Bank of England Quarterly Bulletin



May 1997

Volume 37 Number 2

Bank of England Quarterly Bulletin

May 1997	
Summary	121
Recent economic and financial developments	
The operation of monetary policy Box on auctions of US Treasury Inflation Indexed Notes Box on the Government's financing requirement and remit to the Bank of England for 1007/08	123 128
The international environment Box on German and French industrial surveys	143 145
Research and analysis	
Comparing the monetary transmission mechanism in France, Germany and the United Kingdom: some issues and results	152
Economic models and policy-making	163
The information in money	174
Features of a successful contract: financial futures on LIFFE	181
Reports	
The first year of the gilt repo market Box on the impact of the gilt repo market on the monetary statistics	187 193
The gilt-edged market: the Bank of England's relationship with the gilt-edged market makers and inter-dealer brokers	198
The Bank of England's operations in the sterling money markets	204
Executive summary of the single monetary policy in Stage 3	208
The financing of technology-based small firms: an update	210
Speeches	
International regulatory structure: a UK perspective Speech by the Deputy Governor on 22 February at the Federal Reserve Bank of Atlanta	214
Bond yields and macroeconomic behaviour Speech by the Governor on 25 February at the Euromoney International Bond Congress	222
Monetary policy and the exchange rate Speech by Mervyn King on 27 February to the Governors of the National Institute of Economic and Social Research	225
European central banking — East and West: where next? Lecture by the Deputy Governor on 4 March at the London School of Economics and Political Science	228

Printed by Park Communications © Bank of England 1997 ISSN 0005-5166

The Quarterly Bulletin and Inflation Report

Inflation Report (published separately)

The operation of monetary policy (pages 123–42)

The international environment (pages 143–51)

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. Section 1 considers retail prices, Section 2 investigates money, credit, and financial market data, including the exchange rate, and Sections 3, 4 and 5 examine demand and output, the labour market and firms' pricing behaviour respectively. Section 6 presents the Bank's medium-term inflation projection, the risks surrounding it, and information about non-Bank inflation forecasts.

UK official interest rates remained unchanged at 6% in the first quarter of 1997. Sterling appreciated by a further 2% in effective terms, to 98.0 on its exchange rate index. Gilt yields, in common with yields on government bonds in many other major economies, rose in this period. The Bank introduced reforms to its daily operations in the sterling money markets on 3 March. Gross gilt sales were £9.7 billion, bringing the total for the 1996/97 financial year to £38.8 billion. The Government's financing requirement and remit to the Bank of England for the 1997/98 financial year was published on 12 March.

Activity in the United Kingdom's major export markets has firmed a little since the start of the year, but big differences remain among the major economies. Activity in Germany, France and Italy was very weak around the year end though there were signs of a moderate improvement by March, largely in the export sector. Activity has been more buoyant in many of the smaller EU countries. The recovery in Japan continues to be uneven. Official interest rates in the United States were increased in March; they were also increased in the Netherlands in February and March. Rates remained unchanged in Germany and Japan but were cut in Portugal and Spain. Inflation remained low in the United States, despite a pick-up in earnings growth. Considerable spare capacity remains in the labour markets in Japan and continental Europe; wage pressures have been subdued. Within the European Union, inflation rates continue to converge; new harmonised measures of consumer prices were published for the first time in February. The US dollar, sterling and the Canadian dollar appreciated on an effective basis during the first quarter of 1997; the yen, lira, Deutsche Mark and French franc depreciated over the same period.

Research and analysis (pages 152–86)

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

Comparing the monetary transmission mechanism in France, Germany and the United Kingdom: some issues and results (by Erik Britton and John Whitley of the Bank's Conjunctural Assessment and Projections Division). In this article, Erik Britton and John Whitley analyse the importance of structural differences between the economies of the United Kingdom, France and Germany for the response of output and prices to changes in monetary policy. They review previous studies and report results from a complementary empirical approach, summarising the evidence as inconclusive. They argue that some of the commonly cited differences are not really structural and that even where they are, they do not automatically imply that one economy will be more sensitive than another to a change in monetary policy.

Economic models and policy-making (by John Whitley of Conjunctural Assessment and Projections Division). In this article, John Whitley describes and evaluates the role of macroeconomic models at the Bank of England in the process of policy advice. He outlines how large macroeconometric models were used in the 1970s and 1980s; the reasons why they did not meet the needs of policy-makers; and how the need to incorporate uncertainty about the workings of the economy into policy-making has led to a more eclectic and judgmental approach to models at the Bank of England.

The information in money (by Mark S Astley of the Bank's Structural Economic Analysis Division and Andrew G Haldane of the Bank's Monetary Assessment and Strategy Division). The monetary and credit aggregates are among many indicators used to consider future prospects for inflation. This article assesses the information contained in money and credit about future real activity and inflation. Some of the sectoral components of money and credit are found to have explanatory power over certain disaggregated components of spending. But none of the aggregates is sufficiently reliable to justify looking only at money when formulating an inflation assessment.

Features of a successful contract: financial futures on LIFFE (by Allison Holland and Anne Fremault Vila of the Bank's Markets and Trading Systems Division). The success of a futures contract, defined as its long-term survival, has generally been linked to the existence of a large and volatile spot market and to a design that makes the contract highly effective for hedging purposes. This article examines the importance of these and other factors, using data on the financial futures contracts introduced by LIFFE between 1982 and 1994.

The first year of the gilt repo market. The gilt repo market began in January 1996, and in March 1997 the Bank started conducting daily money-market operations in gilt repo. This article reviews the growth and structure of the market, looks at the uses of gilt repo that have contributed to this growth, and describes its impact on the gilt market and the sterling money markets in terms of greater liquidity, lower financing costs, improved hedging opportunities, and the development of a liquid market in secured money.

The gilt-edged market: the Bank of England's relationship with the gilt-edged market makers and inter-dealer brokers. The Bank of England announced in December 1996 that it would no longer require the gilt-edged market makers (GEMMs), its counterparties in the gilt market, to be separately capitalised firms. This change, which took effect from 3 March 1997, allows firms to merge their specialist gilt-edged market-making subsidiary into their main operating entity if they so wish. The Bank's counterparties must, however, continue to satisfy a range of obligations. The paper sets out these obligations and the facilities available to market makers. The paper also covers the role in the gilt market of the inter-dealer brokers, who provide a service to the GEMMs and continue to be subject to supervision by the Bank.

The Bank of England's operations in the sterling money markets. On 3 March the Bank introduced reforms to its daily operations in the sterling money markets, through which it implements monetary policy. The changes relate to the mechanics of its day-to-day operations in the money markets; they do not alter its basic approach to implementing monetary policy, which remains to manage short-term interest rates through open market operations. This article describes the arrangements for the Bank's money-market operations, including those aspects which have not been changed.

Executive summary of the single monetary policy in Stage 3. This is a summary published by the European Monetary Institute (EMI) of its report on the alternative strategies for conduct of a single monetary policy by the European System of Central Banks (ESCB) in Stage 3 of Monetary Union. This follows the article in the previous edition of the *Quarterly Bulletin* which gave the Bank's views on the EMI's proposals for the operational framework.

The financing of technology-based small firms: an update (by Adrian Piper and Melanie Lund of the Bank's Business Finance Division). In October 1996, the Bank published a report on the problems faced by technology-based small firms. A summary of the main findings and recommendations was published in the February Quarterly Bulletin. This article outlines recent discussion of this issue and highlights areas where the Bank intends to carry out further work.

Reports

(pages 187–213)

The operation of monetary policy

- UK official interest rates remained unchanged at 6% in the first quarter of 1997.
- Sterling appreciated by a further 2% in effective terms, to 98.0 on its exchange rate index.
- *Gilt yields, in common with yields on government bonds in many other major economies, rose in this period.*
- The Bank introduced reforms to its daily operations in the sterling money markets on 3 March.
- Gross gilt sales were £9.7 billion, bringing the total for the 1996/97 financial year to £38.8 billion.
- The Government's financing requirement and remit to the Bank of England for the 1997/98 financial year was published on 12 March.

Introduction

Developments in financial markets in the first quarter of 1997 reflected the continuing perceived divergence between the economic cycles of the United States and the United Kingdom on the one hand, and the major continental European Union (EU) countries and Japan on the other. Continuing evidence of robust economic activity resulted in an upward revision of interest rate expectations for the United States and the United Kingdom relative to Germany and France in particular, which were experiencing slower growth, and to Japan, where uncertainties remained about how much private sector growth would pick up given the prospect of a fiscal tightening after April.

While there was no change in UK official interest rates in this period, there were significant shifts in market expectations of the future path of official rates. There was some expectation of a rise early in the quarter, but between the middle of January and the end of February domestic markets advanced as markets interpreted UK data releases in the main as being less suggestive of inflationary pressure than they had anticipated. Expectations of the timing of an increase in official rates were postponed, and expectations of the extent of the eventual tightening of monetary policy were revised down. Sterling's continuing rise also appears to have been a factor in moderating market expectations of future official interest rate rises. Sentiment began to shift towards the end of the period, however, and there was a particularly sharp rise in money-market and gilt yields following the release of labour market and retail sales data on 19 March. By the end of the quarter, money-market rates were consistent with an expectation of a moderate rise in UK official rates in the spring or early summer.

Internationally, financial markets were influenced by the increasing expectation, and the implementation, of an increase in US official interest rates. The Fed Funds target was raised by 25 basis points to 5.50% on 25 March, the first tightening of US monetary policy

Table A Interest rates, gilt yields and exchange rates; selected dates^(a)

	Interest rates (per cent per annum)					Gilt yields (b) (per cent per annum)				Exchange rates		
	Sterling interbank rates (c)		Short sterling future (d)	Convent	ionals	Index-linked						
	1 month	3 months	6 months	12 months	3 months	Short	Medium	Long	Long	ERI	\$/£	DM/£
31 Dec. 1996 18 Feb. 1997 7 Mar. 1997 19 Mar. 1997 27 Mar. 1997	65/32 63/16 61/32 61/16 63/32	615/32 63/16 65/32 61/4 65/16	621/32 611/32 611/32 615/32 69/16	615/16 65/16 65/8 627/32 615/16	6.92 6.46 6.41 6.67 6.67	7.27 6.78 6.93 7.28 7.37	7.51 7.08 7.30 7.59 7.63	7.62 7.27 7.48 7.72 7.76	3.58 3.39 3.51 3.58 3.61	96.1 96.8 98.1 96.3 98.0	1.7120 1.6017 1.6052 1.5968 1.6303	2.6373 2.7085 2.7590 2.6850 2.7345

Close-of-business rates in London

Gross redemption yield. Representative stocks: short: 7% Treasury 2001; medium: 71/2% Treasury 2006; long: 8% Treasury 2015; index-Linked—21/2% Index-Linked Treasury 2016 (real yield assuming 5% inflation). Middle-market rates. Implied future rate: June 1997 contract. (b)

Chart 1 Effective exchange rate indices: United Kingdom, United States, Germany and Japan







for over two years. By the time of its implementation, financial markets had largely discounted the move and reacted calmly. The Chairman of the Federal Reserve Board, in his Humphrey-Hawkins evidence to the Senate Banking Committee on 26 February, had highlighted the continued absence of excessive price pressure in the United States but had emphasised the increasing utilisation of capacity and the need for the authorities to ensure that they acted pre-emptively against inflation. Anticipation of the tightening was heightened by stronger-than-expected US data on activity, and helps to explain why yields in most major government bond markets, which had fallen in the first half of the period, began to rise from the end of February.

Foreign exchange markets

In the foreign exchange markets the appreciation of the US dollar was the most significant development in this period: the dollar rose by over 5¹/₂% in effective terms, and the appreciation was broadly based, with the dollar rising against all currencies in its exchange rate index (ERI) basket. The relative rise of US short-term and longer-term interest rates appears to have supported the dollar's rise. US short-term interest rates, as implied by three-month eurodollar deposit futures contracts, rose significantly, and the implied money-market term structure steepened. German short-term interest rates, as implied by three-month euromark deposit futures contracts, also rose over the quarter as a whole, but more modestly. Early in the period concerns about the economic impact of the prolonged weakness of the German labour market increased, and the German money-market curve flattened as expectations of a tightening of monetary policy were postponed. The yield differential between ten-year US Treasuries and German Bunds also rose and reached 110 basis points in early March (the highest level since 1989), which coincided with the dollar's peak for the quarter at just below DM 1.72 in early March. At around this time, the release of stronger-than-expected German fourth-quarter GDP figures and inflation data, and persistently high M3 growth, contributed to a rise in expected short-term interest rates in Germany. Bund yields rose further than those on US Treasuries in March, apparently as concerns rose about Germany's fiscal position and its prospects for satisfying the Maastricht criterion on fiscal deficits.

The dollar rose by 6% against the Japanese yen in this quarter, from ¥116 to ¥123¹/₂. It has now risen by over 50% from its all-time low at ¥79.9 on 19 April 1995 (see Chart 5). The dollar reached a high for the quarter of ¥124.67 on 7 February ahead of a meeting of the

Chart 3 **Euromark futures**(a)



Chart 4





Chart 5 US dollar/Japanese yen exchange rate



Group of Seven (G7) countries. The G7 communiqué said that misalignments in exchange markets noted in the April 1995 communiqué had been corrected. This appears to have influenced market expectations about the dollar's future value; it subsequently maintained a narrow range between ¥121 and ¥124.

The US dollar strengthened by around 9% against 'core' European Monetary System (EMS) currencies, but the depreciation of the latter in effective terms was only between $\frac{1}{2}$ and $\frac{1}{2}$. An effective exchange rate is a measure of the value of a currency against a trade-weighted basket of other currencies, and the US dollar's weighting in the baskets of 'core' EMS currencies is modest (the figures for Germany and France are 9% and 10% respectively, for example).⁽¹⁾

Within the EMS, official interest rates were reduced in France, Italy, Portugal and Spain among others; the Netherlands raised its key interest rate in two stages from 2.5% to 2.9%. These rate changes appear to have had little impact on exchange markets. Fluctuating expectations about the prospects for EMU, and in particular a so-called 'wide' EMU with a relatively large number of initial participants, continued to be influential. For example, the Italian lira, which had continued to trade firmly against the Deutsche Mark following the reduction in Italian official interest rates on 23 January, fell by 2% from Lit 970 towards its central rate of Lit 990 between 28 January and 5 February, apparently triggered by concern that Italy would fail to meet the Maastricht fiscal criteria. Moreover, the decline seen in the last quarter of 1996 in the Italian three-month interest rate implied by the December 1997 eurolira futures contract was entirely reversed in this period. The lira finished the quarter at Lit 998, a fall of $1^{1/2}$ % over the period as a whole.

Sterling rose by a further 2% in effective terms to 98.0 on the ERI in the first quarter. Its appreciation in this period, however, was less pronounced than in the final quarter of 1996, when it rose by 10.5% in effective terms, and was more variable. In the middle of March, for example, sterling was below its end-December level of 96.1 on the ERI, before rising in the second half of the month. Sterling fell in the first quarter against the generally stronger US dollar, by 4.8% to \$1.6303, in contrast with its rise of 9.5% to a high point of \$1.7120 at the end of the fourth quarter of 1996.

Sterling appears to have continued to be underpinned by generally robust data on the UK economy, and by positive interest rate differentials against most major EU countries and Japan. By comparing bond yields across countries, and assuming that uncovered interest parity holds in foreign currency markets, implied forecast paths for any number of sterling exchange rate bilaterals can be mapped out.⁽²⁾ In practice these paths rarely materialise, because the exchange rate reacts to 'news' about the real economy and about monetary policy, both in the United Kingdom and elsewhere. Nevertheless, by focusing on how these paths shift over time, it is possible to estimate that part of the unexpected movement in the spot exchange rate that is consistent with movements in relative yields. In this period, around half of sterling's appreciation against the Deutsche Mark may reflect an

See 'Revisions to the calculation of effective exchange rates', in the February 1995 edition of the *Quarterly Bulletin*, pages 43-48, for a discussion of the basket's composition.
 See the box on page 16 of the February 1997 *Inflation Report* for more detail.

Chart 6 Effective exchange rates: Germany, France and the Netherlands



Table BSterling exchange rates

1990 = 100

	<u>1996</u> 31 Dec.	<u>1997</u> 31 Jan.	25 Mar.	27 Mar.	Percentage change since 31 Dec.
£/DM	2.6373	2.6233	2.7365	2.7345	3.7
£/\$	1.7120	1.6027	1.6183	1.6303	-4.8
£/¥	198.68	194.46	200.46	201.54	1.4
£ index	96.1	94.4	98.0	98.0	2.0

Chart 7

Sterling exchange rates



anticipated increase in UK interest rates relative to those in Germany. And perhaps as much as one third of sterling's depreciation against the dollar might be accounted for by an anticipated relative increase in US interest rates.

As often in the past, the dollar's rise was also a supportive factor for sterling. In January and February, for example, a rally in the sterling money market saw the three-month interest rates implied by short sterling futures contracts fall by more than similar rates implied by eurodollar, euromark and Pibor (the French interest rate futures) contracts. Despite this, sterling rose to DM 2.7740 on 7 March, marginally below its former ERM floor of DM 2.7780, at the same time as the dollar rose to its high for the period against the mark of DM 1.7210; sterling had, however, fallen to \$1.6125 from \$1.7120 at the end of December.

In the following two weeks sterling retreated from these levels because of a combination of factors. Financial markets' concerns around this time that Germany might fail to meet the Maastricht fiscal deficit criterion, and hence that EMU might be delayed, had the effect of strengthening the Deutsche Mark against a wide range of currencies, including sterling and the dollar. Sterling fell against both the Mark and the dollar following the announcement on 17 March that the United Kingdom's General Election would be held on 1 May, apparently as financial markets focused on the potentially unsettling effects of a long election campaign. However, interest rate differentials moved sharply in favour of sterling on 19 March as a result of the release of UK labour market and retail sales data: between 18 March and 27 March, sterling rose by 2¹/₂% against both the dollar and the Mark from \$1.5869 and DM 2.6643 to end the quarter at \$1.6303 and DM 2.7345.

Sterling money markets

UK official interest rates remained unchanged at 6% in the first quarter of 1997. Within the period, however, there were significant shifts in market expectations of the future path of short-term interest rates as evidenced by the three-month forward rate curve implied by short sterling futures contracts.

In the final quarter of 1996 market expectations of the path of short-term interest rates had been revised up, both in the immediate aftermath of the 25 basis point increase in official rates to 6% on 30 October and, subsequently, in the wake of stronger-than-expected data on prices and activity. At the beginning of 1997, there was therefore some expectation in the market that official interest rates might soon be raised further, either as a result of the Monetary Meeting scheduled for 15 January or that on 5 February. However, the money market began to rally in advance of the January Meeting, influenced in part by similar moves in the US and German money markets, but also by domestic producer price data and a retailers' survey which were interpreted by the market as being less strong than it had expected. The rally continued after the January Monetary Meeting, when it became clear that official interest rates had not been increased. The market was influenced in this period by domestic data releases which it interpreted as being less suggestive of a build-up in inflationary pressure than it had earlier thought: it appears to have focused in particular on the retail price and the retail sales data for December, which were released on 16 and 22 January respectively. The rally









Chart 10

Mean and mode of the implied distribution for three-month sterling interbank rates at June 1997^(a)



in the money market also seems to have been influenced by the appreciation of sterling (the lowest rates implied by short sterling contracts coincided with sterling's peaks in early March), apparently in reaction to official comments and to the minutes of Monetary Meetings which suggested that the effects of the appreciation of sterling were a factor in the authorities' current assessment of monetary conditions.

