange members have access to products from each exchange. Another example of this is a link between the French derivatives exchanges, MATIF/MONEP, and the Spanish and Italian derivatives exchanges, MEFF and MIF, which has allowed MEFF members access to MATIF interest rate products from February 1999; MIF members are expected to gain access in May 1999. The London Stock Exchange (LSE) and the Deutsche Börse have also embarked on an alliance, the first stage of which began in January 1999, allowing each exchange's members access to both exchanges' electronic trading-platforms. The second stage of the alliance will

⁽¹⁾ Other contracts-including Tibor and Libor-based Euroyen futures, and Japanese Government Bond futures-are also available on this (mutual

Office Contracts—Including Troot and Electric cases Encycle Tenters, and the contracts and the contracts and the contracts and the contract and the contrect and the contract and the contract and the contrect and th

trading-platform.(3) There was a delay until June 1997 before members of the Oslo Stock Exchange gained access to Swedish products

apply common rules and regulations, and the final stage (some time after 2000) will establish a single centralised trading-platform for around 300 of the largest European shares (by market capitalisation). It is possible that other exchanges will join the alliance in the longer run. Separately, the Swiss, French and Italian stock exchanges have also agreed to implement a cross-membership link, as the first stage in linking their existing electronic trading-systems. Though such cross-membership links are possible with open-outcry trading, electronic trading has clearly made them easier.

A third structural trend is the separation of exchange ownership from membership. So far, the stock exchanges in Stockholm, Helsinki, Copenhagen, Amsterdam, Milan and Australia have done this. Members of the London International Financial Futures and Options Exchange (LIFFE) voted in February this year to separate shares from trading permits and allow external shareholders; this was implemented in April. In addition, there are plans for the merged Singapore Stock Exchange and SIMEX company and for the merged Hong Kong Stock and Futures Exchange to have outside ownership. Some of these exchanges, such as those in Stockholm and Australia, have taken the further step of floating as a public company, and others, such as the Hong Kong exchange, have plans to do the same.

Factors driving these structural changes

(i) Technological advance

Technological improvement is a key factor influencing market structure. Advances in technology mean that most parts of the trading process can now be automated. For example, the LSE moved from a trading-floor to telephone quotes in 1986, to electronic and largely dematerialised⁽¹⁾ share-settlement in CREST in 1996, and to the electronic order-book SETS for its largest 100 plus stocks⁽²⁾ in 1997. LIFFE is switching from floor trading to its new electronic system, CONNECT, which was launched in November 1998 for equity options and introduced from April 1999 for futures contracts.⁽³⁾ Initiatives to introduce 'straight-through processing', under which a transaction will be automated from the initial input through to settlement, are well advanced in some markets. In a number of exchanges, trades are routed automatically to the settlement or clearing system.

(ii) Technology and scale economies

Electronic trading allows exchanges to increase in size and to benefit from potential scale economies. It widens access to markets (compared with floor trading), because it relaxes the limit on the number of firms that can participate directly (subject to any credit or regulatory constraints), and reduces the need for geographical proximity to an exchange. Though telephone trading also widens market access, an electronic order-book has the added advantage of being able to provide constantly updated information on a wide range of bids and offers, allowing orders to be communicated instantly to all other market participants. Moreover, the 'reach' of exchanges can be extended further by use of public networks, which, for example, is how a number of brokers offer Internet broking services to retail investors. In the United States, Internet broking is estimated to account for about one quarter of all retail stock trades.⁽⁴⁾

Economies of scale can be gained from larger electronic networks by pooling exchange overheads such as marketing, product development and systems development. Malkamäki (1999)⁽⁵⁾ finds significant economies of scale in the trading function of exchanges (but not their listing function). Larger networks also allow cost savings to members from having to deal with fewer exchanges and comply with fewer sets of rules and regulations. There are reasons to believe that the scope for scale economies, and therefore the minimum efficient scale of exchanges,⁽⁶⁾ may have risen: the marginal costs of adding further participants to an electronic network may be lower than for an open-outcry network, partly owing to the increased ability of electronic markets to benefit from network externalities. Network externalities(7) exist where the benefits to an individual participant increase with a greater number of participants in the system, because existing members benefit when new members join. In the case of an exchange, network externalities arise because new members give existing members additional trading opportunities, so making the market more liquid and reducing trading costs for all.

(iii) Technology and competition

Technology is also increasing the competition that exchanges face from other exchanges and from new entrants, such as broker-dealers offering trading to their clients on their own electronic networks. Competition between existing exchanges increases, because they can offer remote electronic trading and therefore compete for the business of firms in other countries, and because firms can switch from one trading-platform to another more easily. As a result, exchanges have acquired an increasing number of remote members; for example, EUREX, the German-Swiss derivatives exchange, had 148 remote members⁽⁸⁾ in January 1999, 65 of which were based in London. In the European Union, this cross-border access is facilitated by the Investment Services Directive (see below). In the United States, the Chicago Board of Trade (CBOT) adopted

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Without a share certificate or a paper stock-transfer form. 135 stocks were traded on SETS on 14 April 1999. The SETS population includes the current FT-SE 100, ex-FT-SE 100 stocks, stocks for which there are LIFFE traded options, and UK stocks included in the Eurotop 100. CONNECT for Futures was launched in April for long gilt and five-year gilt futures. From May FT-SE 100, FT-SE 250, FT-SE Eurotop 100, Bund, BTP, JGB, Euroyen, five and ten-year LIFFE Euribor Financed Bonds, FT-SE Eurobloc 100, FT-SE Eurotop 300, MSCI Pan-Euro Index, MSCI Euro Index will be listed on CONNECT; the other short-term interest rate contracts will be added from August. Arthur Levitt, Chairman, Securities and Exchange Commission, 27 January 1999, statement concerning on-line trading. Malkamäki, M (1999), 'Are there economies of scale in stock exchange activities?', Bank of Finland Discussion Paper. The minimum efficient scale is the level of production at which average costs are minimised. Domowitz, I (1995), 'Electronic derivative exchanges: implicit mergers, network externalities, and standardisation', *The Quarterly Review of Economics and Finance*, Vol 5, No 32. This was calculated by subtracting the number of members based in Germany and Switzerland from the total number of 315 EUREX members.

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⁽⁸⁾ This was calculated by subtracting the number of members based in Germany and Switzerland from the total number of 315 EUREX members

daytime electronic trading of Treasury bond (T-bond) futures in September 1998, in parallel to floor trading of these contracts. This may have been motivated (at least partly) by the potential competition posed by Cantor Fitzgerald's trading-platform for T-bond futures.

National exchanges also face a potential increase in competition from new entrants, such as Alternative Trading Systems (ATSs). (See the box on US equity markets on page 205.) An important reason for this is that fixed costs to entry have fallen, because electronic trading systems have become cheaper to develop. New entrants may attempt to 'cream off' the more profitable segments of the market.⁽¹⁾

Over-the-counter (OTC) derivatives markets also offer an alternative to derivatives exchanges. In the past five years, the value of OTC derivative positions outstanding has increased more rapidly than the value of exchange-traded outstandings (see the chart below). Some traditional OTC markets (particularly for straightforward, unstructured products) are moving away from pure, decentralised bilateral trading to establishing some common market infrastructure, bringing them closer in some respects to exchanges. For example, the London Clearing House (LCH) is establishing Swapclear as a central counterparty clearing-house for OTC derivatives.⁽²⁾ In the foreign exchange market, much of the trading now occurs over the electronic platforms provided by Reuters or EBS. It may soon be more difficult to distinguish positions in on-exchange government bond futures from OTC government bond repos, with both traded electronically and settled through a clearing-house.

Value of OTC and exchange-traded outstanding contracts



This comprises data of around 100 ISDA members' outstanding interest rate swaps, currency swaps and interest rate options. The population fluctuates over time. Exchange-traded outstandings for 1998 are based on June 1998 data; the BIS will publish the December 1998 data in June 1999. (a) (b)

(iv) Effects of competition

Increased competition puts greater pressure on exchanges to maximise their trading volumes, reduce overhead costs, and

therefore achieve economies of scale, as well as update their technology and offer an attractive overall 'package' to users. One reason for merger of stock and derivatives exchanges within countries is likely to be the potential for cost reductions via changes in business organisation, such as shared product development and legal departments. These exchanges may want to merge in order to strengthen their competitive position in the face of increased cross-border competition, and to put themselves in a better bargaining position in the event of subsequent international consolidation. Technology also widens the potential gains from merger. Although most existing merged equity and derivatives markets currently retain separate electronic markets, it may be possible to integrate them in the future.

A number of these mergers between stock and derivatives exchanges have been accompanied (or preceded) by demutualisation of the exchange. Again, technology and increased competition are important factors. In times of more dynamic markets, when quick responses are required, co-operative ownership can have disadvantages: consensual decision-making across members and the need for the support of the majority of members may in some cases have prevented exchanges from being sufficiently flexible to respond quickly to technological and market changes. Co-operative decision-making also becomes less desirable as the exchange members become more diverse, which could happen, for example, as exchanges widen their membership through remote trading. In addition, competition reduces the disadvantages of outside ownership. With more competition between exchanges, there is less scope for outside owners to exploit their power by charging excessively high fees to members.(3)

(v) Cross-border investment and EMU

Greater global cross-border investment flows may result in demand for further consolidation of existing exchanges from investors who find it easier to trade on a reduced number of exchanges. EMU is likely to have a significant impact on investment flows between euro-area countries. By removing currency risk, it is likely to result in pressure for market integration both from investors and from companies seeking access to a wider pool of capital. EMU has a direct impact on derivative exchanges, as contracts based on interest rates form a significant part of total exchange volumes. A single euro interest rate makes government bond contracts closer substitutes and short-term interest rate contracts almost identical.