The rally in the money market began to reverse from the beginning of March, influenced in part by the retreat of sterling from its peak levels, and also by the general international rise in implied short-term interest rates after the Chairman of the Federal Reserve Board's Humphrey-Hawkins evidence. There was a sharp change in UK market sentiment on 19 March, when labour market and retail sales data for February were released, both of which were stronger than the market had expected; it seems to have taken the view that inflationary pressure in the UK economy was greater than it had thought for much of the quarter. This resulted in a significant rise in implied yields on the day: the rate implied by the June short sterling contract rose by 17 basis points, and the contracts beyond this rose in a broadly parallel fashion by around 20 basis points.

By the end of the quarter the three-month forward rates implied by short sterling contracts from the start of 1998 and beyond were a little higher, but not significantly so, than they were at the end of December. This suggested that over the period as a whole, the market had not fundamentally revised its view on how far monetary policy would be tightened over the next two to three years. On 27 March, the June 1997 contract implied a rate of 6.67%, which was consistent with an expectation of a moderate tightening of policy in the spring or early summer, although anecdotal comment suggested that the market did not expect an increase in official interest rates until after the General Election.

Using the prices of options on short sterling futures contracts it is possible to construct the market's implied probability distribution for future interest rates.⁽¹⁾ Chart 10 shows the evolution of the mean and the mode of the distribution for the June 1997 short sterling futures contract. Intuitively, if the mean (the expected interest rate, which should equal the rate implied by the price of the futures contract) is above the mode (the most likely outcome) of the distribution, it suggests that the market attaches a higher probability to interest rates being much higher than the mean than they do to rates being a corresponding amount lower. For both June and September 1997 contracts, the positive differential between the mean and the mode of the distributions narrowed towards the end of January. This reduction was sustained when, from the middle of March, the expected interest rate implied by the price of these contracts rose. This suggests that the market continued to perceive the balance of risks as being fairly symmetrical around the mean.

Gilt yields and inflation expectations

The yield on ten-year gilts rose over the quarter from 7.51% to 7.63%. The ten-year yield spread of gilts over German Bunds and French OATs was little changed at around 180 and 190 basis points respectively (the spread between ten-year nominal forward rates is not nearly so great—see below); but gilts, like Bunds and OATs,

For a discussion of this, see the box 'Estimating market expectations of short-term interest rates' on pages 10–11 of the February 1997 Quarterly Bulletin.

Auctions of US Treasury Inflation Indexed Notes

Inflation indexed government bonds have been issued in the United Kingdom since 1981. After considering the issue of such bonds for a number of years, the US Treasury began issuance of its Inflation Indexed Notes in January 1997. The Treasury believes that the new notes will enable it to reduce its borrowing costs, as well as provide information on the market's expectations of inflation. The design of the notes is based on that of Canada's Real Return Bonds, with indexation to CPI-U (the US City Average All Items Consumer Price Index for All Urban Consumers). Both principal and interest payments are adjusted for inflation; indexation has a three-month lag to allow for the compilation and publication of the index. A shorter lag is possible than for index-linked gilts since it is not necessary to know the next dividend to compute the accrued interest. Instead, accrued interest for a given date is based on cumulative movements in the CPI running from the last coupon date, lagged by three months.

Inflation Indexed Notes are issued quarterly by single price auction on a real yield basis. The initial offering of \$7 billion of a ten-year note was followed in April by an \$8 billion reopening of the same issue. The coupon rate of $3^{3}/8\%$ was set at the inaugural auction by rounding the clearing yield of 3.449% down to the nearest eighth. Bids at the first auction totalled more than \$37 billion, producing a cover statistic of 5.31, more than double the demand of a typical conventional Treasury auction. The large cover statistic was partly attributed to strong client demand for the issue. Investor demand at the second auction was much more subdued; the note cleared at a yield of 3.650%, 3 basis points higher than expected by the market. Cover at the auction was 2.26, which, although considerably lower than in the first auction, is broadly in line with the typical cover at conventional auctions. No decisions have been made about whether the January issue will be reopened at the third auction, scheduled for July. Treasury officials have, however, indicated that they intend to issue a new maturity at some stage this year and another in 1998.

Since the first auction, turnover in the secondary market has been a fraction of that for the comparable conventional Treasury note. In an active day for the indexed note, \$100 million of stock might trade, compared with perhaps \$5 billion of the ten-year conventional Treasury. The Chicago Board of Trade has filed for government permission to trade futures and options contracts on the US indexed notes. These will allow traders to take a position on moves in real yields or the CPI, and could enhance liquidity in both the US and other index-linked bond markets. However, it is not clear at this stage when these contracts are likely to be available.

Chart A shows that the introduction of the US indexed notes has had little impact on the real yield differentials between the different index-linked bond markets, with only

Chart A

Real yields on index-linked bonds



the convergence between UK and US yields standing out (differences in the method of calculation of real rates mean, however, that they are not strictly comparable).

Comparing the real yield on the indexed note with the nominal yield on a ten-year conventional note allows calculation of the break-even inflation rate (for a tax-exempt institution). The break-even rate gives an indication of US average market expectations of CPI-U inflation over the next ten years, though the derived measure will also reflect the inflation risk premium and any other premia that may exist such as an index risk premium or liquidity premium. Chart B compares the break-even inflation rate for the US note with that for the twelve-year index-linked gilt for a tax-exempt investor. Once indexed securities have been established at other maturities it should be possible to construct a term structure of inflation expectations, as can be done for the UK market.



Chart B Break-even inflation rates

Chart 11 Ten-year benchmark yields^(a)



Chart 12 Gilt par yield curves



Chart 13 Six-month forward rates at ten years^(a)



outperformed US Treasuries, with the ten-year yield spread narrowing by almost 60 basis points to end the period at 78 basis points.

In the first half of the period, the same influences that were bringing about a rally in the money market—falling yields in continental European markets, weaker domestic data releases than the market had expected, and sterling's appreciation-also helped gilt yields to fall. Sentiment in the gilt market began to turn at the end of February, when yields began to rise in common with those in government bond markets internationally on a strengthening expectation that US official interest rates would soon rise. Gilt yields rose further, and yield spreads against Treasuries and the major European government bond markets widened, when domestic labour market and retail sales data were released on 19 March, which initiated the significant shift in market expectations of the path of UK short-term interest rates described above: the yield on ten-year gilts rose 12 basis points to 7.59%, and the spread over Treasuries and Bunds widened by 12 and 11 basis points respectively.

UK implied six-month annualised forward interest rates derived from the gilt yield curve fell in the first half of the quarter, before rising again to end the quarter higher. The rise was greater at the shorter maturities, and the term structure flattened. Chart 13 shows six-month annualised forward interest rates at ten years for the United Kingdom, Germany and the United States. In the last quarter of 1996 there had been a narrowing of the market's expectation of the extent to which UK short-term interest rates would be above those of the United States and Germany in ten years time. In the first quarter of 1997 there was on balance little further change in the differentials between these implied forward rates.

The increase in UK forward rates is consistent with higher forward inflation expectations, which are derived from the yields on conventional and index-linked gilts. There was a small rise in the real yield on index-linked gilts at all maturities in this period.⁽¹⁾ The trend in longer and shorter-term inflation expectations was downward between the second half of August 1996 and the end of the year. Inflation expectations at all maturities rose in early January, which coincided with the brief period of bearish sentiment in domestic markets described above, before resuming a downward trend. Towards the end of the quarter, however, as expectations grew of an early tightening of US monetary policy, and particularly following the sharp increase in UK interest rate expectations in the middle of March, inflation expectations increased. The rise was particularly marked in short and medium-term inflation expectations (at three and five years), with the effect more muted further along the maturity spectrum.

Other UK capital markets

The UK equity market, in common with most other major equity markets, rose over the period as a whole, and reached new highs in the second week of March before partly falling back. The FT-SE 100 index rose by 4.7% between the end of December and the end of March, from 4,118 to 4,313, and peaked at 4,444 on

⁽¹⁾ The box which accompanies this article describes the launch of US Treasury Inflation Indexed Notes, and the convergence of UK and US real yields.

Chart 14 Yields on index-linked government stock



11 March. Lower market interest rates and strong reported corporate profits helped support the rise in the first two months of the quarter. The subsequent retracement was influenced by the same factors that brought about the change in sentiment in other domestic markets: firming expectations of a rise in US interest rates and stronger-than-expected UK data releases in the middle of March. Equity markets' immediate reaction to the announcement on 25 March of the tightening of US monetary policy was muted, which suggested that the move had been discounted in the previous few weeks. UK and most continental European markets were closed for the Easter holidays in the last few days of March, during which the US equity market fell sharply as investors began to consider the possibility of further rises in US official interest rates. The UK and most other European markets fell on reopening after the Easter break on 1 April: the FT-SE 100 ended the day 65 points lower than its closing level on 27 March, at 4,248.

Total fixed-rate sterling bond issuance was particularly high at £13.8 billion in the first quarter of 1997. The reinvestment of proceeds from a large number of redemptions and buy-backs in late 1996, together with significant interest from investment funds, boosted demand for sterling paper in the first few weeks of the year. Subsequently, however, the most significant source of demand appears to have been continental European and Japanese retail investors. Such investors were purchasers of a large number of smaller denomination sterling bonds, as well as several dual yen/sterling currency issues that gave exposure both to sterling and

Chart 15 Implied inflation expectations



This 3D surface illustrates how the implied forward inflation expectations curve has evolved day by day. The shading emphasises the level of implied forward inflation rates at any given point on the surface. The implied forward inflation rates are annualised six-month rates derived from the yields on conventional and index-linked gilts.

Operation of monetary policy

Chart 16 Major equity indices^(a)



Chart 17

Net total issues of sterling debt instruments by overseas institutions



to higher UK interest rates. A large proportion of issues $(\pounds 8.7 \text{ billion})$ in the quarter was for maturities under seven years, as attractive interest rate swap rates meant that it was relatively advantageous for issuers to raise fixed-rate debt and swap into floating-rate liabilities. Issuers of such bonds were primarily overseas financial institutions but also included overseas corporates, overseas public bodies and supranationals. Total net issuance by overseas institutions in this period was particularly high, at $\pounds 7$ billion (Chart 17).

The US government agency, Federal National Mortgage Association (FNMA), brought the inaugural sterling global issue which, unlike a normal eurobond, is listed outside as well as within Europe, notably in Japan and the United States. Around 47% was sold in the United Kingdom, 20% in Asia, 18% in continental Europe and 15% in the United States. The original £1 billion five-year issue was heavily oversubscribed and the 10-basis-point issue spread over the 2002 gilt narrowed to under 7 basis points in secondary trading. The bond was subsequently reopened and a further £250 million issued, although the spread over the gilt then widened to 15 basis points. Another US government agency, Federal Home Loans Board, issued a second, though smaller, sterling global soon after FNMA's initial offering.

Floating-rate note issuance amounted to $\pounds 2.2$ billion, and was predominantly by financial institutions, both United Kingdom and overseas. Of these, $\pounds 600$ million had legal maturities of over 15 years but with step-up and call options at ten years.

The Bank's operations in the sterling money markets

On 3 March the Bank introduced reforms to its daily operations in the sterling money markets, which had been outlined in a paper published on 4 February.⁽¹⁾ The main elements are that the Bank has extended the range of instruments used in its daily operations

Chart 18 How the Bank's daily refinancing was provided, March 1997



(1) Reform of the Bank of England's operations in the sterling money markets, known as the 'Pink paper'. The reforms are outlined on page 12 of the February *Quarterly Bulletin*, and an article, 'The Bank of England's operations in the sterling money markets', in this edition of the *Bulletin* describes the new arrangements for the Bank's operations in the money market, see pages 204–7.

to include gilt repo; broadened the range of counterparties to include active participants in either or both of the gilt repo and eligible bill markets; and made some technical changes to the arrangements by which it may operate in the market at the end of the day to adjust for any late imbalance that may have arisen.

The transition to the new operating arrangements has been smooth. The Bank now has more counterparties in its daily money-market operations, comprising banks (including a number of discount houses), building societies and securities firms that have satisfied the Bank that they meet the functional criteria for counterparties. Chart 18 shows a breakdown of the instruments used in the daily refinancing operations in March, and shows that gilt repo quickly established a major role. Gilt repo via open market operations (OMOs), either in the form of delivery-by-value or member-to-member deliveries through the Bank's Central Gilts Office (CGO), comprised just over 50% of refinancing. The continuing importance of eligible bills, which may either be repoed or sold outright, is attested by their total share of a little over 47% of refinancing. Outright sales of eligible bills offer counterparties additional flexibility in the maturity at which they take refinancing, as bills may be offered for sale with any maturity up to the maturity of the longest-dated repo offered in that day's OMOs. In this context it is interesting to note the share of outright sales of eligible bank and Treasury bills in the OMOs: together they accounted for almost 39% of refinancing in March.

The inclusion of gilt repo and new counterparties active in gilt repo in the daily operations has increased the capacity of the market to clear shortages, and also appears to have given the market as a whole greater depth. The gilt repo market is most active in the morning, and proportionately more of the refinancing applied for at the Bank's 9.45 am round of OMOs is in the form of gilt repo than of repo or outright sale of eligible bills. For the 12 noon round of OMOs the relative proportions are more even, and at the final daily round of OMOs, at 2.30 pm, offers of outright sale of eligible bills predominate. In recognition of the greater liquidity of the gilt repo market in the morning, the Bank has been prepared to provide proportionately more of the day's refinancing need through its 9.45 am round of OMOs, and to offer a 9.45 am round on slightly smaller shortages, than under the previous operating system. The further reduction of volatility in short-term market interest rates, which coincided with the introduction of the new operating arrangements, provided a stable background for this adaptation of the pace at which the Bank supplies liquidity to the market through the day.

The discount houses' end-of-day repo facility was used on eight days in March, and the settlement banks' repo facility was opened just once, on Wednesday 5 March. On this occasion, the Bank's counterparties had not applied for sufficient refinancing to clear that day's official estimate of the daily shortage by the time of the Bank's final round of OMOs at 2.30 pm or via the discount houses' repo facility. This would not normally of itself be sufficient reason for the Bank to make the settlement banks' repo facility available, but other factors on that day that led the Bank to judge that it would be appropriate on this occasion. There were reports of difficulties in the equity settlement system, which made it possible that market participants were only learning their true liquidity positions relatively late in the day. There was also an element of

Chart 19 Sterling interbank overnight rate, high





Table C Influences on the cash position of the money market

f billions: not seasonally adjusted Increase in settlement banks' operational balances (+)

	1996/97	1996/9	7	
	AprDec.	Jan.	Feb.	Mar.
CGBR (+) Net official sales	17.8	-5.5	5.4	7.3
of gilts (-) (a)	-21.6	-3.1	0.8	-2.4
National Savings (-)	-4.3	-0.4	-0.1	0.0
Other	-1.0 -0.4	0.8	-0.2	-1.3
Tatal	10.1	7.0	4.2	57
Iotai	-10.1	-7.9	4.5	5.7
Outright purchases of Treasury bills and Bank bills	-0.1	2.9	-3.1	-2.0
Repos of Treasury bills, Bank bills, and British Government stocks and				
non-sterling debt	3.6	3.8	-0.2	-2.3
Late facilities (b)	-0.4	0.2	-0.2	-0.1
Total refinancing	3.2	7.0	-3.5	-4.4
Treasury bills: market issue and redemptions (c)	es -7.4	-0.4	0.8	0.8
Total offsetting operations	10.5	7.4	-4.3	-5.2
Settlement banks' operation	al 0.4	0.5	0.0	0.5
balances at the Dalik	0.4	-0.5	0.0	0.5

(h)

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. Prior to this, late facilities were available to the discount houses and the gilt-edged market makers. Issues at weekly tenders plus redemptions in market hands. Excludes repurchase transactions with the Bank (market holdings include Treasury bills sold to the Bank in repurchase transactions) and tap Treasury bills. (c)

uncertainty surrounding the official forecast of the daily shortage that day, which led the Bank to believe that the market might in fact be more short than the forecast suggested-as indeed proved in the event to be the case. Against this background, and taking into account that this was only the third day of the new arrangements, the Bank decided to make the facility available. In the event, £150 million was provided by way of the facility, enough to meet the best estimate of the residual shortage at 3.50 pm.

At the rollover of the twice-monthly gilt repo facility on 19 March, the Bank announced that the facility, which it had previously used as a supplementary refinancing mechanism alongside its daily operations, would be withdrawn after the maturity of the final repo offered on that date. The Bank had indicated that this was its intention in the February 'Pink paper', on the basis that the successful introduction of the reformed daily operations would mean that the facility would not need to be used on a regular basis. The facility is, however, retained for future reintroduction if ever necessary.

The market had in practice reduced its participation in the twice-monthly gilt repo facility, taking advantage of the greater flexibility available under the new arrangements by holding gilts to use in the daily OMOs. The effect of this was to increase the amount of refinancing provided through the daily operations in March: the average size of the daily shortages published at 9.45 am in March was £1,270 million, more than £350 million greater than for February and January. These relatively larger shortages were comfortably relieved.

With just one month's experience of the new operating arrangements it would be premature to draw definitive conclusions on their impact, but there are already signs that the broadening of the range of counterparties able to participate directly in OMOs, and the extension of the instruments that may be used, have brought about a reduction in the friction that occasionally arose in the previous system. Chart 19 shows the high and low of the overnight rate for the first quarter of 1997. Volatility in very shortterm rates was greatly reduced following the introduction on a formal basis of the twice-monthly gilt repo facility in January 1994; Chart 19 suggests that (despite the withdrawal of the facility) the introduction of the new daily money-market arrangements has contributed to a further reduction in the volatility of the overnight rate. This is consistent with market comment that volatility in very short-term rates more generally is much lower, which should benefit end-users of sterling markets.

The Bank continues to use the weekly Treasury bill tender to drain liquidity from the market, and so ensure that there is a steady demand for liquidity in its daily money-market operations. The size of the Treasury bill tender varies depending on the Bank's forecast of the other influences on the prospective position of the money market over the period ahead.⁽¹⁾ The Bank increased the size of the weekly Treasury bill tender on 31 January, from £200 million to £400 million, to drain more liquidity from the market. On 27 March a reduction in the size of the tender, back to £200 million, was announced, to take effect from 4 April. Cover at the weekly tender remains strong. As part of its new operating

These are described in the accompanying article describing the Bank's money-market operations in this *Quarterly Bulletin*, pages 204–7.

Table DThe 1996/97 CGBR financing requirement

£ billions

	Original remit	Summer forecast	Budget forecast	Provisional outturn
CGBR forecast	24.1	28.1	27.9	25.1
Expected net change in official reserves	0.0	0.0	0.0	-0.3
Expected gilt redemptions	11.5	11.5	12.5	12.4
Under/overfund from 1995/9 Financing requirement	6 (a) n.a. 35.6	2.2 41.8	2.2 42.6	2.2 39.4
Financed by:				
Assumed net National Saving	gs			
contribution Net sales of certificates of	3.0	3.0	4.5	4.8
tax deposit	0.0	-0.1	-0.3	-0.4
Gilt sales required for full financing	32.6	38.9	38.4	34.9
Memo: Actual gross gilt sale	25			38.8
n.a. = not available.				

(a) Underfund outturn only known after the original remit was published.

arrangements, the Bank has ended the formal underwriting obligation previously undertaken by the discount houses, but it expects all of its money-market counterparties to participate actively over time in the weekly tenders.

Gilt financing

Gross sales of gilts during the final quarter of 1996/97 totalled $\pounds 9.7$ billion, bringing the total for the financial year to $\pounds 38.8$ billion. As can be seen from Table D, this represented a small overshoot of the target for gilt sales for the 1996/97 fiscal year. Table D also shows the provisional outturn for gilt sales, in the light of the end-year outturns for the CGBR, reserves, and sales of National Savings products. The result is a provisionally estimated gilt sales residual of $+\pounds 3.9$ billion carried into the 1997/98 fiscal year, of which the principal element is the lower-than-forecast CGBR for the year.

Auctions were held in each month of the quarter, with a 'double-headed' auction in January. The two previous 'double-headers'-auctions of two different stocks in the same week-had both combined an existing short and an existing long stock, with the weighting in volume terms on the short auction (the less risky part in duration terms), and with an overall amount of £3.5 billion. The January dual auction departed from this pattern in a number of ways. The remit's requirement for conventional funding for the year to be roughly evenly distributed between shorts, mediums and longs meant that the preponderance of funding in the final quarter had to be in the medium-dated area. Comments from market participants in the December quarterly consultations had also indicated demand for a new ten-year stock early in the quarter. The authorities decided to issue the new medium in the dual auction, and to issue £2.5 billion of it, the maximum possible size for one leg of a dual auction, to give it as much initial liquidity as possible; the opportunity was available to reopen the stock in March. Combined with £1.5 billion, the minimum possible, of the accompanying short stock (a reopening of the 7% 2002 created in December), this resulted in a £4 billion dual auction.

The January auction of the new ten-year benchmark produced considerably stronger demand, as evidenced by cover and tail, than the previous December auction of the new short-dated benchmark. Demand was even better for the small second auction; the stock had at times traded 'special' in the gilt repo market, and the quarterly announcement of auction ranges at the end of December made clear that no further short-dated supply was scheduled for the quarter.

For the February auction the authorities issued a further £2.5 billion of the longest-dated conventional, the 8% 2021. It had been clear from comments at December's quarterly consultations that most market participants favoured building up liquidity in this stock prior to the advent of the gilt strips market rather than introducing a new ultra-long stock. The auction produced cover of 1.93—lower than the 1996/97 average for all stocks, but not significantly different from the average for long stocks—and a tail of 1 basis point (in line with the 1996/97 average).

In March, after market consultations, the authorities set the closing time for bidding at future gilt auctions at 10.30 am instead of

Table E Auctions of Conventional stock 1996/97 fiscal year

Date of auction	Stock	Amount issued (£ millions)	Price at issue (per £100 stock) (a)	Yield at non-competitive allotment price (b)	Cover (c) at auctions	Tail (d) at auctions (basis points on yield)
24.4.96	71/2% Treasury 2006	3,000	95.9062	8.08	2.65	2
29.5.96	8% Treasury 2021	3,000	96.5000	8.33	2.04	2
26.6.96	Floating Rate Treasury 2001	3,000	99.7100	n.a.	4.51	1
23.7.96	8% Treasury 2000	2,000	102.9375	7.20	4.81	0
25.7.96	8% Treasury 2015	1,500	97.9063	8.21	1.88	2
28.8.96	71/2% Treasury Stock 2006	2,500	97.1563	7.90	2.69	1
25.9.96	8% Treasury Stock 2021	3,000	98.4375	8.14	1.73	2
22.10.96	7% Treasury Stock 2001	2,000	99.5313	7.10	3.57	0
24.10.96	8% Treasury Stock 2015	1,500	101.3438	7.86	2.66	0
4.12.96	7% Treasury Stock 2002	2,500	99.4063	7.13	1.70	2
28.1.97	71/4% Treasury Stock 2007	2,500	97.6875	7.57	2.17	1
30.1.97	7% Treasury Stock 2002	1,500	99.4063	7.13	3.82	0
26.2.97	8% Treasury Stock 2021	2,500	106.9685	7.38	1.93	1
26.3.97	71/4% Treasury Stock 2007	2,500	97.1875	7.64	3.09	1

n.a. = not applicable

(a) Non-competitive allotment price.
 (b) Gross redemption yield per cent based on the weighted average price of successful competitive bids.
 (c) Total of bids divided by the amount on offer.
 (d) Difference in gross redemption yield between the weighted average of successful competitive bids and the lowest accepted competitive bids.

10 am. This change was made because many of the Bank's new money-market counterparties are also active participants in the gilt market, and so there was some potential for a clash between the timing of gilt auctions and a 9:45 am open market operation in the money market. The March auction was a reopening of the new ten-year stock created in January. Though the gilt sales requirement would have allowed an auction at the bottom of the remit range, the small size of the outstanding stock made it desirable to auction £2.5 billion to increase liquidity. The result, particularly in terms of cover, was very strong and lent support to gilts despite the general global environment of rising yields.

The results of auctions for the year as a whole are summarised in Table E. £33 billion nominal was issued at auction in 1996/97 compared with £25 billion the previous year, but with a smaller average auction size (£2.4 billion compared with £2.8 billion). Cover has been higher this year-on average 2.80 times compared with 1.75 times in 1995/96. The increase has come from increased competitive bidding by GEMMs (accounting for 42% of the total increase in cover), increased non-competitive bidding by GEMMs (use of the new expanded non-competitive bidding facility), and most markedly, increased competitive bidding on behalf of the GEMMs' clients (accounting for 52% of the total increase in cover). Various factors may have contributed to this: increased willingness by both GEMMs and clients to submit low bids following the uncovered auction of September 1995, which heightened the perception that this might on occasion be worthwhile; growing awareness of the authorities' transparent auction programme and procedures as a result of the annual remits and quarterly announcements; the smaller size of auctions not being fully reflected in downsizing of bids; development of the gilt repo market, which has facilitated taking short positions; and perhaps, at the margin, more opportunity for last-minute client bids to be transmitted following the relaxation of telephone bidding limits for GEMMs at the beginning of 1996/97.

The introduction of dual auctions may have helped, as these resulted in higher average cover and smaller average tails and discounts to the secondary market price. As can be seen from Table E, however, the short-dated part of the auctions was largely responsible for the favourable results, so this may be in part a reflection of greater market appetite at the short end.

No conventional stocks were tapped in the January-March quarter. Two packages of index-linked gilts were issued, which are described in the following section. Overall for the fiscal year, the distribution of gilt sales was 85% in conventionals and 15% in index-linked—in line with the remit targets for the year. The distribution of conventional funding also conformed to the remit targets of roughly one third in each maturity band, ending up 34.1% in shorts, 31.5% in mediums and 34.5% in longs. Auctions accounted for the bulk of issuance; conventional tap sales amounted to only 1.5% of total issuance, well below the indicative ceiling in the remit of 10%.

Turnover increased in the Bank's shop window for gilts in the first quarter of 1997. Turnover averaged £570 million (nominal value) per month in this period, compared to £203 million per month in the last quarter of 1996; turnover in February was nearly £900 million. All of the turnover represented switches of stocks, and was restricted to stocks with a residual maturity of between three and fifteen years. Participation by the GEMMs widened as the number of stocks available increased, partly owing to some sales of stock by public funds managed by the Commissioners for the Reduction of the National Debt.

On 12 March the Treasury published the *Debt Management Report*, *1997/98*. This included a financing remit to the Bank which is reproduced in the box overleaf. It continues the broad themes and framework of the previous year's remit, while aiming at gradual development of the market in some areas. In particular:

- the target for index-linked sales has been increased to 20% from 15% in the two previous years, reflecting the authorities' assessment that indexed gilts have cost and risk advantages for the government. Conventional sales are still to be broadly evenly spread across the short, medium and long-dated maturity bands, but with a slight skew to the short and long ends. The target distribution of 35%/30%/35% takes into account the pattern of refinancing in the near future, and is broadly consistent with a stable portfolio mix in the medium term. It also reflects the greater likelihood of demand for gilt strips in the short and long maturity areas, and the stock maturities that fit more readily into the dual auction format;
- it has been announced that the UK authorities see positive merit in moving to an index-linked auction programme as soon as is feasible, with the aim of further improving the transparency of the borrowing programme. Consultations regarding the form of these auctions will begin as soon as there is sufficient experience of the US indexed bond programme later this year;
- all new benchmark conventional stocks will be strippable when the strips market begins (expected in the autumn of 1997). Dividends on all existing and future issues of strippable gilts will be paid gross of withholding tax from 7 June 1997 onwards. Holders of these stocks will also be exempt from requirements to account for withholding tax on a quarterly basis from this date;
- the dual auction mechanism is to be continued with four dual auctions—one per quarter—planned for 1997/98. The

Table F Gilt issuance

Date	Stock	Amount issued (£ millions)	Price at issue (per £100 stock) (a)	Yield at non-competitive allotment price (b)	Yield at issue	Yield when exhausted (Average yield (d) c)	Cover (e) at auctions	Tail (f) at auctions (basis points on yield)	Date exhausted
Auctions	of Conventional stock									
28.01.97	71/4% Treasury Stock 200	07 2,500	97.6875	7.57	n.a.	n.a.	n.a.	2.17	1	28.01.97
30.01.97	7% Treasury Stock 2002	1,500	99.4063	7.13	n.a.	n.a.	n.a.	3.82	0	30.01.97
26.02.97	8% Treasury Stock 2021	2,500	106.9688	7.38	n.a.	n.a.	n.a.	1.93	1	26.02.97
26.03.97	71/4% Treasury Stock 200	2,500	97.1875	7.64	n.a.	n.a.	n.a.	3.09	1	26.03.97
Tap Issue	s of Index-Linked Stock									
17.01.97	21/2% Index-linked 2003	150	182.1875	n.a.	3.27	3.27	3.27	n.a.	n.a.	17.01.97
17.01.97	21/2% Index-linked 2011	100	178.5000	n.a.	3.49	3.49	3.49	n.a.	n.a.	17.01.97
10.02.97	2% Index-linked 2006	100	195.7500	n.a.	3.19	n.a.	n.a.	n.a.	n.a.	(g)
10.02.97	21/2% Index-linked 2024	150	128.5000	n.a.	3.44	3.42	3.43	n.a.	n.a.	14.02.97

n.a. = not applicable

(b)

Non-competitive allotment price. Gross redemption yield per cent based on the weighted average price of successful competitive bids. Gross redemption yield or real rate of return (assuming 5% inflation) based on the price when the issue ceased to operate as a tap. Weighted average gross redemption yield or real rate of return (assuming 5% inflation), based on actual price at which issues were made. Total of bids divided by the amount on offer. Difference in gross redemption yield between the weighted average of successful competitive bids and the lowest accepted competitive bid. Exhausted on 16.04.97.

(ď)

precise month of the dual auction is to be announced at the end of the preceding quarter, allowing this to be factored into the quarterly consultations with the market; and

the end-quarter announcements of auction details for the following quarter will now specify precise stocks rather than only maturity ranges, except where further feedback from the market closer to the auction is needed. This further increases the transparency of the gilt issuance process.

The remit was subject to confirmation following the General Election.

Index-linked gilts

In the first nine months of the fiscal year £5.1 billion was raised through index-linked sales, which met 88% of the 1996/97 funding target for the sector (ie that 15% of total gilt sales should comprise index-linked); this meant that only £0.7 billion of index-linked sales were required in this final quarter of the fiscal year in order to meet the target. Over half of this residual requirement was achieved following the exhaustion of a £250 million nominal tap package issued on 17 January (see Table F for details). With the sector untapped since mid-October, demand for index-linked stock had built up and both stocks were exhausted on the day of issue. The successful first auction of US Inflation Indexed Notes (see the accompanying box in this article) stimulated further interest in the sector and, with bond markets continuing to rally, a further tap package was issued on 10 February (see Table F for details). Sales of both taps were made but the subsequent publication of stronger-than-expected UK employment and inflation data saw the market fall back from the Bank's selling levels. The longer-dated tap was exhausted on 14 February after weaker-than-expected US producer prices data resulted in a rally in bond markets, and further sales of the shorter tap were made during the following week. However, towards the end of this period, as financial markets again revised up their expectations of the path of monetary policy in the United States and United Kingdom, real as well as nominal bond yields rose and the price of the outstanding index-linked tap fell significantly below the Bank's selling price. As a result £36 million nominal remained unsold at the end of the financial year. Nevertheless total annual index-linked sales of £5.8 billion

Table G Official transactions in gilt-edged stocks

£ billions; not seasonally adjusted

	1996/97 AprDec.	<u>1996/9</u> Jan.	7 Feb.	Mar.
Gross official sales (+) (a) Redemptions and net official purchases of stock within a	29.1	4.4	3.0	2.4
year of maturity (-)	-7.5	-1.3	-3.7	0.0
Net official sales (b) of which net purchases by:	21.6	3.1	-0.7	2.4
Banks (b)	0.5	-1.4	-1.4	-0.1
Building societies (b)	0.3	0.5	-0.9	0.4
M4 Private sector (b)	13.3	3.6	2.6	2.2
Overseas sector	6.9	0.4	-1.1	-0.1
LAs & PCs (c)	0.7	0.0	0.0	0.0

Gross official sales of gilt-edged stocks are defined as official sales of stock with over one year to maturity net of official purchases of stock with over one year to maturity apart from transactions under purchase and resale agreements. Excluding repurchase transactions with the Bank. Local authorities and public corporations.

The Government's financing requirement and remit to the **Bank of England for 1997/98**

Published as part of HM Treasury's Debt Management Report 1997/98.

The 1997/98 Borrowing Requirement

The Government will aim to issue debt to finance the Central Government Borrowing Requirement (CGBR) plus maturing debt and any net increase in the foreign exchange reserves.

Any under or overshoot of the gilt sales target for 1996/97 will be carried forward and offset in the target for sales of gilts in 1997/98.

The CGBR for 1997/98 is forecast to be £20.0 billion. Some £19.6 billion of gilts are expected to mature in market hands and need to be refinanced. It is not possible to forecast net changes over the year in the foreign currency reserves and so these are assumed to remain unchanged.

The financing requirement for 1997/98 is therefore currently forecast to be around £39.5 billion, subject to any under or overshoot of gilts sales carried forward from 1996/97 and to any change in the foreign exchange reserves. Table 7 (of the Debt Management Review 1997/98, see below) gives full details of all the financing

The 1997/98 financing requirement

(Table 7 in the Debt Management Report 1997/98)

£ billions (a)

	March 199	7
CGBR forecast	20.0	
Expected net change in official reserves	0.0	
Gilt redemptions	19.6	
Gilt sales residual from 1996/97	n.a.	(b)
Financing requirement	39.5	
Less net financing from:		
National Savings	3.0	
Certificates of tax deposit (c)	0.0	
Remaining debt sales required	36.5	
Made up by net sales of:		
Treasury Bills and other short-term debt (d)	0.0	
Ultra-short conventionals (1–3 years)	0.0	
Short conventionals (3–7 years)	10.2	
Medium conventionals (7-15 years)	8.8	
Long conventionals (15+ years)	10.2	
Index-linked gilts	7.3	

n.a. not available.

- (a) Figures may not sum due to rounding
 (b) Since the remit was published, the gilt sales residual for the 1996/97 fiscal year has been estimated as an overshoot £3.9 billion.
 (c) Certificates of tax deposits (CTDs) are deposits made by taxpayers with the Inland Revenue in advance of potential tax liabilities. Changes in the level of CTDs act as a financing item for central government. The working assumption at the beginning of each year is that the level of CTDs remains unchanged.
 (d) The level of net Treasury Bill issuance may fluctuate in year as a result of money-market operations.

instruments the Government intends to use to achieve this in 1997/98. The Government does not intend to use marketable debt instruments of less than three years maturity to finance the 1997/98 CGBR.

National Savings

The net contribution of National Savings to financing (including accrued interest) is assumed to be around \pounds 3.0 billion (with gross sales of around \pounds 12.0 billion). This is not a target, but an estimate based on experience in previous years and forecasts for 1997/98.

Other debt sales

Net sales of central government debt instruments other than gilts and National Savings are expected to make a negligible contribution to financing. In particular, the intention is that net Treasury bill issuance will not contribute to financing the CGBR, although the stock of Treasury bills and the pattern of issuance will fluctuate in the light of the needs of money-market management.(1)

Quantity of gilt sales

The Bank of England, on behalf of the Government, will aim to meet the remainder of the financing requirement by selling gilts to the private sector. On the basis of the 1996 Budget CGBR forecast, this means gilts sales of approximately £36.5 billion, plus or minus any under or overshoot of the gilt sales target carried forward from 1996/97, and any net change in the foreign currency reserves.

Nature of stocks

The Government will continue to have available the full range of financing instruments. Within conventional stocks, the Government will aim for liquid benchmark issues in the five-year, ten-year and long-dated maturity areas. There may also be floating-rate gilt issuance. The aim will be to issue index-linked gilts across the maturity spectrum.

In order to build up the liquidity of the gilt strips market further, the Government intends that all new issues of benchmark stocks in 1997/98 will be strippable from the beginning of the market.

Pace of gilt sales

The Bank will aim to sell gilts at a broadly even pace through the year. Within year seasonal fluctuations in the pattern of Central Government expenditure and revenue will be met by other financing means, including changes to the weekly Treasury bill tender and the Ways & Means advances.

Maturity structure of gilt issues

Over the year as a whole, the Bank of England will aim to make approximately 20% of its gilt sales in

(1) Treasury bill issuance is used to drain the money market so as to provide a basis for the Bank of England's open market operations.

index-linked stocks with the remainder in conventional stocks spread across the maturity ranges, with approximately 35% of issues in both the short (3–7 years) and long-dated (15 years and over) bands and 30% in the medium (7–15 years) band. For 1997/98, there are no plans to meet the financing requirement with marketable instruments of a maturity of less than three years.

Auctions

Auctions will constitute the primary means of conventional gilt sales. The authorities plan to hold auctions on a monthly basis, toward the end of each month on the calendar set out below. Four dual auctions are planned, instead of single auctions, one in each quarter. The actual month in the quarter will be announced in the quarterly calendar announcement. In the case of dual auctions the two stocks will be offered in successive auctions on the Tuesday and Thursday of the week indicated. Single auctions will be held on the day indicated.

Auction calendar 1997/98 (a)

Wednesday 23 April 1997 (b) Wednesday 21 May 1997 Wednesday 25 June 1997 Wednesday 23 July 1997 Wednesday 27 August 1997 Wednesday 24 September 1997 Wednesday 29 October 1997 Late November/December 1997 (c) Wednesday 28 January 1998 Wednesday 25 February 1998 Wednesday 25 March 1998

- (a) If a dual auction is held instead of a single auction, it will be on the adjacent Tuesday and
- Thursday. (b) In the event of the General Election being called for after 21 April, this auction will be reviewed.
- reviewed. (c) This auction date will depend on the timing of the Budget. It will be published in the relevant quarterly auction announcement (see below).