(vi) Globalisation and consolidation of main market participants

In the past decade, there has been a global consolidation of the main intermediaries in the world's capital markets. Since these firms are the major users and, in some cases, owners of the market infrastructure (exchanges,

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Domowitz and Steil (forthcoming, 1999), 'Automation, trading costs and the structure of the trading services industry', *Brookings-Wharton Papers on Financial Services*. Hills, Parkinson, Rule and Young (1999), 'Central counterparty clearing-houses and financial stability', *Financial Stability Review*, Issue 6. (2) (3)

See Hart and Moore (1996), 'The governance of exchanges: members co-operatives versus outside ownership', for the original (and fuller) discussion of the relative efficiency of outside versus co-operative ownership of exchanges

US equity markets⁽¹⁾

The stock exchanges in the United States vary markedly in character. They can be broadly categorised as the national exchanges-the New York Stock Exchange and the (merged) American Stock Exchange and Nasdaq Stock Market-and the five regional exchanges. There are also many Alternative Trading Systems (ATSs), which offer additional means of trading. Though these have existed in some form for several decades, they have recently begun to make a huge impact on stock trading, and they are likely significantly to affect the environment in which stocks are traded in the future.

Background

Although overlapping markets, mergers and the effects of technology mean that there is no single delineation between the business of each, key features of the mainstream exchanges are as follows.

- New York Stock Exchange (NYSE): the largest stock exchange, covering major national and international companies.
- American Stock Exchange (AMEX): similar stock categories to the NYSE, though a smaller exchange. Trades some derivative securities, in addition to equities. Merged with Nasdaq in November 1998; since then, both have operated as separate subsidiaries under the management of the Nasdaq-Amex Market Group, ie there has been no integration of trading-systems.
- National Association of Securities Dealers Automated Quotations system (Nasdaq): known particularly for its coverage of high-growth companies, especially the technology sector, though its listings cover a wide range of the US economy. Comprises two separate markets-the Nasdaq National Market for the largest and most actively traded securities, and the Nasdaq SmallCap Market for emerging-growth companies.⁽²⁾
- The regional stock exchanges—the Boston, Chicago, Cincinnati, Pacific (with floors in Los Angeles and San Francisco) and Philadelphia exchanges. These trade mainly equities, many issues being dual-listed with the national exchanges; options trading is an additional major business of the Pacific and Philadelphia exchanges.

Trading-systems

The US national exchanges exemplify two generic types of stock-market systems. The NYSE and AMEX both have a trading floor and are order-driven (or 'auction') markets, meaning that prices are established from the incoming buy and sell orders. Buyers and sellers are matched by 'specialist' traders, whose role is to ensure orderly markets in their particular stocks (though this matching can be performed by computer-see below). Nasdaq, by contrast, primarily conducts business by a market-maker (or 'dealer') system, where market-makers compete for investors' orders by quoting prices at which they will buy or sell. Nasdaq has no physical floor; its trading is conducted electronically via its own terminals, or by telephone.

The rapid advances in computing capacity combined with steeply falling costs have driven the development of ATSs. These operate on the same basic principles as traditional exchanges, but deliver in a different manner. ATSs now handle more than 20% of the orders in securities listed on Nasdaq.

Alternative trading systems⁽³⁾

ATSs are functionally similar to exchanges, competing with many of their services. (There is no clear definition to differentiate an ATS from an exchange-their facilities overlap, which is one reason why they have raised considerable regulatory issues.)(4) ATSs are systems that provide facilities to bring together buyers and sellers, with particular criteria for how the trades should be executed. In practice, they operate electronically (no floor) and have tended to operate parallel to existing exchanges, often as members or facilities of an existing exchange.

The main attractions of ATSs are the possibility of lower transaction costs and often greater anonymity, which increases the possibility of trading without adverse market impact. Depending on the system, there can be a range of other facilities, including wider access to the market, the means to specify more complex preferences (eg about price/quantity/urgency) and the possibility of direct trades by crossing orders within the system.

Operation of ATSs

Central to an ATS is its 'order-execution algorithm'—a set of rules to determine which of the competing orders should be executed first and how. Price is usually the first criterion, with priority going to the highest bids and lowest offers. Secondary criteria could include the time that the order was submitted, the size of the order (eg orders placed first having precedence, or larger orders executing before smaller orders), and numerous other factors, including those required to comply with market rules (such the ranking of retail trades relative to those from institutions).

Though these are the broad principles of ATSs, their particular characteristics vary markedly, as does their complexity. Some operate as continuous electronic auctions, in effect replacing specialist traders such as those in the NYSE and AMEX (eg Instinet). Others operate as a single-price periodic call auction, with bids and offers entered into the system ahead of a cut-off time, after which the system calculates an equilibrium price (eg Posit, AZX). Other systems add additional features; for example, Optimark allows the specification of a complex preference profile of prices and quantities. Systems also vary in the extent to which they either offer mechanisms for independent price discovery or are passive, making explicit reference to prices on other markets.

This box was prepared by Helen Allen of the Bank's Market Infrastructure Division.
The other routes for listings for small companies are the OTC (over-the-counter) market, either via its OTC Bulletin Board (the electronic quote service operated by Nasdaq) or the 'Pink Sheets', a daily publication of the National Quotation Bureau.
There is a growing literature on the subject. See, for example, Lee (OUR, 1998), 'What is an exchange?' and Domowitz and Steil (forthcoming, 1999), 'Automation, trading costs and the structure of the trading services industry', *Brookings-Wharton Papers on Financial Services*. Other terms that are variously used to refer to such systems are Proprietary Trading Systems (PTSs), Electronic Communications Networks (ECNs) and broker-dealer trading systems.
The US Securities and Exchange Commission modernised its rules governing exchanges in December 1998, broadly allowing ATSs the choice of whether to register as an exchange or as a broker-dealer, and adjusting the approach according to the ATS's significance in the market. The rules are intended to level the regulatory playing-fields, integrating the ATSs into the regulatory framework, and to plug regulatory gaps that had emerged.

clearing-houses, settlement systems, messaging systems, information systems) in each country, their interests have a strong influence on market structure. These firms may prefer to use their own balance sheets to offer some types of products to their customers, rather than a central exchange. So the major firms are often in effect in competition with infrastructure providers, for example when offering in-house trading or custody services to their clients. But they also want to trade with each other in order to manage their own risk and inventory and to take proprietary positions. For this purpose, they want low-cost trading and settlement mechanisms that minimise their exposure to counterparty risk and the impact on their balance sheets. To the extent that there are economies of scale in trading, firms are likely to encourage consolidation to minimise costs. Set against this, the major firms may be reluctant to allow the dominance of a single supplier. For example, Electronic Broking System was set up by a number of the major banks to offer an alternative system for foreign exchange trading.

Implications

There are conflicting pressures on the role of financial intermediaries in this new market structure. Further capital market integration seems likely to add to the market power of the large global intermediaries, which are better placed than local firms to offer cross-border services. However, new technology has the potential to reduce the cost of trading directly on the market in small size, and to reduce the market impact of trading directly in large size. Electronic systems, such as those based on the Internet, could also allow end-investors to trade and settle with each other directly through a central market. At one extreme, it is possible to envisage a 'retail capital market'.⁽¹⁾

These changes in exchange-traded markets are also likely to have implications for other types of infrastructure. For example, common trading-platforms for derivatives directly affect derivatives clearing, particularly since clearing-houses are often under the same ownership as the exchange. The EUREX common trading-platform mentioned above also has common clearing, and there is a cross-clearing link for the OM-Oslo Stock Exchange trading-platform. Other alliances, such as the GLOBEX alliance, intend to establish co-operation on clearing. Common clearing can offer other benefits, through margin offsets, operational efficiency and better surveillance of members' overall positions.

Common trading-platforms for equities are likely to affect securities settlement infrastructure. If there are fewer trading-platforms, investors are likely to demand a similar consolidation of settlement infrastructure. In the United States, there is already a single settlement system, the Depository Trust Company (DTC). But in Europe, there are separate securities settlement systems in each country. There are various ways in which this settlement infrastructure could evolve, including the creation of a common settlement infrastructure through multilateral links (such as the model that has been developed by the European Central Securities Depositories Association), or consolidation, to leave one or more settlement hubs.

There may be another implication for the organisation of clearing and settlement of securities and derivatives. With increasing competition between exchanges, some exchanges may see their ability to offer settlement as part of their competitive edge. On the other hand, market-users may prefer to have clearing and settlement provided by entities separate from exchanges, to minimise costly duplication, given the fixed costs of settlement. In this model, clearing and settlement might occur in utilities open to various exchanges and the OTC market. This already happens in some countries; for example, in the United Kingdom, the LCH clears for four exchanges, and plans to clear repos and OTC swaps; CREST settles trades on the LSE and the Irish Stock Exchange. In the United States, the DTC settles trades on all the major US stock exchanges.

These changes should bring benefits to market-users in the form of a better service, more liquid markets or lower costs. There is also likely to be more choice. For example, London firms might trade bonds on an Italian platform, hedge them using a EUREX futures contract, settle the trade through Euroclear in Belgium, and make the associated payments through a pan-European system. Market-users will no doubt want to ensure that consolidation does not occur to the extent that it reduces the competition and innovation that has been driving change.

The structural changes also have implications for the authorities. The regulatory framework needs to encompass advances in cross-border businesses, and to allow competition between all types of exchanges without an erosion in standards. An example is the US Securities and Exchange Commission's adoption of a new regulatory framework for ATSs. In the European Union, the 1996 Investment Services Directive (ISD) provides a legal framework in which EU exchanges can compete for business throughout the European Union: exchanges recognised in one Member State can gain access to other Member States, for example by establishing remote trading terminals. Each exchange is regulated by the home country, and the ISD requires only minimum harmonised standards. The creation of the Forum of European Securities Commissions in December 1997 also provides scope for coordination between Europe's securities commissions. However, further progress towards consolidation of exchanges and other market infrastructure within Europe and beyond may well require more coordination between regulators.(2)

See Financial Services Foresight Panel (1999), '2010: W(h)ither Financial Services?'.
Howard Davies, Chairman, Financial Services Authority, 'Euro-regulation', European Financial Forum Lecture, 8 April 1999.