These auction dates may be altered to avoid data releases or monetary policy meetings between the Chancellor and the Governor of the Bank of England.

Each single auction is planned to be for between £2 billion and £3 billion of stock. A dual stock auction will be for between £3 billion and £4¹/₂ billion of stock in total, with individual auctions between £1¹/₂ billion and £2¹/₂ billion.

At the end of each calendar quarter, the Bank of England will announce plans for the auctions scheduled for the coming quarter. For each auction, this will indicate either the stock (where relevant indicating a new stock) or, where further market feedback on the choice of stock would be valuable, the intended maturity range of stock. The announcement will also set out the month of the dual auction to be held that quarter (as noted above). Towards the end of each quarter the Bank will publish details of progress to date with the gilt issuance programme, any changes to the Government's financing requirement and any changes to the gilts auction programme.

The Bank will announce at 3:30 pm on Thursday 27 March 1997, the plans for auctions in the first quarter of 1997/98.

Full details of these, and subsequent, auctions will be announced at 3.30 pm on Tuesday of the week preceding the auction.

Index-linked gilts

To increase transparency in the gilts supply process further, the authorities see positive merit in moving to an index-linked gilt auction programme as soon as is feasible. The market needs to be consulted further on the form of an auction programme (eg format, timing, size). It is the Governments intention that the Bank initiates these consultations as soon as there is sufficient experience of the US indexed bond programme later this year.

Reviews to the issuance programme

The issuance programme, and in particular the timing and nature of auctions (ie single or dual) and the allocation between maturity bands and index-linked, may be varied during the year in the light of substantial changes in the following:

- the Government's forecast of the gilt sales requirement;
- the level and shape of the gilt yield curve;
- market expectations of future interest and inflation rates;
- market volatility.

Any revisions will be announced. This remit will be subject to confirmation following the General Election.

Tap sales

The programme of conventional gilt auctions may be supplemented by official sales of stock by the Bank of England 'on tap'. Taps of conventional stocks will be used only as a market management instrument in conditions of temporary excess demand in a particular stock or sector or when there is an exceptionally sharp general rise in the market. In 1997/98, it is envisaged that conventional tap issuance will not constitute more than about 10% of expected total issuance.

In 1997/98, it is envisaged that index-linked gilts sales will principally be made through tap sales, even if an auction programme is initiated (see above).

After an auction, the Bank will generally refrain from issuing stocks of a similar type or maturity to the auction stock for a reasonable period. Such stock will only be issued if there is a clear market management case.

Coupons

As far as possible, coupons on new issues of gilts will be around gross redemption yields at the relevant maturity, at the time of issue.

Conversions

In order to build up the pool of strippable stocks further, the authorities envisage the Bank of England making offers for the conversion of unstrippable stocks into strippable ones of similar maturity during 1997/98. The programme of conversion offers is unlikely to be extensive. Details of any such offers will be announced in due course, in the light of market conditions. had been achieved, and the 15% target for index-linked funding was exactly met.

Sectoral investment activity

At £4.8 billion, net investment in gilts in the first quarter of 1997 was low relative to previous quarters, reflecting the weight of redemptions which totalled nearly £5 billion. Within sectors, there were substantial net purchases by the domestic non-monetary sector, of nearly £8.5 billion. The robust buying of gilts by the overseas sector in 1996 was reversed and it was probably a net seller in the quarter. This may be evidence of profit-taking following the initial appreciation of sterling. It is unlikely that the redeemed stocks, the larger of which was non-FOTRA, were significantly held by the overseas sector. The reduction in the holdings of the monetary sector, on the other hand, may largely reflect holdings by banks of the ultra-short stocks redeemed during the year.

Office for National Statistics data, which are as yet only available to end-December, may shed some light on the strong net purchases by the domestic non-monetary sector. These show a picture of high overall institutional investment and, within this, significant net inflows into gilts. Pension funds directed about 50% of their total investment into gilts in 1996, well above the end-1995 portfolio share of around 10%. This may have been motivated by the maturing of funds and the approach of the Minimum Funding Requirement from April 1997. Long-term insurers similarly directed about one third of their net investment into gilts, well above the end-1995 portfolio share of 16%. These trends may have continued into the first quarter of 1997. In addition, the two auctions of the new 71/4% Treasury 2007, expected to be the new ten-year benchmark, and the auction of a further amount of the long 8% Treasury 2021 in the quarter may have been particularly attractive to the large domestic investing institutions.

Technical developments

The Bank's consultative paper on money-market reform, issued in December 1996, proposed ending the requirement for the gilt-edged market makers (GEMMs) to be separately capitalised, reflecting the changing structure of the sterling markets and the fact that the Bank proposed to deal with a wider group of counterparties in the money markets. The proposal was well received, and was adopted with effect from 3 March, the date of the start of the Bank's new money-market operating arrangements. The removal of separate capitalisation enables GEMMs to assimilate their specialist market-making subsidiary into their group-wide securities trading entity. For GEMMs that take this route, existing prudential supervision requirements under the 'Blue book'(1) regime are discontinued, and the business is regulated under Securities and Futures Authority (SFA) rules or, where the GEMM has merged into a bank, under the Banking Act. There is a six-month transitional period (to September 1997) for GEMMs to implement any restructuring plans, after which any remaining separately capitalised entities will transfer to SFA supervision. The Bank's revised 'Blue book', which reflects the end of the separate capitalisation requirement for the GEMMs, is reproduced separately on pages 198-203 of this Quarterly Bulletin. It sets out, among

⁽¹⁾ The future structure of the gilt-edged market, April 1985.

other things, the Bank's dealing relationship with the GEMMs, and the facilities available to, and obligations of, market makers, and the continuing supervisory arrangements for inter-dealer brokers. On 3 February the Bank published three consultative papers, on: changes to ex-dividend arrangements; decimal and daycount conventions in the gilt market; and conventions for calculating gilt strips prices from yields. The results of the consultation on these papers will be published in due course.

The upgraded Central Gilts Office (CGO) system, due to be inaugurated in August, will in time allow the possibility for dividend and redemption payments to be made direct to CGO members' cash memorandum accounts, rather than outside the system as at present. This possibility was one of the factors behind the Bank's consultative paper on possible changes to the ex-dividend period for gilts. Payment through cash memorandum accounts, combined with the much shorter registration cycle in the upgraded CGO, opens up the possibility of various changes to dividend payment arrangements. The paper sought views on whether to abolish the ex-dividend period for gilts held in CGO, and whether the ex-dividend period for gilts held outside CGO should be reduced from seven working days to five. The paper also asked for views on whether the special ex and special cum-dividend facilities should be amended or dropped.

The decimals and daycounts consultation paper sought views on possible changes to two gilt market conventions: the quotation of price movements in decimals (£0.01 per £100 nominal) rather than fractions (£¹/₃₂ per £100 nominal), and the use of Actual/Actual rather than an Actual/365 daycount for the calculation of accrued interest. The paper took forward the recommendations relating to gilt market conventions made in the report of the Working Group on the gilt market after EMU.⁽¹⁾ One argument in favour of change was to bring about greater harmonisation between conventions in the gilt market and those in other government bond markets in Europe and the rest of the world.

The consultative paper on conventions for calculating strips prices from yields followed from a round of consultations with the GEMMs on the introduction of the strips market, at which the issue of whether strips should trade on a price or a yield basis was discussed. Of the market makers consulted, the overwhelming majority favoured a yield approach; those indicating a preference for quoting strips on a price basis cited the potential difficulty of agreeing a formula for converting yields into prices as their main reason. Since the market needs to be able to agree a price/yield formula to make the idea of trading strips on a yield basis workable, the Bank published its paper offering the more obvious alternatives for discussion. Once a consensus has been reached, the formula could then be added to the Stock Exchange Rules.

Gilt documentation was issued in a new simplified form from 1 April 1997. From that date, press notices, prospectuses and notices in lieu of prospectus only incorporated information specific to the stock being issued, which made them shorter, clearer and more user-friendly. Other general information and terms relating to

⁽¹⁾ The group, which comprised experts on gilt and EMU issues, including representatives from investors, the Gilt-Edged Market Makers Association, other relevant industry associations, the Stock Exchange, LIFFE, HM Treasury and the Bank of England, published its report on 16 December 1996 as part of the third issue of the Bank's quarterly publication, *Practical issues* arising from the introduction of the Euro.

gilt issuance is now published in an Information Memorandum,⁽¹⁾ a stand-alone document that should be read in conjunction with the prospectus, but which will also be of more general interest. The introduction of shortened documentation does not affect the terms of issue of existing stocks.

UK Government Ecu issuance

The United Kingdom continued to hold regular monthly tenders of ECU 1 billion Ecu Treasury bills during the first quarter of 1997, comprising ECU 200 million of one-month, ECU 500 million of three-month and ECU 300 million of six-month bills. The tenders continued to be over-subscribed, with issues being covered by an average of 2.5 times the amount on offer, the same as the average cover during 1996 as a whole. During the first quarter, bids were accepted at average yields up to 16 basis points below the Ecu Libid rate of the appropriate maturity, with bidding particularly strong in the January tender. There are currently ECU 3.5 billion of UK Government Treasury bills outstanding. Secondary market turnover in the first quarter averaged just over ECU 1 billion per month, slightly lower than the average turnover during 1996.

ECU 500 million of a new three-year Ecu Treasury Note, the sixth in the programme of annual new issues, was auctioned on 21 January. Cover at the auction was three times the amount on offer and accepted bids were in a tight range of 4.16%–4.19%. The settlement date for the new issue coincided with the redemption of the third Ecu Treasury Note, which had ECU 2.5 billion outstanding with the public. The total of Notes outstanding with the public under the UK Note programme thus fell from ECU 6.5 billion to ECU 4.5 billion in January 1997.

Copies of the Information Memorandum are available from the Bank of England Registrar's Department, Southgate House, Southgate Street, Gloucester, GL1 1UW, and it is accessible on the Bank of England's web site, BANKOFENGLAND.CO.UK.

The international environment

The main news since the previous Quarterly Bulletin is:

- Activity in the United Kingdom's major export markets has firmed a little since the start of the year, but big differences remain among the major economies.
- Activity in Germany, France and Italy was very weak around the year end. There were some signs of a moderate improvement by March, largely in the export sector. Domestic demand remained weak. Activity has been more buoyant in many of the smaller EU countries.
- The recovery in Japan continues to be uneven, with large manufacturing companies faring better than non-manufacturing and smaller companies.
- In the United States, the Federal Reserve Board raised the target federal funds rate by 25 basis points in March, as the US economy continued to grow strongly in the first quarter of 1997.
- Interest rates were also increased in the Netherlands in February and March, but were cut in Portugal and Spain. Interest rates remained unchanged in Germany and Japan.
- Inflation remained low in the United States, despite a pick-up in earnings growth. Considerable spare capacity remains in the labour markets in Japan and continental Europe; wage pressures have been subdued. Within the European Union, inflation rates continue to converge; new harmonised measures of consumer prices were published for the first time in February.
- Long-term bond yields in the G7 fell at the start of 1997 but rose sharply towards the end of the first quarter, except in Japan where they continued to fall.
- The US dollar, sterling and the Canadian dollar appreciated on an effective basis during the first quarter of 1997 (up 5.6%, 3.2% and 1% respectively); the yen, lira, Deutsche Mark and French franc depreciated over the same period (by 3.3%, 2.8%, 1.5% and 1% respectively).

 Table A

 Contributions to US GDP growth(a)

 Percentage points

	1996					1997
	Q1	<u>Q2</u>	<u>Q3</u>	<u>Q4</u>	Year	Q1
Domestic demand	0.8	1.3	0.9	0.4	1.5	1.9
Stockbuilding	-0.3	0.2	0.4	-0.2	-0.3	0.4
Investment	0.4	0.3	0.4	0.1	1.0	0.4
Government	0.1	0.3	0.0	-0.1	0.1	0.0
Consumption	0.6	0.6	0.1	0.6	0.7	1.1
Net trade	-0.3	-0.1	-0.3	0.5	1.6	-0.5
GDP	0.5	1.2	0.5	0.9	3.1	1.4

(a) Contributions may not sum because of rounding.

Activity has remained strong in the United States

The US economy has entered its seventh year of expansion. US GDP grew by 0.9% in the final quarter of 1996 to a level 3.1% higher than a year earlier. Activity was broadly based but, as Table A shows, consumption and net trade contributed most to growth. GDP growth was even stronger in the first quarter of 1997, at 1.4% quarter on quarter, the highest quarterly rate of growth in the current expansion. Consumption remained very strong, but net trade made a negative contribution. Employment continued to grow strongly (non-farm payrolls rose by an average of 240,000 a month in the first quarter of 1997—well above the long-run monthly average increase of 160,000) and unemployment fell to 5.2% in March, below most estimates of full employment. (Most estimates fall in the range 5.4%–6%.) A strong recovery is under way in the construction and housing sectors, helped by the decline in long-term interest rates in the latter half of last year;

Table B Contributions to German GDP growth^(a)

Percentage points

	1996						
	Q1	Q2	Q3	Q4	Year		
Domestic demand	-0.4	1.2	-0.2	0.4	0.8		
Stockbuilding	0.3	-0.9	-0.5	0.6	-0.2		
Investment	-1.2	1.5	0.1	0.2	-0.2		
Government	0.1	0.2	0.2	-0.1	0.5		
Consumption	0.4	0.3	0.1	-0.2	0.6		
Net trade	0.0	0.3	0.8	-0.2	0.6		
GDP	-0.4	1.5	0.7	0.1	1.4		

(a) Contributions may not sum because of rounding

Table C Contributions to French GDP growth^(a)

Percentage points

1996				
Q1	<u>Q2</u>	<u>Q3</u>	<u>Q4</u>	Year
0.7	0.1	0.5	0.2	0.8
-0.8	0.9	-0.3	0.3	-0.6
-0.1	-0.3	0.3	0.1	-0.1
0.1	0.1	0.1	0.1	0.2
1.5	-0.6	0.4	-0.3	1.3
0.7	-0.3	0.3	0.0	0.6
1.3	-0.2	0.8	0.2	1.5
	<u>1996</u> <u>Q1</u> <u>0.7</u> -0.8 -0.1 0.1 1.5 0.7 1.3	1996 Q1 Q2 0.7 0.1 -0.8 0.9 -0.1 -0.3 0.1 0.1 1.5 -0.6 0.7 -0.3 1.3 -0.2	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1996 Q1 Q2 Q3 Q4 0.7 0.1 0.5 0.2 -0.8 0.9 -0.3 0.3 -0.1 -0.3 0.3 0.1 0.1 0.1 0.1 0.1 1.5 -0.6 0.4 -0.3 0.7 -0.3 0.3 0.0 1.3 -0.2 0.8 0.2

(a) Contributions may not sum because of rounding

Chart 1 Unemployment rate^(a)







construction spending in February was more than 10% higher than a year previously. Home sales also rose strongly.

The National Association of Purchasing Managers Survey showed rises in the first quarter in production, new orders and employment. Consumer and business confidence were high and stock levels were low. Production should therefore continue to rise in the near term. Indeed the question now is how much spare productive capacity remains in the United States.

In contrast with the rapid growth in the United States, activity in the major countries of continental Europe was far more subdued during the year. GDP barely grew in the final quarter of 1996 in Germany and France (see Tables B and C) and fell fractionally in Italy. Exports were in general more buoyant than domestic demand, helped by improved exchange rate competitiveness.

GDP growth in the first quarter of 1997 was probably only a little higher. Construction activity fell sharply in Germany in January in part owing to harsh weather; employment data and fiscal outturns in the first two months of the year were also weak. Unemployment, largely but not solely structural, remains the major economic problem for these countries (see Chart 1). In March it stood at 11.2% seasonally adjusted in Germany, and 12.8% in France. Unemployment in Germany, France and Italy combined has reached almost ten million. Although some of the recent rise in unemployment was probably owing to temporary factors, such as the unusually harsh winter and a change in the way of recording unemployment among construction workers in Germany, labour market conditions remain extremely weak. Unemployment is not expected to fall much during 1997.

Data available for 1997 point to a rebound in activity, albeit a moderate one, since the start of the year. Industrial production in Germany rose by 1.9% on the month in February, up 7.1% on a year earlier, with manufacturing output particularly strong. Production of intermediate and capital goods was stronger than production of consumer goods, supporting the notion of an export-led recovery. As Chart 2 shows, business sentiment in Germany, as measured by the IFO Survey, improved sharply in January and slightly further in February. It fell back in March, but was nonetheless higher in the first quarter of 1997 than in the last quarter of 1996. (See the box opposite for a fuller discussion of survey data on industrial production in France and Germany.) But business sentiment in eastern Germany deteriorated sharply. The INSEE survey of industrial confidence in France also showed an improvement, again largely related to export orders. The key issue is how far export growth stimulates domestic demand during the course of the year. In this respect, the growth in fixed investment in Germany in the fourth quarter may be an encouraging sign.

There is less evidence of a pick-up in consumer spending (see Chart 3). Retail sales in Germany were some 6% lower in February than a year before. Household consumption in France rose 2.7% in January, but fell back in February and was flat in March.

The weakness of investment in Germany and France in the current cycle is a puzzle. As Tables B and C show, investment fell in Germany and France in 1996. Several explanations have been

German and French industrial surveys

An important source of information on the current international conjuncture is survey data. Given the uncertainty surrounding the recoveries currently underway in the core European economies, this box considers survey evidence relating to short-term industrial prospects in France and Germany.

In Germany, the IFO industrial Survey has a well-established track record. The most widely quoted index is the business confidence measure, which has a strong contemporaneous correlation with both industrial production and GDP growth.

But this survey may also contain more forward-looking information. IFO question industrialists about prospects for production over the next four months. Intuitively, the *one quarter lag* of that series should be highly correlated with quarterly production growth. But, as shown in Chart A, it actually exhibits a high correlation with annual growth in German industrial output. (Many German industrialists base their responses on year-on-year comparisons. A similar finding applies to UK data.)

Chart A



For most of the sample period, this relationship suggests that the survey balances may be an accurate predictor of future production. But since reunification, turning points in industrial production have occurred before the lagged survey balance, suggesting that the predictive power may have deteriorated slightly.

The French Statistical Agency INSEE also publishes a balance of business confidence which has a contemporaneous correlation with industrial production. But the *one quarter lag* of the balance of industrialists' assessment of prospects for their own companies (Chart B) also has a reasonable correlation with annual production growth (with the exception of the early eighties). This suggests it may also hold some forward-looking information.

Chart B

French industrial activity



These relationships suggest that, in addition to information relating to current developments, surveys can provide an indication about the short-term outlook. In both countries, industrial activity picked up in the middle of 1996 (in France, this partly reflected the effects of an incentive scheme for new cars) following weakness over the 1995/96 winter. This expansion faltered at the end of 1996.

The industrial surveys suggest that these recoveries could continue throughout 1997. In Germany, the balance of firms expecting to increase output was +3.6% in 1996 Q4, rising to +6.5% in 1997 Q1, compared with an average balance of -7.2% in 1996 H1. Coupled with the continuing weakness in the Deutsche Mark and sharp rises in exports orders, the evidence from the IFO Survey suggests that annual German industrial production growth should strengthen sharply over the first half of 1997, following annual growth of 1.7% in 1996 Q4.

In France, the balance of industrialists expecting an improvement in company prospects has also strengthened over the past year, particularly so in recent months: the balance was +8.3% in 1997 Q1, compared with +3.3% in 1996 Q4. This suggests that, alongside Germany, a competitive exchange rate and rising export orders, coupled with modest improvements in consumer confidence may now be in place for a sustained recovery in French industrial production over 1997.

Overall, the survey data for the French and German industry suggest that expectations of future output have increased. That suggests that the modest recoveries currently under way in these core European economies should continue over 1997.

Chart 3 Consumer confidence and consumption



Table DContributions to Japan GDP growth(a)

Percentage points

	1996				
	Q1	Q2	Q3	Q4	Year
Domestic demand	2.4	0.1	0.1	0.6	4.4
Stockbuilding	0.1	-0.2	0.0	0.0	-0.1
Investment	1.0	0.7	0.1	-0.2	2.6
Government	0.1	0.0	0.1	0.1	0.2
Consumption	1.2	-0.6	-0.1	0.7	1.7
Net trade	-0.3	-0.2	0.2	0.4	-0.9
GDP	2.0	-0.3	0.3	1.0	3.6

suggested. In Germany, the reunification boom in investment at the start of the 1990s was such that capacity utilisation remains moderate. Capacity utilisation is not unduly high in France. And a considerable volume of investment has flowed abroad, for example to neighbouring Eastern European countries where wage costs are much lower. Inward direct investment in Germany has been extremely low (though higher in France). Uncertainty, particularly over the outlook for domestic demand, the stance of fiscal policy and the composition of the euro area, may have resulted in investment decisions being postponed.

In some respects, the investment environment is favourable. Real interest rates are low, corporate profitability is high and equity markets have risen strongly. At the end of March, the German DAX index was 42% higher than at the start of 1996 and the French CAC index was up by 32%.

Overall, domestic demand did not appear to strengthen at the start of 1997 in the three largest continental European economies. Though exports are firming and there is some evidence of improving business confidence, record unemployment and the tighter fiscal stance in 1997 are likely to hold down consumer spending, and may lead to a further deferral of investment plans. Structural rigidities in European labour and product markets further impede a strong recovery.

Several smaller EU economies are growing faster

Growth in the other EU countries has been higher. These eleven EU economies between them account for about 30% of UK exports—equal to the combined proportion exported to Germany, France and Italy. Estimated GDP growth in Ireland, the Netherlands, Finland, Greece, Portugal and Luxembourg was more than 2.5% in 1996, in contrast to 1.5% or less in the three largest continental European economies.

The weakness of investment noted in the larger continental European economies has not been evident in Sweden, Finland and Spain. These countries also experienced strong export growth, but economic recovery since the 1995 slowdown has been more broadly based. Domestic demand was sustained by strong consumer spending in Denmark, the Netherlands and Portugal. Investment has made an important contribution to growth in Belgium and Austria. Growth in Ireland moderated to around 7% in 1996, from more than 10% in 1995.

The manufacturing sector leads the Japanese recovery

GDP growth in Japan in 1996 was 3.6%, the highest among the G7 countries. This masks an uneven picture during the year and between different sectors of the economy. GDP grew very strongly in the first quarter of 1996, reflecting significant public expenditure (see Table D). Over the middle two quarters, GDP was broadly flat, before rising by 1% during the fourth quarter. The key question for the Japanese economy is: is the recovery firmly under way and, in particular, what will be the effects of the fiscal tightening (equivalent to about 1.5% of GDP) introduced in April?

As in the major continental European economies, exports provided an important stimulus to growth in Japan in the second half of 1996 (see Table D). But domestic demand was also robust, particularly in the fourth quarter. Several special factors may have boosted demand, including incentives on residential investment, and the prospect of the increase in consumption tax from 3% to 5% in April 1997, which may have led to some consumption being brought forward. These factors are however unlikely to account for all of the increase in domestic demand.

Exports continued to rise strongly in January and February. The March 1997 Tankan Survey of corporate sentiment confirmed the unevenness of the recovery. In the survey, manufacturing companies, particularly large ones, expressed most optimism. Non-manufacturers were less optimistic, suggesting that the stimulus from exports had yet to feed through to the rest of the economy and/or that the slowdown in the real estate and construction sectors may have accelerated. Non-manufacturers, mainly those in construction and real estate, also reported more difficulty in obtaining credit, reflecting the continued weakness in these two sectors. As in Germany, investment intentions remained weak.

Growth in the other advanced Asian economies slowed around the middle of last year, in part owing to a slump in the electronics market that reduced exports, and as a result of monetary tightening to prevent overheating.

The Mexican economy—an important export market for the United States—is estimated to have grown by more than 5% in 1996, after a 6% fall in GDP in 1995. Output in the transition economies of Eastern Europe as a whole also began to recover during 1996, although their growth was probably affected by weak export demand in some EU countries.

It is notable that many industrialised countries are relying on net exports to stimulate output growth. For this to happen, net imports by other countries such as the United States, the advanced Asian economies and emerging markets, will have to increase commensurately. Current account imbalances may therefore widen over the next year or so. A key issue is how different countries may react to these imbalances, and whether the necessary financing will be available.

Money

In January, the weighted average of broad money growth in the G7 economies rose to 5.7%, the highest growth rate since 1991. Broad money growth in the G7 has now been rising almost continuously for two years (see Chart 4), but this has so far not been clearly reflected in a strengthening of nominal GDP growth: broad money velocity has fallen.

The strength in broad money has been accompanied by strong growth in private sector credit and may partly be owing to wealth effects arising from higher equity prices. The increased wealth and broad money holdings have not, however, had any clear and significant effects on spending in the G7. But the rise in broad money growth may presage stronger activity later this year. Narrow money also rose strongly in January (except in the United States, where it has been falling since 1995, probably as a result of the increased use of sweep accounts).

Chart 4 Average broad money and nominal GDP growth in the G7



Chart 5 United States consumer prices and average weekly earnings







Chart 7 Consumer price inflation



Inflation remains low

Inflation remained low in the advanced overseas economies in 1996, and declined further in Asia and most developing countries. Strong growth and doubts about remaining spare capacity in the United States and some of the smaller EU economies suggest that there may be some inflation risks further ahead.

The main potential source of inflationary pressure in the United States is the labour market. Unemployment fell to 5.2% by the end of the first quarter, and average hourly earnings were 4% higher than a year earlier-the fastest rate of increase during the current seven-year expansion. The lack of strong wage pressures over the past few years, despite near-full employment, has been a feature of the US economy. Slow growth in non-wage costs (particularly health insurance costs), job insecurity and increased competition between firms have been cited as possible explanations. The first two factors may have become less important in recent months. (For example, the number of people voluntarily leaving employment-the 'quit rate'-increased in the first quarter, and the year-on-year increase in health care costs to employers remained constant at around 2% per annum during 1996, after falling in 1995.) And as Chart 5 shows, wage inflation has been rising since early 1996. The concern is that it might be difficult to reverse this trend.

Outside the labour market there are few signs of inflationary pressure. The twelve-month increase in consumer prices has been around 3% for the last two or three years (see Charts 5 and 6). Core inflation, which excludes food and energy, remained at 2.5% in March. The strong dollar has put downward pressure on imported goods prices.

In Japan, measured consumer price inflation has been negligible for the past four years or so. The depreciation of the yen by 12% in real terms since the start of 1996 has brought an end to twelve-month falls in the consumer price index, but there is little sign of inflationary pressure. In the March Tankan Survey more companies said they were reducing their prices than increasing them, even in the manufacturing sector. Retailers are unlikely to increase their prices by the full amount of the increase in consumption tax.

Within the European Union, convergence among inflation rates has increased, as inflation has fallen further in Italy and Spain and picked up in Ireland, Denmark and the Netherlands (see Chart 7). In the European Union as a whole, the twelve-month rate of increase in prices declined gradually during 1996 from 3% in January to 2.4% in December. It has since fallen further to 2% in February, a record low. In March, annual consumer price inflation fell to 1.5% in Germany and 1.1% in France. The process of disinflation is likely to continue as lower energy prices and administered prices (especially in France and Spain) feed through.

A more accurate comparison of inflation rates in individual EU countries is now possible, following publication by Eurostat of harmonised indices of consumer prices. These measure prices on a common basis. They differ from national CPIs in coverage (particularly in the treatment of housing costs) and in how data are aggregated. The harmonised indices use geometric rather than arithmetic means. The Office for National Statistics estimate that

Table EAnnual rates of inflation for January 1997

	HICP	National index
Finland	0.9	0.6
Sweden	1.3	-0.1
Luxembourg	1.3	1.3
Austria	1.6	1.9
Germany	1.7	1.8
Netherlands	1.8	2.3
France	1.8	1.8
Ireland	1.9	n.a.
United Kingdom	2.1	2.8 (a)
Belgium	2.2	2.3
Denmark	2.6	2.7
Italy	2.6	2.7
Spain	2.8	2.9
Portugal	2.8	3.3
Greece	6.6	6.8
EICP	2.2	n.a.
n.a. = not available.		
(a) RPIX.		

Chart 8 EU consumer price inflation^(a)



Chart 9 Long-term interest rates, January 1997



Source: National data (series proposed by the central banks for the purpose of the Maastricht criteria).

(a) Criterion equals 2 percentage points above three best-performing countries in terms of inflation. this latter effect accounts for about half of the difference between UK inflation as measured by the harmonised measure and the RPIX measure. National measures may be preferable for assessing inflation in an individual country—for example, RPIX has a wider coverage than the harmonised measure—but the harmonised measures are useful for cross-country comparisons.

Table E shows harmonised and national measures of inflation in EU countries in January 1997. A striking point is the reduced disparity between countries' inflation rates when measured by the harmonised indices. Apart from Greece, all EU countries had inflation rates within two percentage points of each other, whereas on national definitions the differential was nearly 3.5 percentage points. Countries with the lowest rates of inflation on national measures—notably Sweden and Finland—had higher rates of inflation on the harmonised measure. Greece, Portugal and the United Kingdom, with higher-than-average inflation on national definitions, had lower inflation on the harmonised measure.

The convergence of inflation rates among EU countries at the start of 1997 masks some divergent trends among countries with different cyclical positions. Inflation in Belgium, the Netherlands and Denmark increased a little over 1996, and there are signs of further inflationary pressure in these countries and in Ireland. In both Denmark and the Netherlands, house price inflation was more than 10% per annum at the start of 1997; house prices have also been rising sharply in Ireland. Mortgage lending rose by around 18% in the Netherlands in 1996, and private sector credit was up about 11.5%. In Ireland, too, broad money growth was 16% in 1996, but the appreciation of the currency in 1996 helped offset inflationary pressures.

So there is evidence of some modest inflationary pressure in some of the smaller EU countries, but for the European Union as a whole inflation is likely to fall further, reflecting subdued wholesale prices, the absence of capacity constraints and the moderation in oil prices.

EMU

The harmonised measures of consumer prices will be among the variables used to assess convergence against the criteria set out in the Maastricht Treaty for the EMU process. Charts 8–11 show the position at the start of 1997. Convergence of inflation and interest rates has generally been more substantial than fiscal convergence. In 1996, according to latest national estimates, only 5 of the 15 countries had deficit/GDP ratios below the 3% reference value (Chart 10). In eight other countries the ratio was between 3% and 4.5%. Italy and Greece had deficit ratios of more than 6.5%.

These figures provide only a snapshot of the fiscal position in Europe. In assessing the fiscal stance it is necessary to look at the underlying position and at the issue of sustainability. There is evidence of fiscal consolidation in the EU as a whole in the past two years: the aggregate fiscal deficit fell from 5.4% of GDP in 1994 to an estimated 4.3% in 1996. But the aggregate deficit was no smaller in 1996 than in 1991. And some of the improvements are due to one-off measures that improve the budgetary position in one or a limited number of years only. Moreover the snapshot figures give no indication of the effect of cyclical influences on the

Chart 10 EU general government deficits, 1996







Table FG7 ten-year forward rates

	<u>Basis po</u> 1996 Q3	<u>Q4</u>	<u>1997</u> Q1	18 Feb.– 27 Mar.	Level 27 Mar 1997
United Kingdom	-12	-75	-4	+42	8.02
United States	-3	-35	+27	+47	7.37
Germany	-29	-35	-13	+82	7.89
France	-49	-54	-8	+47	7.06
Italy	-83	-64	+5	+90 (a)	9.05
Canada	-21	-67	-11	+22	7.82
Japan	-35	-65	-44	-20	3.89

(a) Change from 24 February 1997, as rates started to rise later in Italy.

deficit. Above-trend growth usually results in increased government revenue and lower welfare payments; this is quite different from structural fiscal consolidation.

The fiscal ratios for 1996 also ignore demographic trends; in the European Union as a whole, the proportion of elderly people in the population is rising, so future pension and health care costs will be greater. What is important, from the point of view of economic convergence and the success of EMU, is that fiscal consolidation should be sustainable over the medium to longer term.

The Maastricht reference level for the ratio of general government debt to GDP is 60%. In 1996 Luxembourg, the United Kingdom and France had debt ratios below 60%; Germany's was marginally above. All other countries had debt levels above 60%: in Greece, Italy and Belgium, debt/GDP ratios were around double the reference value (see Chart 11). The ratio of general government debt to GDP for the EU as a whole has risen dramatically over the past twenty years or so. In 1980 the ratio was less than 40%; in 1990 it reached 55%, and by 1996, an estimated 74%.

France, Austria, the United Kingdom and Germany expect the ratio of their general government debt to GDP to rise in 1997 (though not above 60% in France and the United Kingdom). All other countries (except Luxembourg) expect the debt ratio to fall, but not below 60% and at varying speeds depending on, among other things, the size of the primary surplus.

Interest rates

Two issues dominated international futures and bond market developments in 1997 Q1; higher expected and actual official interest rates in the United States and market uncertainty over the EMU timetable.

The US federal funds target rate was raised by 25 basis points to 5.5% on 25 March. There was only a limited reaction from financial markets (the dollar effective index rose by 0.3%, and stock prices fell slightly on the day), suggesting that the move had been widely expected. Expectations about future short-term interest rates were also revised upward during the quarter. In mid-April, US futures contracts were discounting a rate rise of over 80 basis points by the end of the year.

The Netherlands Central Bank responded to signs of inflationary pressure by increasing interest rates by 20 basis points in each of February and March. Official interest rates in Spain and Portugal were cut by 25 basis points in March; Italy and France reduced their interest rates earlier in the quarter.

At the beginning of the year, ten-year bond yields fell in most European countries and the United States but increased sharply after the middle of February, in many cases more than offsetting the initial decline. The largest increases have been in Swedish, US, Italian and Spanish yields; yields fell in France and Austria.

The sharp rise in long-term international interest rates since mid-February may in part be explained by expected policy tightening worldwide. But the sharp rise in German and Italian rates (see Table F) may also reflect EMU factors. Forward rates—ie the future short-term interest rates implicit in the current yield curve—enable us to distinguish between movements at different time horizons. Ten-year yields reflect the average short-term interest rate expected to prevail over the next ten years (and not just in ten years time), and so, unlike ten-year forward rates (ie the short-term interest rates ten years in the future that are implicit in the current yield curve), will be influenced by a combination of short and long-term conditions.

Ten-year forward rates in the United States rose by 47 basis points in the second half of the first quarter, but two-year forward rates (not presented in the table) rose by considerably more (up 74 basis points). This suggests that a large proportion of the rise in US yields is caused by short to medium-term cyclical factors. In contrast, ten-year forward rates in Germany rose by 82 basis points between the middle of February and the end of March, compared with an increase in two-year forward rates of 29 basis points over the same period. Increasing uncertainty among market participants over the feasibility of the EMU timetable, and fears that Germany may not meet the Maastricht fiscal criteria and about the possibility of a 'soft' euro may have raised the risk premium on bonds of prospective EMU Member States or increased long-term inflation expectations.

Equity markets

International equities, as shown in market indices of leading shares, performed well (see Chart 12). Over the quarter as a whole, though markets fell back a little after the rise in US official interest rates, the FT-SE 100 was up 6.3%, the Dow Jones 4.6%, the Frankfurt DAX 20.4% and the Paris CAC -40 by 17.7%. The Nikkei fell by 6% over the same period.



130 120

- 110

100

90

United Kingdom

96

Chart 12

1995

Comparing the monetary transmission mechanism in France, Germany and the United Kingdom: some issues and results

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

In this article,⁽¹⁾ Erik Britton and John Whitley analyse the importance of commonly cited structural differences between the economies of the United Kingdom, France and Germany for the response of output and prices to changes in monetary policy. They review previous studies and report results from a complementary empirical approach, summarising the evidence as inconclusive. They argue that some of the differences between the three economies are not really structural and that even where they are, this does not automatically imply that one economy will be more sensitive than another to a change in *monetary policy.*

Introduction

The prospect of a single European monetary policy raises the key question of whether this would affect all Member States equally. The answer will depend crucially on how each economy adapts to a single currency, which will not be known in advance. But we can start by evaluating how far a similar change in monetary policy (in particular, a change in interest rates) has had different effects on prices and output in these countries in the past.

It is normally assumed that, in the long run, changes in the stock of money will be fully reflected in changes in the price level, with little or no effect on real output. But wages and prices are not perfectly flexible in the short to medium term. So changes in monetary policy may have consequences for real output over this period. This nominal stickiness may partly be caused by incomplete adjustment of economic agents' expectations of inflation, and partly by the costs of acquiring information on the appropriate price to charge and of changing prices accordingly. Some economists argue that these real effects are largely the result of 'structural' features, ie those institutional arrangements and underlying determinants of individual behaviour that are insensitive to changes in fiscal and monetary policy. These dictate the relative importance of different channels of the monetary transmission mechanism.⁽²⁾ That suggests that structural differences between countries may lead to differences in the effects of a change in monetary policy. Indeed, structural differences between the UK economy and other (especially European) economies have been cited as prima *facie* evidence that the effects of changes in monetary policy in the United Kingdom are different from those experienced elsewhere. However, one of the problems in this debate is the lack of consensus as to what is meant by structural.

This article has two main parts. The first section looks at some of the commonly cited differences between the three economies. It considers whether the differences are in some sense fundamental, and whether they have important implications for the transmission of monetary policy onto output and inflation. The second section reviews a selection of empirical studies of the monetary transmission mechanism in the United Kingdom, France and Germany, and sets out our own results, which are based on a complementary approach. It evaluates the different empirical approaches to assessing how important structural differences are for the impact on output and prices of changes in interest rates.

Structural differences between the United **Kingdom, France and Germany**

The differences often cited as structural cover the main channels of the transmission mechanism: from changes in policy interest rates to changes in market interest rates, to changes in demand for goods and money and the exchange rate, and so through to output and prices. We note, however, that some of the differences outlined may not in fact be structural, and also that structural differences may not map straightforwardly onto changes in output and prices.

The response of market interest rates to policy rates

How fast and far the central bank's policy rates translate into market interest rates and bank loan rates can vary significantly between countries. This may reflect differing competitive pressures between the banking sectors. But banks and other market lenders may respond differently to a change in policy rates. The response depends partly on how long the change is expected to be sustained, and partly on the costs of taking action in response. So this response may be different for different policy changes.