Developments in small business finance

In this speech,⁽¹⁾ the **Governor** reviews developments in the provision of finance to small and medium-sized business, including the initiatives taken by the Bank to facilitate improvements in the relationship between finance providers and companies. He concludes that there has been great progress in this area—though more remains to be done, especially in the area of equity finance.

I'm sure I don't need to emphasise to this audience the importance of the small and medium-sized enterprises (SME) sector to the UK economy. Defined as businesses employing fewer than 250 people, the sector accounts for more than 60% of both total employment and total output. But the importance of the sector lies not only in its size. It lies too in its particular capacity for specialisation, and its related ability to respond quickly and sensitively to the needs of the marketplace. Such adaptability and flexibility is crucial, not only to the individual business but to the strength of the economy as a whole, in today's world of continuous, rapid, change.

Huge efforts are being made across a very broad front by the various arms of government-at national, regional and local level-in conjunction with the whole range of private sector organisations, to promote the growth of the SME sector. This begins with the education system to encourage an entrepreneurial culture, the idea that starting a business is a viable career option. It extends to technical support, including training and advice as well as direct financial assistance in various forms. And it includes encouragement through the tax system, as well as efforts to relieve the administrative burden of all the various forms of government regulation. It's not easy, I must confess, for anyone who tries to keep a broad overview of the SME sector, to keep tabs on the range and precise scope of the plethora of initiatives that have been taken in this field in recent years-especially when so many of them, and the particular vehicles promoting them, are referred to simply by their acronyms! But perhaps you all find it easier to find your way through the maze than I do.

In part, this complexity simply reflects the extraordinary diversity of the SME sector itself—with some 3.7 million individual businesses, ranging in size from the one-man band to some 250 employees, in every sector of economic activity from handcraft to the highest tech, and with varying business objectives from the lifestyle to the next generation global company. Their needs for support are all very different. So too are their needs for finance, which is where the Bank of England can sometimes make a contribution—not, I hasten to say, by actually providing finance ourselves, but in a catalytic way by encouraging those whose job it is to be responsive to the needs of the market. Grossly oversimplifying for the purpose of my remarks this evening, I shall divide the SME sector into three: micro-business finance, where start-up capital in particular is often not available through the conventional banking system; mainstream debt finance, through the banking system; and equity finance, particularly for medium-sized and rapidly growing companies.

Micro-business finance

There are about $3^{1/2}$ million micro-businesses, that's to say businesses with up to nine employees, in this country about 95% of the total number of all businesses; and together they make a very major contribution on the jobs front, accounting for about 30% of total employment and nearly 25% of total output.

A particular problem at this end of the scale is access to start-up or early-stage finance for disadvantaged groups in poor neighbourhoods. Potential sources of such finance include some 700 credit unions in this country, with total assets of around £100 million serving some 400,000 members. They also include other community finance organisations that provide micro-business finance alongside personal credit, such as community loan funds, often set up with the help of the commercial banks, and social banks. And they include, finally, special micro-finance funds, the best known of which is the PYBT, which had total assets of £21 million and has provided micro-finance, in the form of low-cost loans and grants, as well as business mentoring and advice, to more than 42,000 mostly unemployed young people since 1986. Altogether, these other community finance initiatives control about £170 million of capital and serve around 100,000 people.

Notwithstanding these increasing efforts, questions clearly remain about the adequacy of access to capital of existing or potential small businesses in low-income communities, and the Social Exclusion Unit established by the Government in December 1997 has set up a Policy Action Team (PAT 3) to look at those questions. Its remit is to explore whether more can be done to encourage new business start-ups in those areas; how to improve access to finance, taking account of recent new initiatives; and to look at the role of business support agencies in this context. The Bank is in close contact with this work.

(1) Given at the KPMG Profitability Seminar on 1 March 1999.

Similar issues arise in the context of the financing of ethnic businesses. The Bank has over the past year spent a good deal of time reviewing the evidence on the financing of ethnic minority businesses in the United Kingdom. Taking advantage of our regional Agents network, we have spoken to a wide range of ethnic businesspeople in different localities; we hosted an academic workshop in the autumn of last year at which leading academics, bankers and officials exchanged views; and we hosted a dinner at the Bank last summer for a number of leading ethnic businesspeople. Our report on the issue will be published in early March.

The main conclusions of our work are that first, notwithstanding a lack of clearly documented evidence, some ethnic minority businesses, particularly African-Caribbean, perceive access to finance to be a disproportionate problem; second, the response to this perception needs to come from various quarters, including not only banks and other finance providers but also Government support agencies and ethnic businesses themselves; and third, there are encouraging signs of action on all these fronts. But what is also clear is that much more research needs to be done in this area.

Mainstream debt finance

Much the largest source of external finance for the SME sector as a whole is the commercial banking system, which currently provides nearly half the total.

At the time of the recession in the early 1990s, it became clear that there was a serious breakdown of confidence and communication between SMEs and their main finance providers. The borrowers complained bitterly that the banks cut back their loans just when they needed them most; while the banks for their part suffered very large losses on lending, which they were unable to recover. The true culprit, of course, was the exaggerated boom and bust cycle, for which we, the authorities, ought to bear at least most of the responsibility. But whatever the history, there was a clear need to try to reassert a better relationship between the two sides.

The Bank's part in that process has been in essence to organise a dialogue. Since 1992, we have regularly consulted with the SME community, through their representative organisations and through the contacts of our regional Agents around the country. And we have consulted too with the individual banks. And then we have brought the two sides together, with some of the key academic observers of SME finance, for an annual symposium. This process has enabled us to monitor progress in the relationship between borrowers and lenders-and what we have seen has been very encouraging. Notwithstanding the current economic slowdown, it was evident at our latest symposium in January that there has in fact been real progress. The banks have devoted considerable efforts to understanding the diverse nature of the business of their SME customers and of their financing needs, helping to

reduce their risks in the process. This is reflected, for example, in a fall in the proportion of finance accounted for by traditional bank borrowing (from 61% in 1987–90 to 47% in 1995–97); and a shift away from short-term lending towards more term finance, which now accounts for nearly 70% of the total. There is now less emphasis on collateral and more on the progress of the business. And leasing and receivables finance has also risen (from 22% in 1987–90 to 33% in 1995–97).

As the banks' understanding of the needs of their customers has improved, so too the small business community has developed a better understanding of the banks' need for up-to-date financial information and for early warning if things start to go wrong. The British Chambers of Commerce, for example, reported on their research, which finds that 87% of their respondents now regard their bank as supportive. The Forum of Private Business reported that its aggregate bank performance index has improved by about 10 percentage points since 1992—and they found that SMEs that had developed a more participative relationship with their banks, with a better two-way information flow, were benefiting from lower charges and collateral requirements.

As a result of this progress, there is little doubt that both the banks and the SMEs are less vulnerable to a slowdown than they were in the last business cycle. And of course, we expect the slowdown to be comparatively mild and short-lived.

That doesn't mean that everything in this particular garden is perfect. We live, as I said, in a world of continuous change. So we welcome recent Government initiatives, including the Cruickshank Review, designed to identify further possible improvements in this crucial area of SME finance, which we will continue to monitor.

Equity finance

Let me finally turn very briefly to SME equity finance, where there has been talk of an 'equity gap' ever since the MacMillan Report in 1930.

In fact, there still appears to be a marked reluctance on the part of many, particularly family-owned, small businesses in this country to use external equity finance, because they prefer to remain independent or are not looking to expand.

But it is nevertheless important for the economy as a whole that the market should provide equity for those companies that do need it, especially since they will tend to be among the younger, growth-orientated businesses.

There does in fact appear to have been a significant increase over the past few years in the provision of relatively small amounts of equity through 'business angel' networks and through the banks, though the aggregate sums involved remain of course quite modest. And there has been a more substantial increase in formal venture capital provision, though much of this has gone to finance management buy-outs and management buy-ins. Early-stage investment by venture capital firms accounts for about one fifth of the total number of their investments, but only some 5% of the total value. This suggests that venture capitalists may be deterred from small start-up or early-stage investments by the relatively high cost of researching and managing them. And in this area, too, potential borrowers could help themselves by better understanding investors' needs for more comprehensive and timely information.

Equity finance is a particular issue for high-tech firms, of course, because they tend, understandably, to be more dependent on equity capital than more traditional businesses with readier access to bank finance. The issue was explored in our own report *Financing Technology-Based Small Firms*, and by a Treasury Working Group chaired by Sir Peter Williams, and the Bank will be convening a new forum in April bringing together institutional investors, venture capitalists, and representatives of high-tech companies to investigate some of the particular obstacles to equity investment in this sector.

There may also be a more general problem in the context of public equity, particularly in relation to smaller quoted companies. Although over the longer term, such companies have outperformed the market in terms of returns on equity, there has more recently been a marked underperformance in share prices. The FT-SE SmallCap Index, for example, has fallen by nearly 30% relative to the All-Share Index since early 1996. This may in part be cyclical. There is some evidence to suggest that small firms tend to underperform in economic slowdowns. And it is particularly relevant in the present international economic environment that the SmallCap Index is more heavily weighted to sectors more exposed to overseas markets-'general industrial' shares, for example, make up 22% of the SmallCap Index, compared with only 5% of the FT-SE 100. But the recent underperformance of smaller quoted companies may also reflect the growing concentration of the fund management

industry, and the growth of index-tracking, which would concentrate investment on the larger, more liquid stocks. Some recent very useful research by KPMG would, I think, support this latter view. In any event, if it persists, the recent underperformance is likely to deter smaller company flotations and encourage reversion to the private equity market.

The issue has been considered by the Smaller Quoted Company Working Group chaired by Derek Riches of Merrill Lynch, but I suspect that we need a good deal more research before we can conclude whether this development reflects the evolution of the structure of savings in this country, or whether the illiquidity problem might be addressed by development of the equity market mechanism for small stocks. A separate report, by a working group chaired by Paul Myners of NatWest, emphasises the importance of better dialogue between smaller quoted companies and fund managers, and in particular the need for better information from the companies themselves.

Mr Chairman, there is no doubt that the importance of the SME sector to the supply side of the economy is much more widely appreciated now than it used to be; it has moved up the policy agenda, and there are a whole host of initiatives in train to provide more encouragement to the sector, including initiatives to improve the provision of SME finance. But Rome wasn't built in a day. The problems facing the sector, including the problems of access to finance, are as varied and diverse as the sector itself. I have touched upon some of the current priorities in relation to SME finance, which we at the Bank, working with the Government and with private sector financial institutions, shall be seeking to address over the period ahead. But it is a continuing, incremental process, through which we need to look for continuous improvement across the board. To the extent that we can strengthen the supply side in this way, it will make for a more robust economy and make our monetary policy job on the demand side that much easier.

Economic models and monetary policy

In this speech, U John Vickers, Executive Director and Chief Economist at the Bank, discusses the role of economic models in monetary policy-making, and explains why the Bank uses a suite of models, rather than a single model, to assist its forecasting and analysis.⁽²⁾

Introduction

In the summer of 1938—the birth year of the National Institute—John Maynard Keynes corresponded with Roy Harrod about the role of models in economics. His views are encapsulated in one paragraph:⁽³⁾

'Economics is a science of thinking in terms of models joined to the art of choosing models which are relevant to the contemporary world. It is compelled to be this, because, unlike the typical natural science, the material to which it applies is, in too many respects, not homogeneous through time. The object of a model is to segregate the semi-permanent or relatively constant factors from those which are transitory or fluctuating so as to develop a logical way of thinking about the latter, and to understanding the time sequences to which they give rise in particular cases'.

I can report that in those terms the Bank of England is wholly Keynesian. Aren't we all? But I am afraid that the Bank, and the Institute, are guilty of 'filling in figures', which Keynes saw as a mistake:

'it is of the essence of a model that one does not fill in real values for the variable functions. To do so would make it useless as a model. For as soon as this is done, the model loses its generality and its value as a mode of thought'.

Sixty years of econometrics later, this seems quite an overstatement, and I shall return to it later.

This spring, the Bank is publishing its suite of economic models-with figures filled in. My aim this evening is to explain how economic models are used at the Bank. I am especially grateful for the opportunity to do so here, for there is surely nowhere better than the National Institute for a discussion of the place of economic models in the practical process of policy-making.

How many cheers for models?

Before describing the use of economic models in the practical process of monetary policy, a few more remarks are needed on the wider and deeper question of the role of models in economics generally. These can be brief, thanks in part to the recent Economic Journal symposium on Formalism in Economics.

In that symposium, Paul Krugman (1998) gives two cheers for formalism-by which he basically means models-but reserves the third for 'sophisticated informality'. His key point is that:

'as a practical matter formalism is crucial to progress in economic thought-even when it turns out that the ideas initially developed with the help of formal analysis can in the end, with some work, be expressed in plain English'.⁽⁴⁾

Alfred Marshall favoured burning the mathematics after the translation into English, but Krugman offers a revised version of Marshall's recipe:

- (1) Figure out what you think about an issue, working back and forth among verbal intuition, evidence, and as much math as you need.
- Stay with it till you are done. (2)
- Publish the intuition, the math, and the evidence—all (3) three—in an economics journal.
- (4) But also try to find a way of expressing the idea without the formal apparatus.
- (5) If you can, publish that where it will do the world some good'.

This twin-track publication strategy-but with particular emphasis on step (4)—is in essence how we try to publish economics done at the Bank. The forthcoming publication of our suite of models (Bank of England (1999)) is very much in the same spirit.

While Krugman's recipe is for those seeking to advance economic understanding, upon whom economic policy-makers are of course ultimately dependent, the immediate issue for the Monetary Policy Committee (MPC) is generally an upcoming interest rate decision. But the 'back-and-forth' procedure in step (1) of the recipe seems just as relevant to the MPC's work as to that of economists in general.

models'

Given at the National Institute of Economic and Social Research on 18 March, 1999. I am grateful to numerous colleagues at the Bank for their helpful comments on an earlier version of this paper. The quotations are from Keynes's letter to Harrod on 4 July 1938, printed in Moggridge, D (ed) (1973), pages 296-7. This echoes Keynes, in the letter quoted above: *'Progress* in economics consists almost entirely in a progressive improvement in the choice of (3) (4)

In particular, it underlines the key point that economic models are no more and no less than tools to help solve economic problems. A good model achieves clarification through judicious simplification, by stripping away the inessentials, or at least the aspects judged less essential, to the problem.

What is a good model-a good tool-depends not only on the problem at hand, but also on whom it is for and how it is used. So for example, the MPC and the readership of *Econometrica*—sets that overlap, by the way—quite properly have different concerns as consumers of economic models. Needless to say, of particular importance for the MPC is quantification, and hence econometrics-the 'mutual penetration of quantitative economic theory and statistical observation'-as Ragnar Frisch put it in the editorial statement of the very first Econometrica in 1933.

So how many cheers for models in the context of monetary policy? I ought not to answer this now, especially not before some discussion of forecasting, but in the interests of transparency let me right away echo Paul Krugman's two cheers for models-at any rate in my central case, but of course with risks both on the upside and the downside.

Models, forecasts and policy

In his Cairncross lecture last October, Alan Budd (1998) discussed aspects of the relationship between forecasts and policy. It will help the subsequent discussion of models if I briefly recap some of his main points. The first was that all economic policy-makers use forecasts of one kind or another. As Alan Greenspan rather definitively put it:

'Implicit in any monetary policy action or inaction is an expectation of how the future will unfold, that is, a forecast'.

Alan Budd went on to argue that there is no valid distinction between using forecasts and relying on current observations on the state of the economy, since a forecast is simply a transformation of current (and past) observations. And he discussed the question of how many variables should inform policy decisions, and contrasted the approach of the 'hedgehog', who focuses on one or two big things, and the 'fox', who watches many things.⁽¹⁾ Thus hedgehogs are perhaps less likely than foxes to use models in forecasting. There will be more on hedgehogs and foxes later.

I suspect that some of the interest in models in the context of monetary policy is based on the (inaccurate) notion that the policy process, at least in Inflation Report months, can be represented schematically as:

Model \rightarrow Forecast \rightarrow Policy.

This picture is wrong in several important ways, and I shall suggest a more accurate schema later. First, it might suggest that models are used and useful for monetary policy only via forecasts, which is far from true. Irrespective of

making a forecast for the future, models help understanding of where the economy has been, and how it has worked, in the past. And models can illuminate the relationships between forecasts and policy-see, for example, Goodhart (1999) on the issue of policy reaction functions and uncertainty.

Second, the schema implies that policy decisions are mechanically driven by forecasts-ie that policy depends only upon forecasts. This is untrue in even the very simplest models of inflation targeting such as Svensson (1997), where optimal policy depends not only upon forecast (ie mean) inflation, but also upon the relative costs of the variability of output and inflation. In more realistic settings, it is even less true that policy is forecast-driven.

Third, the schema above implies that forecasts are entirely model-driven (and indeed driven by a single model). This is not the case, as the general discussion of models aboveand the award of only two cheers-has already indicated. Models are tools and, as Keynes observed to Harrod, their use involves some art.

Painting by numbers

One art form that does correspond to the view that models determine forecasts is painting by numbers (in which genre the artist is, of course, the numerologist rather than the painter). The painting-by-numbers method of producing Inflation Report fan charts would go something like this:

- wheel out model:
- feed in latest data:
- press button;
- watch forecast numbers emerge; and
- paint the fan charts according to those numbers.

Suppose, absurdly, that the forecast process did happen in essence in that fashion. Then there would be two broad possibilities as far as policy was concerned. The first is that policy could be decided quite independently of the forecast process, in which case that whole process-from models to fan charts-would be a charade. The second, which corresponds to the simple schema above, is that policy could be completely dictated by the forecast. In that case, the accountability of MPC members would be a sham, being confined to at most the work on the model. And unless the model was incomprehensibly large, much of the wide array of data-for example, survey data and reports from the Bank's regional Agents-that is claimed to influence policy decisions would actually be irrelevant.

There is of course a reverse process, numbers by painting, which would go like this:

- paint the fan charts as desired; and
- make exogenous assumptions and set equation residuals so that, when the button is pressed, the model produces numbers that match the desired fan charts.

^{&#}x27;The fox knows many things, but the hedgehog knows one big thing'. This line from the Greek poet Archilochus inspired and was made famous by Isaiah Berlin's essay on Tolstoy, *The Hedgehog and the Fox*. (1)

(The second step would no doubt require some skill.) Here the irrelevance would be the modelling, which would provide at most an *ex post* rationalisation of the given forecast.

Of course, neither of the polar cases sketched above remotely resembles the way that the MPC's forecast is in fact made in the Bank, which I shall outline below. To use Krugman's phrase, that involves 'working back and forth', whereas painting by numbers is all 'forth' and numbers by painting is all 'back'. Nevertheless, the two polar cases provide useful reference-points, and they bring into sharp focus the question of the ownership of the forecast: with painting by numbers, the forecast belongs only very tenuously, if at all, to the policy-making body.