Useful comments on earlier drafts have been received from Shamik Dhar, Ray Barrell, Keith Cuthbertson, Paul Fisher, Simon Wren-Lewis and representatives of the central banks of France, Germany and Italy. David Tinsley contributed to estimation of the models. We are particularly indebted to Charles Bean for comments.
 There is broad agreement about the channels of the monetary transmission mechanism themselves (see the recent symposium in the *Journal of*

Economic Perspectives, Fall 1995)

According to estimates by the Bank for International Settlements (BIS), changes in policy rates are most rapidly and fully reflected in changes in market interest rates in the United Kingdom, less so in Germany, and more slowly and incompletely in France. A simple statistical analysis of the past relationships between different interest rates gives a similar result. But estimates of this sort often fail to identify genuine structural differences, because they take an average of temporary and persistent interest rate changes. So a country that has experienced more temporary changes to policy rates will probably—on most empirical estimates appear to have a smaller pass-through from policy to market interest rates.

In the United Kingdom, France and Germany, monetary policy is set with reference to different targets (for inflation, the exchange rate and monetary growth), but in each case policy is implemented primarily through policy rates at the short end of the yield curve. This might lead us to expect that activity will respond more sensitively to a change in policy rates in a country where there is a higher proportion of lending and borrowing at short rates. But this is not necessarily the case. Nominal interest rates (risk premia aside) are equal to the sum of real interest rates and expected inflation. So the change in expected inflation resulting from any shock will determine the effect of that shock on the yield curve at all maturities. A shock that affects short rates may also affect long rates. The extent of this depends on two factors. First, the nature of the shock: a demand shock and a change in the target of monetary policy will affect the yield curve in different ways. Second, the expected response of the monetary authority: in some cases, the authority will be expected to accommodate some of the inflationary effects of any demand shock, or to be prepared to miss a target for monetary growth (or any other nominal target), which would lead to expectations of higher inflation.

Moreover, the extent to which the monetary regime is expected to accommodate inflationary shocks (the extent to which it is less than fully credible) may also be reflected in the proportion of borrowing that takes place at long rates. A monetary regime that is not expected to accommodate inflationary shocks is likely to incur a lower inflation risk premium and so encourage borrowing at long-term rates. As countries move to a single European monetary policy and economic agents anticipate that the authorities will respond in a more uniform way to inflationary shocks, we might expect some convergence of behaviour in both the extent of borrowing at long rates and the response of the yield curve to changes in policy rates.

Demand for goods and money

(a) Household and corporate indebtedness

How changes in policy rates affect activity depends partly on how policy rates translate into interest rates more

generally (as above) and also partly on how interest rates influence the decisions of households and firms on spending and investment. Changes in nominal interest rates can influence real behaviour by affecting short-term real interest rates, which may change the rate at which households and firms substitute future for current spending. These consumption decisions will also be affected by the current level of indebtedness, which may be partly determined by structural features. Since households and firms tend to have interest-bearing assets as well as liabilities, the net level of debt, rather than the gross level, will be a more useful measure of their indebtedness. As Table A shows, the level of net indebtedness is not very different between the three countries. The ranking in the corporate sector is as we would expect given the propensity of UK firms to finance their investment internally.

Table ANet debt position (interest-bearing assetsminus liabilities) in 1990

Measured as a percentage of GDP

	Household	Corporate	
United Kingdom	-5	-23	
France	-4	-38	
Germany	1	-41	
Source: OFCD Financi	al Accounts of OFCD	Countries UK Finan	cial Statistics

The size of any policy effect in each economy depends on who the creditors and borrowers are; on their relative marginal propensities to consume; and on the extent of liquidity constraints. A high level of gross indebtedness may indicate the absence of liquidity constraints and, for a given level of net indebtedness, will be associated with weaker rather than stronger real interest rate effects on expenditure.⁽¹⁾ The gross levels of household and corporate indebtedness are significantly higher in the United Kingdom than in Germany or France, consistent with the view that the process of financial liberalisation in the United Kingdom has significantly reduced the level of liquidity constraints.

(b) Home ownership

The finance of house purchase in different countries is often singled out as a prime reason for differences in how real demand responds to changes in interest rates. In particular, more owner occupation and greater use of variable-rate finance are often cited as reasons why real demand in the United Kingdom may be more sensitive than in its European neighbours (see Tables B and C). But if there are no credit constraints, consumer spending will depend on current and prospective income and debt servicing costs. These are not

Table BHomeowners as a percentage of totalhouseholds in 1994

United Kingdom	France	Germany
66	54	40
Source: Council of Mor	tgage Lenders <i>Eur</i>	onean Mortgage Revi

⁽¹⁾ Some of the literature (summarised in Mayer, 1994) suggests that liquidity constraints are a more important determinant of investment in the United Kingdom than elsewhere. One reason put forward for this has been the relatively large number of small firms in the United Kingdom. But in fact data on the distribution of employment by enterprise size show no marked difference between the United Kingdom, France and Germany.
Table CVariable-rate mortgages as percentageof total mortgages in 1993

United Kingdom	France	Germany
90	10	<10
Source: National central	l banks.	

affected at the aggregate level by homeownership patterns or by the extent of fixed versus variable-rate mortgages.

Fixed rates will generally be higher than variable rates on average, since they incorporate an inflationary risk premium. A person holding a fixed-rate mortgage can be expected to have taken account of this inflationary risk in calculating his current and prospective income and real debt servicing costs. The variable-rate mortgage holder does not pay this premium and so has to be prepared to bear the costs of any inflationary shocks. Although permanent income will be unchanged in both cases in response to a nominal shock, agents may nevertheless substitute between current and future consumption. This will not depend on whether they are borrowing at fixed or variable rates. But if agents who are borrowing at variable rates are also constrained in their ability to borrow, they may be forced to change their consumption more sharply, especially if debt is front-loaded (so that the schedule of debt repayments declines in real terms over the lifetime of the mortgage). Although the United Kingdom has a higher proportion of variable-rate mortgages, there may be fewer liquidity constraints, as noted above. The change in consumption may also vary in response to changes other than a nominal shock, such as a shift in the policy regime.

The shares of variable-rate and fixed-rate mortgage lending shown in Table C may respond to changes in either supply or demand. Demand is partly determined by attitudes to risk, which may be sensitive to monetary policy arrangements if these affect the general level of risk; they may also change over time. For example, when mortgages with competitive rates fixed for up to ten years were made available in the United Kingdom in 1994, up to 63% of new mortgages were on these terms. Supply will depend on the portfolio structure of lending and borrowing by financial institutions, which may also be sensitive to the policy regime.

(c) Finance for companies

The same factors apply to companies, and whether their financing is variable or fixed rate will make no difference to the investment decisions they make in response to a shock, unless they have liquidity constraints. As Table D shows,

Table D

Variable-rate lending as percentage of total lending to firms, 1993

United Kingdom	France (a)	Germany
<50	67	<50

Source: BIS (from national central banks).

(a) More recent figures suggest that in France this proportion may since have fallen.

the pattern of variable-rate finance for companies is not the same as that for mortgage finance in the United Kingdom, France and Germany.

The exchange rate

Another key part of the transmission mechanism is how the level of output responds to a movement in the real exchange rate in response to a change in policy rates. In an open economy, nominal wage and price stickiness may mean that a change in policy interest rates has short-term real effects. This is because the nominal exchange rate is not sticky and can adjust more rapidly than other prices in response to a shock, causing a change in the real exchange rate in the short term. A change in the real exchange rate can affect inflation and output by changing the supply and demand for exports and imports. Other factors such as supply-side shifts may also cause the real exchange rate to shift. So it is not easy to trace the relationships between the real exchange rate, activity and prices.

Whatever the shock and its effect, we might expect a more open economy to be more exposed to external shocks and to respond differently to changes in monetary policy. In fact the United Kingdom, France and Germany have a similar degree of openness in trade, as shown in Table E.

Table EAverage of imports and exports as apercentage of GDP in 1995

United Kingdom	France	Germany			
29	25	27			
Source: OECD: National Accounts.					

Nominal stickiness

Domestic demand will also be affected in the short run by a change in real interest rates, whether the economy is open or closed. The adjustment to a new steady-state inflation rate is then determined in either case by the extent of nominal stickiness, which in turn depends on how quickly agents learn about monetary policy as well as on institutional contract arrangements. So a common monetary policy regime—as in monetary union—might cause the degree of nominal stickiness in different economies to converge to some extent. A reduction in nominal stickiness would reduce the real costs of adjustment to any shock.

The behaviour of agents in the labour market is a key factor determining the extent of nominal stickiness. So the degree of nominal stickiness may change as labour market reforms are introduced; for example reducing the bargaining power of the unions, and increasing the flexibility of contract arrangements. Of the three countries, the process of labour market reform is most advanced and started earliest in the United Kingdom. This is grounds for concluding that the degree of nominal stickiness may have fallen in the United Kingdom relative to the other two countries in recent years. Measures produced by Layard, Nickell and Jackman (1991) show almost the same degree of nominal stickiness between the United Kingdom, France and Germany, but these are based on historical averages and may not accurately reflect the current situation, if relevant changes—such as labour market reforms—have had an impact on recent economic behaviour.

Nominal stickiness, combined with the other features discussed above, can be summarised by the cumulative cost in terms of higher unemployment (or lower output) of achieving one percentage point lower inflation (the sacrifice ratio). Ball (1993) shows that although the sacrifice ratio is related to the degree of nominal stickiness, the two do not correspond exactly. This confirms that nominal stickiness is important in explaining the real output consequences of a change in monetary policy, but it is not the only influence. Neither of these papers suggests that the sacrifice ratio has been higher in the United Kingdom in the past than elsewhere.

Different approaches to identifying the effects of structural differences

As discussed above, the relationship between the structural differences and the effects of changes in monetary policy on output and prices in the different economies is rarely straightforward. So we need to look at empirical approaches to quantify structural differences and their effects.

Three contrasting approaches have been commonly used to compare monetary transmission mechanisms. The first is based on the comparative properties of large, one-country macroeconometric models (MEM1s). These are systems of equations representing relationships between economic aggregates, with varying degrees of economic theory imposed. They are typically designed for forecasting and simulation in a single-country context, and are seldom strictly comparable across countries.

The second approach uses multi-country macroeconometric models (MEM2s). These have typically been designed to generate forecasts and simulations for individual countries that are consistent with the implied forecasts for the world (or the group of countries) as a whole. Because they are systems involving many individual country models, multi-country models are generally larger than one-country models.

The third approach is based on 'structural vector auto-regressions' (SVARs). Vector auto-regressions (VARs) are essentially models that describe a purely statistical relationship between variables, designed to produce forecasts and simulation results. SVARs impose long-run restrictions on model responses to make the auto-regressions more amenable to an economic interpretation. It is in this sense that they are called structural. Whereas MEMs focus on the relationships between economic aggregates, SVARs focus on shocks and allow shocks to, for example, supply or demand to be identified. Each approach uses a similar method to identify cross-country differences. Having decided which type of model to use, the next step is to simulate a change in monetary policy within that model, and to observe the responses of variables such as output and prices. But there are problems at every step, both in choosing which model to use and in deciding what assumptions to make when simulating changes in monetary policy.

A problem common to all three approaches is the extent to which they can identify differences which are not the result of changes in fiscal and monetary policy, particularly when the estimated parameters embody implicit assumptions about expectations.

Different studies tend to rank countries differently on the impact of changes in monetary policy on output and prices either because they use different models, or because of differences in simulation design. First, the literature shows that very different results can be obtained for the same country by using different models of that country.⁽¹⁾ Many of the differences between macroeconometric model results have been traced to superficially 'unimportant' equations in the individual models.⁽²⁾ The differences that arise from these equations are often at least as large as differences identified across countries using the same or similar models.

Further issues relating to the choice of model are:

- When different models give different results, it can be very difficult to test whether these are statistically significant or to judge their economic importance.
- Large macroeconometric models are often criticised for their lack of transparency. In a very large model it may be difficult to explain what features are responsible for the overall response of key variables to a shock.
- Decisions about the specification of the model are not systematic: choices depend on individual modeller preference (maybe related to topical issues) rather than on any standardised procedure. Differences in individual preferences can introduce country-specific effects selectively, and this can dominate any genuine cross-country differences.

These considerations are crucial in assessing the differences between the transmission mechanism in different countries. For the observer there is often no way of distinguishing between conflicting results. Also, simulation results may vary according to the assumptions made, even for the same model of the same economy. Key assumptions relate to the following issues:

• What sort of change in monetary policy is being simulated? What is the maintained monetary strategy (or nominal target)? Targeting the money stock and

See Church *et al* (1993).
 See Turner *et al* (1989).

targeting the exchange rate may give differing dynamic responses. In particular, it is not sufficient to model a change in monetary policy by a change in interest rates because this does not describe a monetary policy strategy and leads to an indeterminate price level. To close the system one usually needs to assume that some nominal target is pursued after the initial shock.

- If the shock is to interest rates, what should its scale, direction and duration be?
- Is the shock assumed to be common across countries, or is it restricted to one country? For example, depending on how the exchange rate is modelled, there may be no implied exchange rate response for a common interest rate shock. The exchange rate is often held fixed for forecasts, and sometimes for simulations.
- Changes in real activity or the exchange rate may depend on whether the change represents an announced (and anticipated) change in policy, or whether it is an unannounced (and unanticipated) change. The assumptions about how expectations are formed and how they respond to any change can be crucial to the ultimate response of output and prices.

Outlined above are two important sources of difference between the results obtained in different studies: the choice of model and the design of the simulation. A third is genuine differences between the economies being studied. For the observer, it is often very difficult to assess whether or not genuine differences exist. Since different studies have resolved these problems in different ways, comparison of the results is extremely difficult. Offered below is a representative summary, drawing out the extent to which similar modelling approaches generate similar results, together with results from recent Bank research using a different, small model approach.

Large macroeconometric models: national models (MEM1s)

An example of this approach is a study by the BIS using G10 central banks' own national models (Smets, 1995). The MEM1 approach is very detailed and can capture some structural features of different countries by either disaggregation or inclusion of country-specific factors. Our discussion above, however, indicates how difficult it is in practice to map structural differences onto predictable econometric relationships. In principle the MEMs approach can also allow for expectations to be explicitly linked to the policy regime, and so it partly addresses the criticism that the relationships between economic variables embody an implicit assumption about expectations. But this criticism still has force when thinking about the future: when trying to forecast using a MEM, for example. MEM1s can also be

(1) See Whitley, 1992.

used in like-for-like simulations by trying to make common assumptions about monetary policy across countries.

The BIS study suggests that output responds more to changes in nominal short interest rates in the United Kingdom than in most other countries, including France and Germany. The response in price level is also considerably larger in the United Kingdom, although the implied trade-off between output and prices is less so. But the simulations are not strictly comparable. The French and German models maintain the restriction of operating with a narrow-band exchange rate mechanism (ERM) and their exchange rates are held fixed against other European countries in the simulations. But this is valid only if all ERM countries simultaneously change interest rates and trade effects are also allowed for, requiring a multi-country approach.

Large structural models: multi-country models (MEM2s)

Multi-country models typically apply the same modelling strategy to each country, and so reduce the scope for differences from this source. Three examples of the MEM2 approach are: (1) a study by the National Institute of Economic and Social Research (NIESR) using its NIGEM multi-country model (NIESR, 1995); (2) a study by Richardson (1987), using the OECD Interlink model; and (3) results from the US Federal Reserve multi-country model (MCM), reported in the BIS study using national country models. The NIESR study finds the same relative ranking as the BIS (MEM1) study above in the responses of both output and prices to a change in monetary policy. However, that ranking is not replicated in the OECD study, which finds that the United Kingdom has only an average response. This is explained by the fact that the OECD model tends to adopt similar parameter values as well as structure across countries.⁽¹⁾ The results from the US-based MCM also show much smaller cross-country differences than the national country models.

Structural VAR models (SVARs)

This approach has the advantage that it involves small tractable systems, designed to have simulation properties that are firmly rooted and identifiable in the historical behaviour of the variables being modelled. Criticisms of the relevance of the SVAR approach to the issue of the monetary transmission mechanism point to the lack of detail and to the fact that structural differences cannot be traced to or from estimated parameters of the system. Since in some studies the shocks in the different countries are determined relative to the past volatility of interest rates and in others are a one percentage point shock, it is difficult to ensure that simulations are comparable across studies or across countries.

Examples of the SVAR approach are: (1) a study by the BIS for the G7 countries (Gerlach and Smets, 1995); and (2) a recent study by the IMF (IMF, 1996). Neither the BIS nor

the IMF study finds the United Kingdom to be an outlier in respect of the output or price level response.

Small stylised models (SSMs)

A fourth method, designed to complement the other three, is based on the use of a small structural model with an underlying theoretical framework that is well-understood and relevant to the issue at hand.⁽¹⁾ Such an approach has been the subject of some recent research at the Bank of England. The basic model comprises four equations for four key variables: aggregate demand; aggregate supply; the money stock; and the exchange rate. When demand exceeds the equilibrium rate of output, inflation is higher than economic agents expected when the nominal contracts were set. Positive price surprises make it profitable for firms to increase output temporarily (the familiar Phillips curve). Aggregate demand for goods is related to the real interest rate and the real exchange rate. The demand for money is a function of nominal demand and the nominal interest rate, and an uncovered interest rate parity condition determines the relation of the exchange rate to the interest rate, following any initial jump in the exchange rate. The key feature of this model is that the prices of domestic goods adjust slowly to any change in demand. Hence monetary policy has real effects in the short run through changes in real interest rates and real exchange rates. But the form of the aggregate supply equation (Phillips curve again) ensures that money is neutral (has no effect on real variables) in the long run.

The small model approach captures many of the key features of the monetary transmission mechanism (recently discussed by Taylor, 1995). In particular it assumes that agents form their expectations in a rational (model-consistent) way.⁽²⁾ The advantages of the approach are that: (1) the framework is identical across countries; (2) it involves quantification of key economic relationships which contain parameters that can be related to structural characteristics; and (3) the model can be estimated so that the cross-country differences in the key economic relationships can be tested for statistical significance. The main criticism is that it is too highly aggregated to capture cross-country differences, in other words that by keeping the number of variables so small, it risks glossing over many of the most important cross-country differences. But by being highly aggregated, it concentrates on differences that are important at the aggregate level. The estimation will probably miss some of the dynamics picked up by a VAR, and the form of the model will inevitably involve much simplification of the true process, reducing a large number of parameters to a handful in the model. But behavioural differences can be related directly to stylised structural features (even if not by a one-to-one mapping).

One major problem that it shares with the other three approaches is that any estimated parameter may reflect both underlying economic behaviour and the policy regime (and hence expectations), so the parameters may change for a 'new' policy regime, such as EMU. The results from the small model approach can be interpreted as showing what might happen in the absence of any structural change or shifts in the way that expectations evolve.

We illustrate the results of using this approach in two parts. First, since the estimated models are small and stylised, it is feasible to compare the estimated economic relationships across countries. Second, it is also possible to simulate comparable changes in interest rates within the estimated models, as in the other three approaches.

Estimates of the key parameters of the models for the three economies suggest that the sensitivity of output to the real interest rate is lower in the United Kingdom than elsewhere, but the sensitivity of inflation to output (deviations from trend) is higher.⁽³⁾ But the cross-country differences between these relationships are not generally large enough to be statistically significant (see below). Parameter estimates are also fairly stable over the period of estimation, which suggests the absence of major regime shifts.