Whose forecast?

Models being tools, it is important to explain who uses them and how. In the context of forecasting, a basic question is: whose forecast? Since the MPC was established, the projections in the *Inflation Report* have represented the best collective judgment of the Committee. Thus they are MPC forecasts, rather than Bank staff forecasts. Let me explain what that means.

There is no statutory requirement to publish any forecasts, and the Bank—whose *Inflation Report* has contained inflation projections since it was first published six years ago, and growth projections since November 1997—is one of relatively few central banks that does so.

Given the desirable fact that the *Report* does contain forecasts, the question of whose they are must be seen in the context of the Bank of England Act 1998. Section 18 of the Act requires the Bank to publish quarterly reports containing:

- (a) a review of monetary policy decisions;
- (b) an assessment of developments in inflation in the UK economy; and
- (c) an indication of the expected approach to meeting the Bank's monetary policy objectives.

The Act goes on to say that: 'No report under this section shall be published without the approval of the Monetary Policy Committee'. So the statute implies that any forecasts in the *Report* involve the MPC, at least to the extent that the MPC approves the report containing them.

I have heard it argued that the published forecasts should be by Bank staff, without attribution to the MPC. The main argument advanced for a staff forecast is that it would avoid tension between the individual accountability of MPC members and the apparently collective nature of the published forecasts. How is individual freedom in voting consistent with collective ownership of the means of projection? I believe that this tension is false, and moreover that important benefits—both substantive and procedural—flow from the forecasts being those of the MPC. The tension is false because individuals are perfectly free to, and inevitably will, differ to some degree from the best collective judgment. The regime is not one of 'agree-or-resign' collective responsibility. Indeed, the front page of the *Report* clearly states that:

'Although not every member will agree with every assumption, the fan charts represent the MPC's best collective judgment about the likely paths for inflation and output, and the uncertainties surrounding those central projections'.

The February 1999 *Report* was quite explicit that Committee members had somewhat different views, and explained how different assumptions would shift the inflation profile.

How and where individual differences are expressed is in part a matter of degree. MPC minutes, now published within a fortnight of each meeting, clearly allow for indeed positively elaborate upon—differences of view. However, if differences of view concerning the projections are sufficiently great, these can be stated in the *Report* and, if necessary, alternative fan charts could be published.

If the MPC were removed from the forecast process, an important means of holding the Committee accountable would be lost, and the quality of decision-making might suffer. As Charles Goodhart (1999) put it: 'the publication of the forecast holds the MPC's feet to the fire'. In most circumstances, one would not suppose that forecasting by committee was the optimal organisational design, but for the MPC, involvement in the making of forecasts provides a discipline and focus of analysis that I think is extremely valuable. The MPC is an avid consumer of the forecasts of others—including the National Institute—but it is only in relation to the Bank's forecasts that the MPC can also be a producer, and gain the understanding that the production process yields.

The forecast process

The process is quite intensive. In the most recent forecast round, the full Committee had seven meetings, lasting on average $2^{1/2}$ hours, to discuss forecast assumptions and risks. Early in the forecast process, provisional assumptions are needed about variables exogenous to the core model used for forecast runs. For example, a major area for analysis and discussion in recent quarters has been the prospects for world growth and trade, and the implications for growth of UK export markets and for global price developments.

Some assumptions are made by convention. For example, the starting-point for the exchange rate is taken to be the average over the 15 working days up to the MPC meeting.⁽¹⁾

⁽¹⁾ There are purist arguments for using the current spot rate, but this would have practical drawbacks in the forecast process (eg because of volatility), and the MPC is anyway well aware of the spot rate.

Another conventional assumption is that the short-term interest rate is constant up to the two-year forecast horizon, at the level set at the MPC meeting prior to the publication of the Report. (Projections are also made on the basis of future interest rates implied by the markets.) If I were a forecaster at, say, the National Institute, I would not generally assume constant interest rates, and such an assumption would be foolish for anyone doing long-run simulations. But there are important differences between the contexts in which the MPC and others make their forecasts.

One is the market sensitivity of paths projected by the MPC. Another is that, if the MPC moved away from the settings of constancy and market rates currently used, it would have to divert a good deal of Committee time to the specification of the interest rate path, or of some policy reaction function. As to the latter, there is wide scope for debate even among the class of Taylor rules-for example about the output gap, and how to incorporate open-economy considerations and forward-looking aspects.

The MPC must also decide whether model equations need adjustment (eg residual adjustments) in the light of economic news. To take a simplified example, if consumption has been turning out weaker than expected given income, should that be regarded as random variation, such as measurement error, or as a sign of a shift in the relationship between consumption and income, relative to the past over which the equation was estimated? Or suppose that survey data were suggesting a weaker outlook for consumption than preliminary model projections. How, if at all, should that be factored in? And how to take accountretrospectively as well as prospectively-of historically rare events, such as the windfall payouts to individuals arising from the demutualisation of some building societies? The assumptions that the MPC makes on such issues are typically described in the Report.

Questions of this kind—the list could easily be multiplied many times over—are a routine part of forecasting. They are about what is happening in the economy, not technical issues. Answering them calls for economic judgment, and that is part of what Krugman called sophisticated informality. But he gave two cheers for models, which play a key role in informing those judgments, and I shall say more about the Bank's models shortly.

When the key provisional assumptions have been made by the MPC, Bank staff produce a preliminary central projection. Often this will raise almost as many questions as it resolves, which, far from being a drawback, is a great virtue of the iterative process of 'working back and forth' that then unfolds.

Throughout the process, much of the discussion and analysis concerns risks and uncertainties. The starting-point for calibrating the amount of uncertainty, as measured by the

variances of projected inflation and output growth, is past experience with forecast errors. The skew-ie whether and by how much the balance of risks is above or below the central projection-is based on alternative assumptions for exogenous variables and equation residuals.⁽¹⁾ The Committee's best collective judgment about the explicitly uncertain prospects for inflation and growth is finally depicted in the fan charts.⁽²⁾

Three cheers for pluralism

Models got two cheers. The pluralist approach to modelling gets three. That is why the Bank, like many other organisations, has a suite of models, rather than being wedded to a single model. The Bank uses models for a variety of purposes. In the context of the forecasting process, there has to be a core model in order to ensure overall consistency, but how it is used is informed by a variety of other models. Thus there is no such thing as the Bank model. Even the core model plus the latest data is nowhere near sufficient to determine the forecast, since a great deal of judgment, much of it informed by other modelling, goes into the making of a forecast.

For many, this fact is so obvious as to go without saying. Others, including budding forecast-forecasters hoping to predict MPC projections by studying Bank model equations, may find it disappointing. But for the economy, it would be worse than disappointing if forecasts emerged from model-based painting by numbers.

Why then is it better to be a fox with several models than a hedgehog with one big model? There are three reasons, all of which are based on the fundamental point that economic models are no more and no less than tools to help solve economic problems.

The first reason is that different problems call for different tools. For example, it is important for the MPC to understand and form a view on the possible macroeconomic effects of Government policies affecting the labour market, such as the National Minimum Wage and the Working Families Tax Credit. Macroeconomic models are not designed to assess those effects. So separate tools must be employed in their analysis, with the results then being integrated into the macroeconomic setting. Sometimes, such tools are readily available in the economics literature; on other occasions, they need to be refined or even developed. Of course, the Bank has no local monopoly on such activity, and for the analysis of the Working Families Tax Credit we are following closely, and contributing to the funding of, current research by the Institute for Fiscal Studies. This illustrates the importance to the Bank of productive links with top research organisations.

Second, models are deliberate simplifications, but for any given problem, it is usually not obvious how far to simplify

This procedure is not over-sophisticated, but it provides a practical and disciplined way for the Committee to reach a quantitative view of the risks surrounding its central projection. From a purist perspective, one might instead use stochastic simulations, but this is complicated by model uncertainty. Current research at the Bank is exploring these issues. See the box on page 52 of the February 1999 *Inflation Report*, and Britton *et al* (1998), for a more technical description. (1)

⁽²⁾

and how much to abstract. One aspect of this issue concerns the appropriate level of aggregation. Should demand be analysed as a whole, or split into consumption, investment, government spending, exports and imports? Should manufacturing and services output be separated? What is the appropriate level of international disaggregation for the purposes of analysing UK inflation and growth? The pluralist fox does not strive to find a unique answer to each question: he runs several approaches in parallel. Thus at the Bank, we use simple Phillips curve/output gap models and small-scale macroeconometric core model. We do not at present model manufacturing and services separately, but the Bank has a major project on the service sector under the leadership of DeAnne Julius and Nick Oulton.⁽¹⁾

Another aspect of the simplification issue concerns omitted information. The Bank's core model variables do not include data from surveys (eg on consumer and business confidence) or the Bank's regional Agencies. But we certainly take account of those data, and not only by the method of sophisticated informality. For example, business confidence measures, which are more timely than official output data, are often thought to be a leading indicator of output. Regression techniques can yield estimates of the short-term prospects for output growth, based on the average relationship between the survey responses and output over the past. The errors on these estimates are typically fairly large, but the estimation procedure is more disciplined than simply eyeballing charts of the relationship, and far superior to ignoring the survey data altogether.

Third, for any given problem and degree of simplification, modelling approaches differ according to the weight that they place on theory. There is a kind of spectrum, running from vector autoregression (VAR) models to applied theoretical models. VARs have the simple but important advantage of capturing the stylised facts about the dynamic correlations among economic variables in the historical data.⁽²⁾ When some structure is added to them, VARs become tools for making inferences about the underlying shocks driving the movements of economic variables. But in forecasting and policy analysis, VARs are vulnerable to structural change and the Lucas critique.

The broad category of applied theoretical models covers models that rely particularly on economic theory to understand economic behaviour. Dynamic general-equilibrium models are a prime example. These models have rigorous micro-foundations, and are robust against the Lucas critique. More generally, such models are valuable for assessing the consequences of structural economic change—theory being especially important when there is reason to think that economic relationships may have shifted relative to average past experience.

Given their contrasting pros and cons, the hedgehog might use neither VARs nor applied theoretical models, but the fox uses both, and bears in mind the complementary strengths and weaknesses of each.

Properties of the Bank's core model

Midway along the spectrum come structural macroeconometric models. The Bank's core model of the UK economy, which is a central tool in helping the MPC to form its projections for inflation and growth, belongs to this class. The model is continually being revised and updated, and it can be operated in several ways (eg short-term forecasting or simulation). The model is not large: its main properties are given by about twenty behavioural relationships. Theory plays a stronger role in determining the long-run properties of the model than in relation to its short-run dynamics, which are largely data-determined.

The key long-run economic properties reflected in the core model can be summarised as follows. First, the economy has a long-run equilibrium path for real variables, such as output and employment, that is independent of the level of prices and inflation. Long-run economic performance depends on the supply side of the economy, and there is no long-run trade-off between inflation and unemployment, or between inflation and output. (Indeed, high inflation is likely to be damaging to output, employment, and economic welfare more generally, but the core model is not designed to examine these effects.)

Second, the price level and inflation depend on monetary policy. Subject to changes in the velocity of circulation, the price level is related to the quantity of money, but money is endogenous unless it is the object of policy choice.

Third, it takes time for the economy to respond to shocks away from equilibrium. For example, wages and prices adjust with inertia, rather than immediately, to imbalances between supply and demand. As a result, there is a short-run trade-off between inflation and output—inflation tends to rise or fall as the pressure of demand on supply capacity in the economy varies. Many factors affect the nature of this shifting short-run Phillips curve, including the responsiveness of wages and prices to shocks, and expectations about inflation.

Fourth, since the United Kingdom is a small open economy, domestic output and inflation are strongly influenced by world trade and output growth, and by movements in world prices and the exchange rate.

Conclusion

At the Bank, as in economics more generally, models are no more and no less than tools to help thinking about economic problems. Their use requires art as well as science, especially in the desirable process of working back and forth between models, facts and economic judgments.

The aims and first phase of that project are described in Julius and Butler (1998).
The classic VAR paper is Sims (1980).

The Bank uses models for many purposes, including helping the MPC to form its projections for inflation and growth. Though it may be unusual, and in some ways even awkward, for forecasts to be made by committee, the direct involvement of the MPC has important advantages both for accountability and for the quality of decision-making.

A pluralist approach to models is needed because new issues keep arising that call for new tools, and for any problem there is a range of tools varying by size, complexity and the role of theory. Rather than seeking some optimal single tool, it makes sense to try several. Thus, although there is of course a core model to help the MPC make its projections, its use depends on various judgments, many of which are informed by other models. In schematic form, the process works something like this:



Finally, let me return to Keynes's concern that 'filling in figures' would devalue models as instruments of thought. Keynes was wrong about that, but he was wrong for the right reason—economic material is in many respects not homogeneous through time. (A glimmer of the Lucas critique?) But this has implications about how to be quantitative, not whether to be so. In particular, as Keynes himself put it in his next letter to Harrod:⁽¹⁾ 'One has to be constantly on guard against treating the material as constant and homogeneous', and 'do not be reluctant to soil your hands':

'The specialist in the manufacture of models will not be successful unless he is constantly correcting his judgment by intimate and messy acquaintance with the facts to which his model has to be applied'.

Likewise, the MPC will constantly be correcting its judgments by intimate and messy acquaintance with the facts as they unfold—and doing so with a great deal of help from economic models.

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Inflation and growth in the service industries

In this speech, (1) DeAnne Julius, member of the Bank's Monetary Policy Committee, highlights the growing importance of the service sector in the UK economy in recent decades. She notes that neither of the two main concerns felt by some commentators—that investment will slow in a service-dominated economy, leading to lower productivity and growth, and that new service jobs are mostly lower-skilled and

lower-paid than the manufacturing jobs that they are replacing—is justified by the evidence so far. Over the past year, employment has grown and unemployment has fallen in the United Kingdom to its lowest level in nearly 20 years, despite the loss of 129,000 jobs in manufacturing. Dr Julius concludes that one key factor may be the flexibility of the large and competitive service sector in creating jobs, which may enable the economy to reach a higher level of employment and growth while still achieving the same

May I first say how pleased I was to be invited to present one of your prestigious Vital Topics lectures here in Manchester. I have long followed the work of the Business School and, as a former businessperson myself, I have benefited over the years from its insights and ideas. I hope tonight I may be able to contribute, at least in some small way, to its future research agenda on what I consider to be an underexplored, but very large, region of our economy: namely, the service industries.

Before I get into the substance of that topic, I thought perhaps I should say something about the monetary policy backdrop that has caused me to take a particular interest in services. I don't need to say too much to this audience, because many of you will have attended the Vital Topics lecture given here last year by Eddie George, the Governor of the Bank of England. Naturally, as I began to prepare this speech, I had a look at what the Governor said to you then. As you have undoubtedly read in the papers, we are an independent lot on the Monetary Policy Committee (MPC), and we don't always agree with each other, at least when it comes to the vote on interest rates. In this case, however, I can fully support the Governor's view that giving operational independence to the Bank and setting interest rates in order to achieve the Government's inflation target provides a sound basis for delivering the low and stable inflation that is a prerequisite for sustained economic growth.

He sketched out the new framework for monetary policy, in which there is a clear division of labour between the Bank and the Government. The Chancellor specifies the inflation target at Budget time. For this year, just two weeks ago, the Chancellor confirmed that our target would remain at $2^{1}/_{2}$ % inflation per year as measured by the retail price index excluding mortgage interest payments, RPIX. This is the target we have had since the MPC was set up in May 1997.

With the target set annually by the Government, we meet monthly to discuss our analyses since the previous meeting, to review the most recent evidence on the state of the economy, to compare what has happened with our projections for the future path of growth and inflation and, finally, to debate the arguments for and against a change in interest rates. The minutes of those meetings are published on the Bank's web site two weeks later, along with the votes of all nine members of the MPC.

That is the basic process that the Governor outlined in his speech here last February. I am pleased to be able to report to you, 13 months later, that it is working very well. Inflation has been at, or within a whisker of, $2^{1}/_{2}$ % for eight months now. Because of the interest rate increases during 1997, the economy was slowed before inflationary pressures became intense; and rates peaked at 7.5% in June of last year. During the previous economic cycle, as I'm sure many of you well remember, they went up to 15% and stayed there for more than a year.

Because inflation was held in check by the interest rate rises during 1997, this country was in a good position to respond to the global economic slowdown that began later that year with the exchange rate crises in Thailand and Korea. The MPC's objective is to keep inflation in the United Kingdom as close as possible to $2^{1/2}$ %—no more, but also no less. That has meant that we have been cutting rates since last October to support demand at home as exports and international prices were weakening. We cut rates five times in five months, by a total of two percentage points, to their current level of 5.5%. This has brought mortgage interest rates down to their lowest level in 30 years, as many of you will be aware. It has helped to turn around the fall in business and consumer confidence that we saw last autumn, and it has laid the groundwork for the recovery in growth that we expect to see during the second half of this year.

(1) Delivered as the Vital Topics Lecture at the Manchester Business School on 23 March 1999. I am grateful to Nick Oulton, Services Project Director, and others at the Bank for their assistance with this paper. The views expressed are my own.

Our forecast for inflation is that it will remain on track at $2^{1/2}$ %.

Having said all this, there are probably some in this audience, perhaps especially from the manufacturing sector, who are finding the business environment that they face considerably more threatening. Output in manufacturing has fallen for five of the past six months, and prices at the factory gate, far from growing at $2^{1}/_{2}$ %, have been flat. With labour costs having risen by 3.6% over that period, it is no wonder that employment in manufacturing has been dropping and profitability is low.

The difficulties faced by manufacturers and other internationally exposed sectors are of concern to all of us. But a key constraint of monetary policy, and therefore of the MPC, is that we have only one tool, the interest rate, to use in trying to achieve a single inflation target for the country. We do not have the ability to fine-tune or differentiate our policy. It is not like fiscal policy, where a myriad of tax rates and targeted incentives or exemptions are available for the chancellor of the day to consider. We all know that at any point in time, some regions of the country and some sectors of the economy will be growing faster than others. Our task on the MPC is to give due consideration to each of them, and then to set interest rates to achieve our inflation target across all of them.

This is easier said than done. For various historical reasons, there is much more statistical detail and established survey information on the manufacturing sector than on services. This would not matter greatly if manufacturing accounted for the bulk of the economy, or if the inflation performance of the two sectors was broadly similar. Unfortunately for us, neither of these two propositions is true. Manufacturing accounts for only 22% of UK output, whereas the service sector (excluding government) accounts for 45%. The inflation rate of goods over the past year has averaged 1.4%, whereas that of services has averaged 3.4%. Furthermore, these two differences are neither recent nor random phenomena. They represent long-term trends that are also evident in other European and North American economies. That is why we need a clear understanding of how the service sector behaves, in terms of growth and inflation, in setting interest rates for the economy as a whole.

I shall start with the growth performance of the service sector, and then move on to inflation. First, an important qualification: the distinction between goods and services that I shall be using in the figures that follow is imprecise. It follows conventional statistical practices, but it obscures both the diversity within the service sector and the close linkages between the goods-producing and the service-providing parts of our economy. Each produces things consumed by the other. Part of the growth in jobs classified as services reflects the outsourcing of activities previously carried out in manufacturing firms. When an engineering plant turns over the management of its staff canteen to outside caterers then, according to the statisticians, jobs have been 'lost' in manufacturing and 'gained' in services, even if the same people are doing the cooking.