We can use the estimated models to simulate the response of output and inflation to a change in monetary policy designed to reduce the price level. For each country model this involves holding official nominal short interest rates one percentage point higher than base for a period of two years, before letting them evolve according to a common monetary policy rule, under which they respond to deviations in output from its trend level and in prices from their target level. The overall output response is, if anything, smaller in the United Kingdom than in either France or Germany, although the response of prices is very similar (see Charts 1 and 2).





The economic significance of the estimates can be summarised by weighing up the temporary output cost of

(3)

We use the exchange rate overshooting model of Dornbusch, which is an extension of the Mundell-Fleming framework. Although the informational requirements of rational expectations are quite extreme this model gives a consistent framework to assess cross-country differences, and in the spirit of Currie (1985) it does not rely on expectational errors. See Appendix for detailed description of the model and estimated results. (2)

Chart 2 Price level response



the monetary policy change against the reduction in the price level. One way to do this is to calculate a loss function for each country, which sums the squared deviations of output from trend and the squared deviations of the price level from its target, attaching relative weights to these total output and price level 'losses'. The simulation results show that the United Kingdom does not suffer the greatest loss. This holds for any choice of relative weights on output and prices, as long as the same loss function is applied to each country.

The statistical uncertainty attached to the parameter estimates is quite large, though no larger than in the other approaches described above. Parameter uncertainty maps directly on to the simulated responses of output and prices, and so we cannot be confident that the responses shown in Charts 1 and 2 are significantly different in statistical terms. Moreover, the data do not yield an unique ranking by country of the size of these responses. To illustrate this point, we estimate the model for all three countries jointly, allowing for differences in parameter estimates where justified by the data. This joint model produces much smaller variations between the response of each country, and the rankings by size of response are also different (see

Chart 3 Output response from joint model



Charts 3 and 4). But though the data do not allow us to identify significant differences in how output and prices respond to an interest rate shock in the three economies, we cannot rule out the possibility that there may be such

Chart 4 Price level response from joint model



differences. Econometric tests of these alternative hypotheses have low power and are unlikely to resolve the issue.

Conclusions

This article has identified some differences between the United Kingdom, France and Germany which are likely to affect the transmission mechanism of monetary policy. Some of these may be structural, others not. So the effects of policy changes are unlikely to be identical in the three countries. More specifically, it has been suggested that a change in interest rates will have a greater short-term output cost in the United Kingdom than in continental Europe.

Many studies have used a quantitative framework to evaluate the importance of these structural differences. But they are inconclusive on whether there is a general distinction between continental Europe and the United Kingdom in the transmission of monetary policy onto output and inflation. Some studies disagree about the ranking of the sensitivity of different countries to a change in interest rates, and others find no major difference in response.

This article discusses a further econometric approach which identifies the key economic relationships and yields estimates of these in three European economies. The results suggest that there are no marked differences between the three economies in the response of output or inflation to a common change in policy interest rates. But these empirical estimates are insufficiently robust to draw a firm conclusion.

The inconclusiveness of the econometric approach leads us to place greater emphasis on economic analysis of the role of distinguishing features of the three economies, some of which may be structural. But unless we know how these features interact with each other, our information may not be enough to predict macroeconomic responses to a change in monetary policy. And some of the commonly cited differences between the three economies may themselves change in response to monetary policy changes such that they should not be considered structural at all. We have shown in this article that many of the main links in the monetary policy transmission mechanism may be sensitive to the anti-inflationary credentials of the policy regime. Where these change, as under EMU, responses estimated for past data will be invalid. So even if there have been differences in how countries have responded to a monetary policy shock in the past, we cannot be confident that these differences will persist under a different regime.

Appendix

The theoretical framework which forms the basis of the new research reported in this article is a small structural model of the economy. The model laid out below is the exchange rate overshooting model of Dornbusch *et al* and is well-known in the macroeconomics literature.

1	$m = p + \delta i + \xi y$	(Money demand)
2	$r \equiv i - \Delta p^e$	(Fisher identity)
3	$y = \alpha r + \beta (e + p - p^w)$	(IS curve)
4	$e = e_{(+1)} + (i - i^w)$	(Uncovered interest parity)
5	$\Delta p = \Delta p^e + \gamma (y - y^*)$	(Phillips curve)
т	= money stock	r = real interest rate
р	= domestic price level	p^w = world price level
е	= nominal exchange rate	i^{W} = world interest rate
i	= domestic interest rate	y^* = equilibrium level
y	= aggregate demand	of output
		Δp^e = expected inflation

For estimation we separate out aggregate demand into domestic demand and net trade (see detailed model below). Table 1 below gives our estimates of the key long-run parameters in this model, as they relate to the template laid out above. These are calculated from dynamic versions of the model estimated on annual data for 1964–94. Details of the model are shown in Table 2.

Table 1Estimated long-run parameter values (annual data1964–94)

	United Kingdom	France	Germany
α (real interest rate effect on demand)	-0.9	-1.4	-1.2
β (real exchange rate effect on demand)	-0.1	-0.3	-0.1
δ (nominal interest rate effect on money demand)	-3.3	-5.5	-2.3
γ (output gap parameter in Phillips curve)	0.5	0.2	0.3
ξ (income elasticity of money demand)	1.0	1.0	1.0

The elasticity of output with respect to the real interest rate (α) is larger in France and Germany than in the United Kingdom. This suggests that any structural differences do not make the United Kingdom more sensitive to interest rate changes through the impact upon aggregate demand. The speed of response of demand to a change in real interest rates is also found to be slower in the United Kingdom than elsewhere.

As estimated the **elasticity of exports with respect to the real exchange rate** (β) is small in all three countries. It is most negative in France, with similar estimates for Germany and the United Kingdom. However, dynamic adjustment in the United Kingdom appears more rapid than in the other two economies. There is little *a priori* reason to suppose that this key parameter should be very different across the different economies, and this is confirmed by the estimates.

The data suggest that the parameter δ : the elasticity of demand for real money balances with respect to the short nominal interest rate, is greater in France than in the United Kingdom or Germany. The parameter ξ : the elasticity of demand for real money balances with respect to output and prices has been imposed to equal one in all three models. This restriction is accepted by the data, and allows us to think of the equations as modelling velocity rather than real money demand. It is assumed that in the long run, the demand for real money balances should be proportional to output; in log form it should equal output plus a constant and a time trend, where the latter picks up to what extent velocity is trended over time. Deviations from this relationship provide the measure of disequilibrium in the demand for money equation.

The parameter estimates of the Phillips curve suggest that γ : the trade-off between output deviations from trend and the rate of inflation is larger in the United Kingdom than elsewhere. Thus for a given output gap, prices adjust more quickly in the United Kingdom than in France or Germany, suggesting that there may be less nominal inertia in the United Kingdom. Thus UK prices respond more flexibly (than German prices) to a deviation in rates of growth in output. The results for this parameter suggest that the United Kingdom may not have to sacrifice more cumulative output or employment (in the short run) than Germany or France in order to bring down the rate of inflation. This result is borne out by other pieces of empirical research. Estimates of the coefficient on lagged prices in the Phillips curve gives us a measure of price stickiness, and these also suggest a faster pass-through of a demand shock to inflation in the United Kingdom than in either France or Germany.

Significance of these differences

Although there are some differences in the parameters, it is not clear that they are greater than differences that we would expect when looking at different samples from the same economy. Using joint estimation (pooled regression) finds only the demand elasticity with respect to the real exchange rate and the interest rate elasticity for the demand for money to be statistically different across the three economies. There are also some differences in adjustment parameters and an important difference is found in the relation between import prices and domestic inflation. Here import prices operate less directly on domestic prices for Germany than either France or the United Kingdom. This could reflect averaging of different shocks and differing degrees of credibility of the monetary authorities in the past.

We therefore cannot be confident that, in general, the parameters are really different. But the different point estimates suggest that the United Kingdom is less sensitive to real interest and real exchange rate changes on demand, and more flexible in its price response, than either France or Germany.

The form of the estimated models is set out below. They are estimated in error correction and detrended form. The models are expressed as log-linear relationships.

The country models (logs)

Domestic demand (net of government spending)

$$\Delta dd = \alpha_0 + \alpha_1 dd_{-1} + \alpha_2 t + \alpha_3 r_{-1} + \alpha_4 \left(p_0 - p^w \right)_{-1} + \alpha_5 \Delta \left(p_0 - p^w \right) + \alpha_6 \Delta r + \alpha_7 \Delta TAX$$

Exports

$$\Delta x = \beta_0 + \beta_1 x_{-1} + \beta_2 \Delta y^w + \beta_3 y^w_{-1} + \beta_4 (p_x + e + p^w)_{-1} + \beta_5 (p_x - p)_{-1} + \beta_6 \Delta (p_x + e - p^w) + \beta_7 \Delta (p_x - p)$$

Imports

$$\Delta z = u_0 + u_1 z_{-1} + u_2 dd_{-1} + u_3 \Delta dd + u_4 (p - p_z)_{-1} + u_5$$
$$\left(p_z + e - p^w\right)_{-1} + u_6 \Delta \left(p - p_z\right) + u_7 \Delta \left(p_z + e - p^w\right)$$

Phillips curve

$$\Delta p = \gamma_0 + \gamma_2 \Delta \left(y - y^* \right) + \gamma_1 \left(y - y^* \right)_{-1} + \gamma_3 \Delta p_{-1} + u_1 \Delta p_z$$

Money demand

$$\Delta m = \Delta p + \xi_0 + \xi_1 (m - p - y)_{-1} + \xi_2 t + \xi_3 \Delta i + \xi_4 i_{-1} + \xi_5 \Delta (i_L - i) + \xi_6 (i_L - i)_{-1}$$

dd	=	private domestic demand	p_{χ}	=	export prices nominal exchange rate
					inoninal entenange rate
x	=	exports	p_7	=	import prices
z	=	imports	m	=	narrow money stock
t	=	time trend	р	=	domestic price
r	=	real interest rate	iı	=	long nominal interest rate
p_{0}	=	price of oil	i	=	short nominal interest rate
p^{W}	=	world prices	У.,.	=	aggregate output
TAX	=	aggregate tax rate	y*	=	trend output
y^{W}	=	world income	t;	=	detrending factor

Table 2

Estimated country coefficients

	United 1	Kingdom	France		German	<u>y</u>
Domestic deman $\Delta(dd-\tau_1 t)$	nd					
constant $(dd-\tau_1 t)(-1)$ $\Delta(i_L-i)(-1)$	-0.002 -0.217 -0.114	(0.3) (1.7) (0.7)	0.051 -0.346	(4.1) (2.4)	0.004 -0.434	(0.2) (2.7)
$\Delta r(-1)$ r(-1) r(-2) $(p_{1}, p_{2})(-1)$	-0.205	(1.5)	0.492	(3.6)	-0.505	(2.0)
$\begin{array}{c} (p_o - p^w) \\ \Delta(p_o - p^w) \\ \Delta(\text{TAX}) \\ \Delta(\text{TAX}) \\ \Delta(\text{TAX}) \\ \end{array}$	-0.049	(2.8)	-0.012 -1.585	(1.3) (1.6)	-0.008	(0.7)
dummy 1998	0.116	(4.1)			-2.501	(2.1)
Exports $\Delta(x-\tau_2 t)$						
constant $(x - \tau_2 t)(-1)$ $(y^w - \tau_3 t)(-1)$ $\Delta(y^w - \tau_3 t)$ $\Delta(p_x + e - p^w)$ $(p_x + e - p^w)(-1)$ $p_x - p$	0.924 -0.719 0.812 0.441 -0.094 -0.212 0.196	(3.0) (3.9) (1.8) (1.3) (3.8) (3.0)	1.117 -0.270 0.540 1.149 -0.242 0.231	(1.9) (2.1) (2.1) (4.1) (2.0) (2.3)	0.645 -0.439 0.960 1.573 -0.471 -0.140	(1.6) (1.8) (1.8) (2.0) (1.7) (1.6)
Imports $\Delta(z - \tau_4 t)$						
constant $(z - \tau_4 t)(-1)$ $\Delta(dd - \tau_1 t)$	-0.264 -0.890 1.297	(2.1) (4.1) (7.6)	-0.009 -0.345 2.130	(0.4) (2.1) (10.4)	$(z-\delta t)$ 0	(0)
$\begin{array}{l} (aa-\tau_{1}t) \\ (dd-\tau_{1}t)(-1) \\ (p-p_{z})(-1) \\ \Delta(p_{z}+e-p^{w}) \\ (p_{z}+e-p^{w}) \end{array}$	1.187 0.056 0.072	(3.7) (1.0)	0.451 0.164 0.006	(1.1) (3.4) (1.0)	0.883	(5.5)
Money demand $\Delta(m-p)$						
constant (m - p - y)(-1) t Δy	-3.316 -0.501 -0.018	(4.6) (4.7) (4.1)	-2.668 -0.580 -0.013	(4.0) (4.4) (6.0)	0.481 -0.777 0.010 0.432	(6.3) (6.4) (5.4) (2.3)
$(i_L-i)(-1)$ Δi i(-1) dummy 1978 dummy 1990	-0.308 -1.640	(1.8) (10.1)	-3.397 -1.025 -3.168 0.056	(3.6) (2.0) (5.5) (1.6)	-0.013 -0.013 -1.807 0.092	(2.3) (2.7) (2.8) (4.2) (7.2)
Phillips curve ∆p						
constant $\Delta p(-1)$ Δp_z $\Delta (y \cdot \tau_5 t)(-1)$ $(y \cdot \tau_5 t)(-2)$	$\begin{array}{c} 0.023 \\ 0.500 \\ 0.226 \\ 0.424 \\ 0.540 \end{array}$	(2.0) (3.3) (2.8) (1.4) (2.7)	$0.004 \\ 0.769 \\ 0.142 \\ 0.594 \\ 0.180$	$(0.9) \\ (12.6) \\ (6.1) \\ (3.4) \\ (1.3)$	$\begin{array}{c} 0.014 \\ 0.483 \\ 0.084 \\ 0.242 \\ 0.329 \end{array}$	(4.9) (5.8) (4.9) (3.8) (4.0)
Note: t statistics	in brackets					

References

Ball, L (1993), 'What determines the sacrifice ratio?', NBER Working Paper: 4,306, pages 93-03.

- BIS (1994), 'Financial Structure and the Transmission Channels of Monetary Policy'.
- Buiter, W A and Miller, M (1981), 'The Thatcher experience: the first two years', *Brookings Papers on Economic Activity*, 2, pages 315–67.
- Church, K, Mitchell, P, Smith, P, and Wallis, K, (1993), 'Comparative properties of models of the UK economy', *National Institute Economic Review*, 145, pages 87–107.
- Currie, D A (1985), 'Macroeconomic policy changes and control theory: a failed partnership', *Economic Journal*, 95, pages 31–8.
- Dornbusch, R. (1976), 'Expectations and exchange rate dynamics', Journal of Political Economy, 84, pages 1,161–76.
- Gerlach, S and Smets, F (1995), 'The monetary transmission mechanism: evidence from the G7 countries in *financial* structure and the monetary policy transmission mechanism', Bank for International Settlements, Basle, pages 188–224.
- IMF (1996), World Economic Outlook (October), pages 114-16.
- Layard, R, Nickell, S and Jackman, R (1991), Unemployment macroeconomic performance and the labour market, OUP: Oxford.
- Mayer, C, (1994), 'The assessment: money and banking: theory and evidence', *Oxford Review of Economic Policy*, 10, pages 1–13.
- National Institute of Economic and Social Research (1995), The World Economy, pages 53–58, August.
- OECD (1993), Employment Outlook (July).
- Richardson, P (1987), 'A review of simulation properties of the OECD's Interlink model', OECD Department of Economices and Statistics, *Working Paper, 47, Paris: OECD.*
- Smets, F (1995), 'Central bank macroeconomic models and the monetary policy transmission mechanisms in *financial* structure and the monetary policy transmission mechanism', Bank for International Settlements, Basle, pages 225–77.
- **Taylor, J** (1995), 'The monetary transmission mechanism: an empirical framework', *Journal of Economic Perspectives*, 9, pages 11–26.
- Turner, D, Wallis, K, and Whitley, J (1989), 'Differences in the properties of large-scale macroeconometric models: the role of labour market specifications', *Journal of Applied Econometrics*, 4, pages 317–44.
- Whitley, J (1992), 'Comparative simulation analysis of the European multi-country models', *Journal of Forecasting*, 11, pages 423–58.

Economic models and policy-making

By John Whitley of the Bank's Conjunctural Assessment and Projections Division.

In this article⁽¹⁾ John Whitley describes and evaluates the role of macroeconomic models at the Bank of England in the process of policy advice. He outlines how large macroeconometric models were used in the 1970s and 1980s; the reasons why they did not meet the needs of policy-makers; and how the need to incorporate uncertainty about the workings of the economy into policy-making has led to a more eclectic and judgmental approach to models at the Bank of England.

Introduction

This article explains how new smaller models, drawing on a wider spectrum of approaches, have been adopted to fill the vacuum as the role of large macroeconometric models in the policy debate has lessened. The aim of this process has been to make policy-makers more aware of the underlying economic analysis so that the numerical conclusions can be understood and used with confidence. In other words, policy-makers and the model (or modeller) need to share the same economic paradigm. Instead of using a single large model designed to answer all questions-but in reality thought by many to be unable to do so-current approaches use a range of smaller, more stylised, models. Smaller models make the underlying paradigm more transparent; using a range recognises the inherent uncertainty about the underlying economic structure and its sensitivity to structural change as well as to specific parameter values.

The article gives examples of how this more eclectic approach can focus on understanding the nature of shocks and their relevance for policy. It shows how structural vector-autogressions (VARs), theory-based optimising approaches and macroeconometric models are natural allies rather than competitors and how uncertainty can be incorporated into conditional forecasts in a Bayesian spirit. It concludes that this approach conforms more closely than previous approaches to how policy-makers think about the economy. Models, collectively, can then be seen as flexible friends.

The rise and fall of large macroeconometric models

The development of macroeconometric models in the United Kingdom has probably been unique in that the institutional environment has encouraged a prominent role in the policy debate for competing models in both public and quasi-public areas. This has largely been a result of the central role played by the Economic and Social Research Council (formerly the Social Science Research Council) in funding macroeconomic modelling by academic modelling groups. By the mid 1970s there were four large 'traditional' macroeconometric models financed principally out of public funds. Two were in the policy-making institutions themselves, the Bank of England and the Treasury. The remaining two were at the National Institute of Economic and Social Research (NIESR) and the London Business School.⁽²⁾ Two further projects were financed at Cambridge. The Cambridge Growth Project developed a large multi-sectoral model of the UK economy, and the Cambridge Economic Policy Group emphasised the importance of the balance of payments and its relation to the public sector deficit in analysing the economy.

Each of the four large funded models contained between 500 and 1,000 relationships. Although the models were used as systems they were mainly estimated using single-equation methods. They also shared the same underlying economic paradigm—a fairly basic Keynesian income-expenditure framework with little or no role for supply-side factors. These models were used both for forecasting and policy simulation exercises, typically with short horizons of between eighteen months and two years. The long-run properties of the four main models and their consistency with theory were rarely questioned. But because of their fundamental similarities, they were perceived to have failed at around the same time, and confidence in their use for policy was reduced.