But we must make the best of the numbers we have. And in order to make useful comparisons about the economy as a whole, we have to use aggregated figures. The categories I shall be using are shown in the figure below.



As the figure shows, I divide the economy into three sectors: goods, market services and government services. The goods sector is mainly manufacturing, but it also includes construction, mining, energy and agriculture. Government services includes all the things paid for by taxation, rather than by the individual users of each service. These include the health service, education, police, defence, social services, and so on. A large share of employment is in these sectors, but one would not expect their economic behaviour to be the same as that in the private sector, where market disciplines apply.

The third sector, market services, is really the focus for tonight. These are the services provided (almost entirely) by private sector firms. This category covers a huge spectrum, and so we shall find it illuminating to subdivide it into its three main components. The first is transport and communications, which covers planes, trains, buses, mobile phones and telecommunications of all sorts. Companies providing these services are mostly large, capital-intensive firms, some of which used to be in the public sector. Trade, tourism and leisure includes wholesale trade and retail shops, hotels and restaurants, theatres and sports, and personal services such as hairdressers and aerobics trainers. Many of the companies in this part of the service sector are small firms, and most of the services they sell are to final consumers rather than other firms. Financial and business services covers banking, insurance, real estate, advertising, legal services, accountancy, contract cleaning, etc. Firms in this sector may be big or small, and employees range from the most highly skilled to the unskilled. Most of their customers are other firms, rather than households.

Chart 1 shows how output in the UK economy stacks up across these three sectors. About 45% of UK production is market services. Another 18% is government services. The final third of the economy consists of the production of goods. This chart shows why the MPC must look beyond what is happening in the manufacturing sector.

Chart 1 Output shares of GDP^(a)



(a) 1995.

Manufacturing is shown within the goods column, and by itself accounts for only 22% of total UK GDP. Almost the same percentage is contributed by trade, tourism and leisure. Another 18% comes from financial and business services. The market services sector as a whole is one third larger than goods.

Moreover, the share of market services (in constant prices) has been rising steadily over the past 20 years, apart from during the 1991 recession. By 1997, it was 10 percentage points higher than in 1979. The United Kingdom is not alone in this trend. A similar rise in the share of services output has been under way in most industrial countries. The United Kingdom now has the second-highest share of services in GDP, after the United States. Italy and Germany are among those with the lowest shares.

The picture is even more striking in terms of employment (see Chart 2). More than half of the British labour force is employed in market services, while only 19% work in manufacturing and 27% in the goods sector as a whole. Here in the North West (excluding Merseyside), the employment picture closely parallels the national average. The share of employment in market services is 46%, compared with 28% in goods and 26% in government

Chart 2 Employment shares^(a)



(a) 1996.

services. As you might expect, the highest share of employment in market services is in the South East and London, where it tops 65%, but even excluding those two areas completely, there are nearly twice as many people working in market services as there are in goods in the rest of the country. Under these circumstances, it would be risky indeed to steer monetary policy on the basis of surveys and statistics about employment or employment intentions in the manufacturing sector.

This shift of the overall economy towards market services is well illustrated by developments here in the North West. This is a region with strong historical roots in manufacturing and industrial innovation. The first storedprogram computer was built here in Manchester, and that became the basis of IBM's first digital computers in the 1950s. That high-tech tradition is in evidence not far from where we sit tonight in the Manchester Science Park. While these high value-added elements of manufacturing, such as design and the commercialisation of technology, will remain important to the region's future, the routine production and assembly tasks will inevitably continue their migration to lower-cost countries. Net job creation has been and will continue to be in services. Already, the North West is the largest centre for banking, management consulting and advertising outside London. It is the leading centre of the UK mail-order industry, with three of the top six companies headquartered here. The trade, tourism and leisure sector employs more than one quarter of the workforce, and brought more than £3 billion into the regional economy last year. The redevelopment of Salford Quays into The Lowry, with its art galleries, performance spaces and virtual reality research, provides a graphic illustration of the economic transformation of this region. The North West, like the United Kingdom as a whole, is already a service-dominated economy.

Some commentators think this is a problem. They worry that investment will slow in a service-dominated economy, leading to lower productivity and growth. They fear that new service jobs mostly require low skills and are therefore lower-paid than the manufacturing jobs that they are replacing. Neither of these concerns is supported by the evidence so far. More than half-52%-of total UK investment is undertaken by firms in market services, compared with 34% by goods sector firms. The services share has been growing, and so has the growth rate of labour productivity in the economy as a whole. During the previous economic cycle, between 1979-90, labour productivity grew at an average annual rate of 2.2%. It has accelerated during the 1990s to 2.5%, as shown in Chart 3. Productivity statistics are notoriously imprecise and volatile year to year, so I would not place a great deal of faith in the precise numbers. But in 1990-96, the sub-sectors showing the greatest growth in labour productivity were transport and communications and manufacturing. Productivity in trade, tourism and leisure grew by 2.6% per year, which is slightly above the economy-wide average. Slower productivity gains were recorded in financial and business services, and government services was the laggard, showing

Chart 3 Labour productivity growth 1990–96



virtually no productivity growth over this period. However, I stress that it is particularly difficult to measure productivity in financial and business services, so these figures may understate their true performance. And until recently, productivity growth in government services was based more on assumption than on measurement.

There is another wrinkle in relating productivity in the sub-sectors to that in the economy as a whole. The growth rate of labour productivity in the economy as a whole is determined by productivity growth in the individual sectors, and also by shifts in the allocation of resources between sectors. If some sectors within market services have low productivity growth, as the official measures suggest, then shifts of resources towards these sectors will tend arithmetically to reduce the whole-economy growth rate. But the level of productivity matters too. And here it is pertinent to note that productivity levels, measured by value-added per person employed, differ substantially between sectors. In 1997, the level of labour productivity in financial and business services was 20% higher than that in the goods sector. So shifts of jobs from goods to financial and business services may raise, rather than lower, economy-wide productivity, despite slower productivity growth in financial and business services.

This brings me to the second concern that some people have about the shift to a service-dominated economy. Are we trading in high-paying manufacturing jobs for low-paid service jobs? If automotive assembly moves off-shore, are we doomed to become a nation of hamburger-flippers? Of course, we all know that there are both high-skill and low-skill jobs in both manufacturing and services. But is there any truth to this concern at an aggregate level? Chart 4 shows how average earnings for full-time workers in the various sub-sectors currently compare. The highestpaid are in financial and business services, at an average of more than £10 per hour. Next comes government services, then goods. Jobs in these three sectors pay above the national average, and most of the people who work in these sectors provide services rather than produce goods. However, the two sectors that pay below-average wages are

Chart 4 Hourly earnings, 1998



also service sectors: transport and communications and trade, tourism and leisure. So we are left with the commonsense conclusion that there are both high-paid and low-paid jobs in the service sector: it is the level of skill, not the classification of the job, that determines pay. And this economy has been creating jobs in both the highest and the lowest-paying parts of the service sector.

In particular, over the past year, employment has grown and unemployment has fallen in the United Kingdom to its lowest level in nearly 20 years, despite the loss of 129,000 jobs in manufacturing. And inflation has remained on target as overall unemployment has dropped to these historic lows. The story is similar in the United States. There too job growth in services has more than offset job losses in manufacturing, the nationwide unemployment rate keeps hitting new lows, and inflation remains below 2%. Perhaps it is more than a coincidence that these are also the two countries with the lowest shares of total employment in manufacturing. In the United States, only 14% of the labour force works in manufacturing; in Britain it is 19%; whereas in Germany it is still 27%. A cross-country comparison (see Chart 5) shows a steady decline in unemployment rates in the United States and United Kingdom, compared with a rise in France and Germany



over the past six years. There are many reasons behind this, some cyclical, some structural, but one of the key factors may be the ability of a large and competitive service sector to create jobs of all sorts—full-time, part-time, high-skill, low-skill—in response to changes in the demand and supply conditions in both product and labour markets. Such flexibility in a very large part of the economy may enable it to reach a higher level of employment without igniting inflationary pressures.

If this is true, it would clearly be of great importance for monetary policy. It would mean that we could achieve the same inflation target at a higher level of economic growth, at least for a while. And over the economic cycle, changes in interest rates might provoke less violent swings in unemployment than in the past, as people moved from full to part-time work or into and out of the labour force. Much evidence will need to be accumulated before one can be convinced of such changes. But it is not too soon to start looking for them.

One place to look is for structural differences between jobs in services and jobs in goods. Two striking differences emerge. First, there are many more part-time jobs in services. Only 7% of goods jobs are part-time, compared with 35% of jobs in market services and 38% in government services. The differences are even greater when one looks at the biggest job creators within services. Chart 6 shows the full-time/part-time split of jobs in each of our major sub-sectors. Goods and transport and communications are at one extreme, with only 7% and 11% respectively of their jobs for part-timers. Both of these sectors have seen employment shrinking by more than 2% per year since 1990. At the other extreme are government services, where employment has been stagnant, and trade, tourism and leisure, where 43% of jobs are for part-timers and employment creation has been very strong since 1990. The other big job-creator has been financial and business services, where part-time workers account for 30% of the total. We know from the Labour Force Survey that the vast majority of people working part-time do not want a full-time job. There is a clear implication here-though not

Chart 6 Part-time jobs



Source: ONS (Annual Employment Survey).

conclusive proof—that the expanding sectors of the economy are also those with more flexible working patterns, and that those patterns attract people into the workforce.

The second striking difference between jobs in the goods and services sectors is the gender of their occupants. Put more simply, if less politically correctly, most people working in goods are men, whereas most working in services are women. Again, the difference across the sub-sectors is surprisingly great (see Chart 7). While the workforce as a whole is split almost exactly 50/50 between men and women, fully 75% of those working in goods sectors are men, while 70% of those working in government services are women. And the two sectors that have shed jobs during the 1990s are those most heavily occupied by men-goods and transport and communications-while the big job-creators are those where women make up the larger share of the workforce-trade, tourism and leisure, and financial and business services. Survey evidence again suggests that these patterns reflect the preferences of the employees, rather than discrimination on the part of the employers.

Chart 7 Women's work



In sum, women make up more than half the employees in market services. And more than half of them are part-time. By contrast, men constitute three quarters of the employees in goods, and nearly all of them are full-time. Market services have been creating jobs, while goods have been shedding them. The relevance of this to growth and inflation is that women tend to move into and out of the labour force more often than men during the course of their working lives. They spend more time in the category of 'economic inactivity', which is surely a misnomer for the state of being a housewife or a student! When the labour market is tight, they can be tempted to take a job, especially if a part-time one is on offer. This flexibility has meant that employment could expand (because much of it was in sectors willing to offer part-time work) without running into the labour market bottlenecks that have put strong upward pressures on wages, and eventually prices, during previous upswings. It is possible that this shift in the composition of

the labour force and the split between full-time and part-time employment has reduced the so-called 'natural' rate of unemployment—the rate below which inflation starts to accelerate. If so, that is good news indeed for economic growth and for the opportunities available to women. It may also have fundamental social effects on family life and the economic role of men, but that is a Vital Topic for another day.

Let me now turn to my final subject: the behaviour of inflation in the service sector. The Chancellor has set the MPC a single target for inflation, 2¹/₂% per annum as measured by RPIX. The rate at which RPIX rises is a weighted average of the rates at which the components of the index, such as goods and services, are rising. There is no target for any of the individual components. So in theory, each component can rise or fall at any rate whatsoever, provided that the average, RPIX, rises at the target rate. Just as the MPC can only seek to set monetary policy in accordance with the needs of the economy as a whole, not those of any one region or industry, so it seeks to keep the average rate of inflation at the target rate, not the prices of any particular component of the RPIX.

In practice, the inflation rates of the goods and services components of the RPIX have shown a tendency to behave rather differently. It is useful to monitor them separately, in order to understand better what is happening to inflation in the economy as a whole. One of the most striking regularities is that the prices of services tend to rise more rapidly than the prices of goods. Chart 8 shows how the goods and services components of the RPIX have moved since the beginning of the decade. Over the nine years to this January, prices in the economy as a whole have increased by slightly less than 40%. But the prices of goods have risen by about 32%, while those of services have increased by 53%. The United Kingdom is not alone in finding that services prices usually rise faster than goods prices. The same is true in the United States, Germany, France and Japan.

Chart 8 RPIX inflation



In the United Kingdom, the differential between inflation in the two sectors (inflation in services minus inflation in

goods) has averaged 1.7% over the past 15 years. There has been considerable variation over this period. During the depths of the early 1990s recession, when goods prices were particularly hard hit by the strength of sterling, the differential rose to 4.9%. Then it fell back and actually turned negative for a period in the mid 1990s, when the prices of the regulated utilities showed a strong decline. But since its trough in December 1995, the differential between services and goods inflation has been rising again, and in recent months it has been around 2%.

Services currently make up 39% of the consumption basket of households whose purchases are represented in the RPIX, while goods make up the other 61%. So if the differential between services and goods inflation is generally around 1.7%, and the Government's inflation target is $2^{1/2}$ %, then that target will be met with services prices generally rising at 3.5% and goods prices rising at 1.8%. We shall come to the reasons behind this differential in a moment. But it is important first to recognise its existence, in other countries as well as this one, and its persistence over time, albeit sometimes exacerbated or masked by movements in the exchange rate or changes in government taxes or regulations. It would not be appropriate to conclude, as some commentators have, that with goods prices rising at only 1.8%, the inflation target will eventually be undershot. Nor is it appropriate to worry that because service prices are rising by 3.5%, the inflationary pressure in the economy is too high for the continued achievement of the overall inflation target without a rise in interest rates. Since inflation in services is sometimes used as a proxy for the economists' unobservable concept of 'domestically generated inflation', this persistent differential is an important qualification to keep in mind. A rate of services inflation of 3.5% will generally be consistent with achieving an inflation target of $2^{1/2}$ %.

The overall rate of inflation is a monetary phenomenon, but the inflation differential between services and goods is a real phenomenon: it is the rate at which the relative price of goods and services is changing. It is determined by real forces at work in the international economy, and is largely independent of monetary policy. To illustrate, the differential between services and goods inflation is about the same now, 2%, as it was in January 1988. But RPIX inflation then was 4.6%, whereas in January 1999 it was 2.6%.

So what are the real forces that determine the differential? We may get a clue by seeing if it is specific to particular service prices, or if it is more widespread. Chart 9 shows the total percentage increase since 1987 in the prices of the 22 service components of the RPIX compared with goods. Nearly all of the services prices rose faster than goods. In fact, the only services whose prices rose more slowly than goods were regulated by government: telephone charges, gas, TV licences and electricity. (Parenthetically, not all regulated services showed such price restraint. Water charges rose faster than any other component of the RPIX over this period.) But the striking fact remains that where



prices are determined in competitive markets, services prices show a widespread tendency to rise relative to goods prices.

Research is under way at the Bank and elsewhere to explain what lies behind this. The two factors that appear to be the most important in explaining the differential are, first, the degree of labour intensity of the industry and, second, its rate of productivity growth.

Take labour intensity first. Firms that employ more labour than capital compared with other firms will find that their total costs are relatively more dependent on their wage costs. We have already seen that wages differ widely across industries and occupations. But there is a broad tendency for average wages to rise over time at the rate of inflation plus the average rate of productivity growth in the economy as a whole. Meanwhile, at least over the past decade, the cost of many capital goods has actually fallen, especially those incorporating computer technology. So more labour-intensive firms, where wages are a higher proportion of total costs, have seen their costs rise faster, and have been able to pass on some of this in higher prices.

Next, consider productivity growth. Opportunities for raising efficiency differ between industries. In some, new technology brings a flood of new ideas, new techniques and, often, labour-saving new machines. In others, much less change is apparent. Rapid productivity growth leads initially to high profits. Then either the existing firms expand, or new firms enter the market, driving prices down. In other words, higher-than-average productivity growth tends to be accompanied by lower-than-average growth of prices. This has been a worldwide story, first for agriculture since the 1950s and then for much of manufacturing during the 1980s and 1990s.

It has often been argued that service industries are labour intensive and have inherently low productivity growth. So they have two strikes against them, and at first blush we seem to have a ready-made explanation for the

services/goods inflation differential. But matters are not quite so simple, and that is why further research is needed. The correspondence between service products in the RPIX and service industries is not very close. So even if it were true that services are more labour intensive and have lower productivity growth, this would not necessarily explain the differential in prices. In addition, the prices of goods in the RPIX include the prices of many servicesfor example, the wholesale and retail margins and the transport costs of getting the goods from the port or factory to the consumer. Financial and business services are a major service industry but they play a very minor role in RPIX. This is because most of their output is sold to other firms, not directly to households. But this means that the price of everything that consumers buy, whether goods or other services, is influenced to some extent by the prices charged for financial and business services. And that, of course, depends partly on productivity growth in that sector.

The problem becomes complex, and this brings us full circle to the qualification I made at the outset of this lecture: that although I am focusing tonight on the key differences between goods and services, it is also important to understand their inter-relationship in the economy as a whole. Further research, using input-output data, is under way in this area.

Let me conclude with a few words about what the future may hold for this service-dominated economy.

The shift of employment towards the service industries is a long-term trend in all advanced countries. There is no reason to think that it is about to halt, still less reverse. The sectoral pattern of employment in the United Kingdom is approaching that in the United States, which is presumably further down the road on which we are travelling. Goods still account for 27% of employment in the United Kingdom, compared with 21% in the United States.

Given the large and still-rising importance of services, the future prosperity of the British economy will largely be determined by the competitive success of its service sector. There are two ways in which the higher living standards and better public services that most people want can be achieved. The first is through rising productivity. Here, the record of services is rather mixed. In transport and communications, productivity growth has been strong, but that may partly reflect the large one-off gains many companies in this sector made after privatisation. Productivity growth in other market services has tended to be below average, at least if we rely on official measurements. However, there are some well-known difficulties in measuring output in services, and the problems are particularly acute in financial and business services. So it is possible that productivity growth may be faster than statistical estimates currently show. Certainly the skills base in this sector is strong, wages are high, exports have been growing and profitability has been above the

economy-wide average. These are all signs of a highly competitive industry.

The second route to higher living standards is through expanding employment opportunities. Unlike rising productivity, which in principle can go on forever, there is an upper limit to the size of the labour force. But one of the surprises of the long-running US expansion has been the continuing rise in the participation rate of women and older people in the job market. In the short to medium term, getting more of the population into work has important economic as well as social benefits. That requires upgrading the skills of those who find it difficult to hold a job. And it requires more flexibility in job specification, so that different working hours and working patterns are on offer to suit the diverse preferences of different workers. Service sector jobs seem to fit this bill. The United Kingdom has built an enviable record of job creation in private sector services over the last decade. No one welcomes the jobs lost in manufacturing, but we should not let this blind us to the impressive gains made in services. Concerns that a service-dominated economy will suffer from low productivity or low wages are not supported by the evidence, either in this country or in the United States. There is evidence that inflation is generally higher in services than in goods, but this persistent differential, when properly understood, does not threaten the achievement of the inflation target for the economy as a whole. Indeed, it is just possible that the greater flexibility of jobs in services may be helping us to achieve low and stable inflation at lower levels of unemployment than this economy has managed for many decades.

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