The first major failures came after the expansionary fiscal policy of 1972–73 and the first major oil shock in 1974. The inflationary mechanism in the models was based around a Phillips curve that was downward-sloping, even in the long run. Problems in finding a stable econometric relationship meant that wages were often treated as exogenous in forecasting and policy analysis. The exchange rate was treated in much the same way, because of the lack of data on a flexible exchange rate regime. Thus two principal components of the transmission mechanism of shocks to inflation were essentially ignored in analysis, and inflation was consistently underestimated in this period. Even if the models could explain how an increase in

This article has benefited from many helpful comments from Paul Fisher.
 A more detailed history is given in Ball and Holly (1991).

demand might be associated with higher inflation, they could not explain 'stagflation' in 1974–75, when output fell and inflation rose.

By the early 1980s it became clear that policy-makers had little confidence in macroeconometric models in general. This can be attributed partly to the failure of forecasts (Barker, 1985), but also to the perceived theoretical shortcomings of the models (and particularly the absence of a key role for money). The models were generally regarded as fairly primitive demand-driven systems. In his memoirs (1992), Lawson recalls the forecasts made in the Treasury during 1980 and remarks that 'Treasury forecasters were predicting the worst economic downturn since the Great Slump of 1929-31. Yet they expected no fall in inflation at all. This was clearly absurd and underlined the inadequacies of the model' (page 50). He describes several instances where he substantially changed the in-house forecast despite 'a deep in-house commitment not merely to the Treasury forecast, but to the Treasury model as a central tool of analysis and policy advice' (page 49). Followers of the policy debate around this time could not have failed to notice that the underlying economic analysis more closely reflected the properties of the London Business School model, which had recently been converted to an 'international monetarist' approach and whose former director of forecasting had become government chief economic advisor, than those of the official Treasury model. Some of the characteristics of the new Liverpool model of the economy were also apparent in contemporary economic analysis.

The Liverpool model was one of two new smaller models that were developed in the early 1980s. The Liverpool 'new classical' model and the City University Business School (CUBS) model were radical alternatives to the existing models. They emphasised the role of expectations (Liverpool) and both money and supply-side factors (Liverpool and CUBS). Some of these innovations (but not the role of money) also found their way into the existing models (see Wallis and Whitley, 1987). But this did not remove the inherent distrust of the models, which was shared by many academic economists, for example, Lucas (1976), Sims (1980) and Kydland and Prescott (1977). Earlier expectations of what models might achieve had evidently been set too high, with unrealistic claims about their reliability and scope.

The main continuing problem was that policy-makers were faced with apparently conflicting results from different models. Holden (1989, page 862) commented that 'the basic question of whether policy simulations give insights into the real world or just demonstrate the properties of the models (and the beliefs of the model builders) remains to be answered'. Users of models were essentially asked to take results on trust, yet they were aware that different models generated apparently different policy conclusions, the causes of which were not clear. There were several possible reasons for this. First, policy questions addressed to the models tended to be relatively broad. The various ways in which the broad question was interpreted could lead to differences in the conclusions. Second, even where the interpretation was common, many of the models were not designed to answer these policy questions without supplementary assumptions. Differences in these further assumptions could also generate differences in the conclusions revealed by identical models. Third, the apparent precision of the conclusions took no account of uncertainty. Finally, there was no way to discriminate between the different conclusions. As policy-makers were unable to understand why different results emerged, their natural inclination was to distrust them all.

By the early 1980s it was no longer clear whether these different results emerged because the models were themselves fundamentally different, or because they were being used or adjusted in different ways. The work of the ESRC Macroeconomic Modelling Bureau, set up at Warwick University in 1983 and surveyed by Smith (1990), began to show that many of the differences were the result of simulation methodology, in particular the need to make supplementary assumptions about the policy experiment (for example, Turner, Wallis and Whitley, 1989a). The work of the Bureau also showed that many of the models were not fundamentally different and that comparative econometric testing could resolve many of the differences in whole-model simulations (Turner, Wallis and Whitley, 1989b).

Although the work of the Bureau helped to make the UK macroeconometric models more transparent, it may have confirmed what policy-makers felt all along—that model results were unhelpful in taking a view about the effects of policy changes. There were as many different views as there were models. Models were judged to be inadequate on the grounds of their econometric and forecasting performance, and this appeared to include the in-house models in the policy-making institutions. If these had contained a clear and strong theoretical base, policy-makers might have felt more reassured that the economic analysis implicit in them was useful, even if there was a great deal of uncertainty about the numerical magnitudes.

In turn, modellers probably gave the misleading impression that their approach could deliver precise measures. Although they were almost certainly aware of the limitations and uncertainties of forecasts based on econometric models, they may have been reluctant to expose doubts to policy-makers in case it gave ammunition to those opposed to the modelling approach. In contrast, some supporters of modelling as a tool for policy analysis and forecasting emphasised the similarity to using an engineering control system. This was illustrated by the optimal control approach, based on the principle that the economy could be controlled in a mechanical way by setting the appropriate trajectory of policy instruments for given targets for key macroeconomic variables. This view was given some limited support by the Committee on Policy Optimisation chaired by Ball (1978). All that was needed was for the policy-makers to define their welfare function, with the role

of the model being to define the empirical trade-off between different policy objectives. But the result was that more was learnt about the idiosyncrasies of the model than about the workings of the economy (as illustrated in Wallis *et al*, 1987).

Academic economists also tended to regard macroeconometric modelling as rather an unproductive process. Deaton (1981) commented that 'little in the way of scientific knowledge is to be gained from the construction of large-scale models over what can be learned by other means'. Modelling was seen as a second-rate activity done by people who were not good enough to get proper academic jobs. Maintaining models was also very expensive, and public funding was being reduced. Both official models were scaled down and some models, such as CUBS, disappeared, although one major new model emerged, COMPACT, constructed at the University of Strathclyde.

One UK model that clearly represented a coherent theoretical paradigm was the Liverpool model with its new classical origin. It could be argued that its clear message and underpinnings were more consistent than many of the other UK models. The appeal of the Liverpool approach to policy-makers was twofold. It emphasised the role of money and inflation expectations, and its smaller, more stylised approach made its predictions and analysis easier to understand. This comes close to the main theme of this article-that policy-makers require a framework that gives them a stable and consistent way of interpreting an economic system subject to many and varied shocks. Large macroeconometric models were perceived by their users to have failed to meet this need. The failure of forecasts was probably the most important symptom of this, subsequently documented in Wallis (1989). Forecast failure could also be associated with the Liverpool model. But the models were also thought to give an inadequate representation of the impact of exogenous shocks, including policy changes.

Modelling and forecasting cannot claim to have led to many major insights or produced original research or findings, but they generated the issues and problems that encouraged developments in econometric techniques. For example, the stimulus to work on consumption by Davidson *et al* (1978), which led to the development of error correction models, came from the breakdown of empirical models of consumption behaviour. More recently, others have argued (Hall, 1995) that macroeconomic modelling has developed empirical applications of different expectations mechanisms.

The suggestion that large macroeconometric models have somehow lost their way might suggest a wholesale rejection of the model-based approach to forecasting and analysis of the economy. The risk then is that policy becomes wholly dependent on the implicit model(s) in the minds of policy-makers. These implicit models are less transparent; less likely to be consistent over time; less able to be judged against empirical criteria; and more likely to be internally inconsistent. Downgrading the role of formal models in the policy process may leave a vacuum that might be filled by an entirely subjective approach. That the formal approach has not been completely abandoned may in part be the absence of satisfactory alternatives. But it may also be a consequence of adaptations to the forecasting process and the way in which models are used, as well as improvements in the models themselves. These adaptations have been designed specifically to improve policy-makers' confidence in models. This can be achieved by satisfying the following conditions:

- (i) Models can be explained in a way that is consistent with accepted economic analysis.
- (ii) The model-based results are also consistent with relevant historical episodes.
- (iii) Results are consistent over time; the policy-maker is likely to be impatient with results that differ because the economic model has been changed in some respect (for example, new estimates of parameters) without convincing reasons.
- (iv) The judgmental part of the process is made explicit.

If these conditions are not met, econometric models may continue to have a low priority in many areas of economic policy-making. The second section of this paper describes how approaches to modelling are being developed at the Bank that still retain the role attributed to them by Higgins in his comments on the volume edited by Bryant *et al* (1988, page 294), namely that 'a formal and quantified framework is an irreplaceable adjunct to the process of policy thought'.

Filling the vacuum—new approaches

This section sets out how models can be more successfully integrated into the policy process. In particular, it outlines the approach that has developed at the Bank since 1993. Part of the new approach relates to the models themselves and how they are used, but the more important part relates to integration of senior policy-making officials into the judgmental process that invariably accompanies the use of formal models. The new approach has three main aspects: the use of several models; the treatment of uncertainty; and the co-ordination of the process in official institutions. At the Bank the process has been given additional focus by the adoption of new monetary arrangements since 1992, under which the Bank advises on monetary policy with reference to an externally determined inflation target, set two years out. Since monetary policy takes time to act on output and inflation, a forward-looking assessment is essential. The inflation target makes this assessment explicit. In the interests of transparency, the Bank publishes its analysis in its quarterly Inflation Report, including a projected path of future inflation. Before this the Bank did not publish its forecasts: they were supplied only to the Treasury (Treasury and Civil Service Committee, 1991).

The multi-model approach

The new approach to the use of models in the policy process recognises that all models are, at best, only a rough approximation to the workings of a modern economy, despite attempts to make them more theory-consistent and the use of more sophisticated econometric techniques. Matching the level of rigour of pure theory models would be extremely difficult. Empirical data are unlikely to be sufficiently informative to capture the range of shocks likely to be experienced and the closeness of fit of models is often not sufficient to pick up small changes (Fisher and Wallis, 1990). Essentially, models represent averages of past behaviour. Usually they are affected by changes in the policy regime, which is a major disadvantage for policy-makers. In principle, 'structural' parameters might be derived by explicitly allowing for changes in expectations and these could adjust when the policy regime changed. But expectations are not usually observed and can only be included in models by making restrictive assumptions about how the information set is formed and how it is updated. The use of rational, or model-consistent, expectations has a certain logical appeal but imposes informational assumptions that are often regarded as implausible. Modifications of this approach, such as rational learning, are still being developed and are not yet a standard part of the model builders' armoury, although they have been used regularly at the London Business School. Even if the expectations problem is avoided, parsimony of the model equations usually implies that most exogenous shocks are subsumed in the error terms of the estimated equations. Moreover, the effects of these exogenous shocks on different aspects of economic behaviour are usually assumed to be uncorrelated.

It would be unrealistic to expect a macroeconometric model to identify all the various shocks that can hit the economy and to condition estimates on them. In practice this means that only those shocks which can be quantified are included, and then only when they have been observed in the past. As a result, most models have very few explicit exogenous influences, and thus risk failing to satisfy standard identification criteria. If the macroeconometric model provides the model framework and gives a response to an average shock, then other approaches need to identify what types of economic shock are likely to occur (or have occurred) and to predict how these will affect economic behaviour in a different way from the average shock. This is the essence of the multi-model approach, which complements macroeconometric models with other types of model. For example, the structural VAR approach of Blanchard and Quah (1989) is much better designed to identify different economic shocks and has been used at the Bank by Astley and Garratt (1996) to decompose and identify sources of shocks to the nominal and real exchange rate. Analytical models can then be used to illustrate the qualitative responses expected. These analytical models can be based on micro-optimising approaches or stylised macro models. A second example is the Dornbusch-Buiter-Miller (DBM) model that has been used at the Bank to illustrate the consequences of monetary or real shocks (see Inflation

Report, May 1995). This additional model analysis can then be used to ensure that the empirical macro model gives a result consistent with accepted theory.

A forthcoming paper by Fisher and Whitley (1997) will describe the suite of models that the Bank currently uses. These use different modelling methods, each of which has advantages and disadvantages. In combination, the different models allow a range of economic analysis to be performed that would be impossible (or at least highly flawed) for any single approach. The models cover the spectrum from almost entirely theoretical to almost purely statistical. They are briefly described below. There is a range of models in each category.

(a) Small analytical model project (SAM)

These models all derive theoretically from optimising behaviour of economic agents. Models currently in use at the Bank include a real business cycle model and a set of labour market models. Each is solved under the parameterised expectations method of den Haan and Marcet (1990) for a given choice of parameters. They are useful for predicting the economic consequences of shifts in deep structural parameters such as risk aversion, preference shocks etc. Their empirical support is gauged by their ability to explain the stylised facts of the UK economy (variances and correlations of economic variables).

(b) Stylised macro model

These models have been developed to reflect the aggregate macro approach to modelling in contrast with the micro-based optimising SAM models. One basic model is a Dornbusch overshooting approach, which is probably the best-known macro 'text book' model. In this context it is a simple five-equation model determining real output, money, prices, exchange rates and the interest rate. It was used to analyse the inflationary consequences of the exchange rate depreciation of early 1995. It can be solved as a static model with calibrated parameters or in a dynamic version with econometrically estimated coefficients. This approach has been applied to the issue of whether the monetary transmission mechanism differs in the United Kingdom from that of Germany and France, by estimating equivalent models for these other two economies (Britton and Whitley, 1997).

(c) Macroeconometric forecasting model

This model is in the mainstream of macroeconometric modelling and is constructed specifically to help project inflation up to a medium-term horizon. There is no fixed model; it is subject to regular revision and updating but most of these revisions occur as a result of the analysis agreed during the forecast round with the policy-makers. It is much smaller than other contemporary macroeconometric models of the United Kingdom (such as the models of the Treasury, the NIESR, the London Business School and the COMPACT model). It has fewer than 20 core equations and can be seen as an extension of the Dornbusch overshooting model described above. It is based on quarterly data and forms the framework for the inflation projection made for the Bank's *Inflation Report*. The much larger model used by the Bank up to 1993 explained the output side of the economy in considerable detail, with less emphasis on price determination. The present model attempts to redress the balance, with relatively more emphasis on price determination and less on the income accounts. Money plays an important role. The model attempts to incorporate the key elements in the transmission of monetary policy to inflation. As noted above it is not used mechanically, but the forecast takes into account information and analysis from the other economic and statistical models as well as other statistical and survey-based information (such as reports from the Bank's regional Agents).

(d) Simple output gap models

These are simple two-equation models which relate inflation to measures of the output gap. They can be interpreted as a reduced-form representation of the macroeconometric model, allowing focus on the importance of the size of the output gap and the role of expectations/policy credibility in the inflation process. Point estimates of the output gap can act as a consistency check on the Bank's inflation projection.

(e) VAR models of inflation

At the other end of the spectrum from the purely theoretical SAM models there is the 'theory-free' VAR approach, which relates inflation to key indicators such as retail sales and narrow money. Monthly and quarterly Bayesian VAR models have been developed, following previous work by Henry and Pesaran (1993). Structural VAR models with some limited theory content are also used (Astley and Garratt, 1996).

The small macroeconometric models play a particular role: they provide a benchmark for average responses to average shocks and they are the vehicle for mapping the analysis from other models onto the inflation projection. They are deliberately small and highly aggregate. This allows modellers and model users to focus on key issues rather than become distracted by excessive detail, which can if necessary be handled quite easily in sub-models. The results of more disaggregated analysis can then be used only when relevant to the macro picture. The aim is not to forecast every detailed aspect of the economy but to help clarify and focus on the developments most relevant to the determination of inflation. Disaggregation does not always help, since there is often at least one very poorly fitting component of any disaggregated model. This is often the case, for example, when more attention is placed on explaining the manufacturing sector, where data is more accessible, than on the quantitatively more important service sector.

A small macroeconometric model, like any other formal model, evaluates the effects of shocks to included exogenous influences, such as aggregate government expenditure or the income tax rate. But as Turner *et al* (1989a) show, even

these forecast or simulation properties may be misleading when the shock relates to a particular component of the exogenous variable that might then affect the economy in a distinctive way. The Bank's small forecasting model was specifically designed to evaluate the consequences of interest rate changes on output and inflation. This does not mean, however, that there is a unique ready-reckoner for the impact of a change in official interest rates on the inflation projection. For example, the reduced-form impact depends on whether the change in official rates has already been incorporated in market expectations.

The multi-model approach also allows different models to be used for forecasting and policy analysis. In the past these have often been treated as a joint purpose. This reflects the view that models should not be used seriously for policy when they cannot be shown to explain past economic history. But models designed for forecasting may not be designed for policy analysis. Particular policy instruments may not be specified, channels of transmission may be absent or poorly defined, or there may be inadequate allowance for policy to respond to prevent unstable outcomes (for example to maintain fiscal sustainability) the model closure problem.

Two examples may help to show how the multi-model approach can be used. First, consider the hypothesis that job insecurity has increased in recent years in the United Kingdom. Most macroeconometric models would have nothing to say about this, because they have no variable akin to job security, but micro-based optimising models (such as search models) can be used to assess the implications of a change in the level both of general risk aversion and of idiosyncratic risk. If the implications appear consistent with historical data, they can be used to modify the relevant behavioural equation in the macroeconometric model (in this example consumption and labour supply behaviour).

A second example is an analysis of sources of an exchange rate appreciation (or depreciation). The exchange rate is endogenous to the macroeconomic system, and so it is inappropriate to evaluate the effects of an appreciation by simply changing the level of the exchange rate as if it were an exogenous influence, and then looking at the consequences for other endogenous variables. The impact of a shock to the exchange rate on output and inflation depends on its source. A shift in the exchange rate will only be truly exogenous if it is completely unrelated to the domestic economy, and even in that case its cause may have other effects on the domestic economy (eg on import prices measured in foreign currency). At the other extreme the exchange rate change may merely reflect a shock that primarily affects other endogenous variables in the system. Other approaches are needed to identify the nature of the shock. Structural VAR models may help to assess the relative probabilities of nominal or real shocks. Inspection of yield curves may help to identify whether the shock reflects a change in expected domestic or foreign monetary or fiscal policy. Use of stylised macro models (such as the DBM model) may also help in understanding the exchange

rate and other macro consequences of various shocks, and in comparing these with recent data.

The main requirement of the multi-model approach is that there is some basic consistency in economic paradigm across the various models. It would usually be inconsistent to use, for example, an analytical model based on market-clearing behaviour of the labour market in combination with a macroeconomic model that assumes that the labour market does not clear, so that there is involuntary unemployment. But sometimes the implications of these different assumptions may be at the heart of the matter. If, for example, we wanted to allow that labour markets have become more nearly market-clearing, the analytical model could be used to inform the macro model of the consequences of this change.

The multi-model approach is not as radical in practice as it may seem. It is common to use other information in forecast and simulation analysis, but perhaps not systematically and transparently. The emphasis of the Bank's approach is the use of models as a framework for analysis and for thinking about the economy. Using several models is by no means an attempt to obscure policy-makers' views of the economy. The policy-makers' response would be that their view of the economy has never been simple enough to be captured in even a large model. Nor were policy-makers ever signed up to the idea that they should adjust policy instruments mechanically to changes in key economic variables. What is important is that the overall economic analysis and judgment are as transparent as they can be. This is the aim of the Bank's Inflation Report. It is important to recognise that the publication and availability of models are not a substitute for the analysis itself. They are merely a necessary input. The Bank's small macroeconomic forecasting models are used to provide an overall framework within which this analysis is integrated in a consistent way. The multi-model approach implies that it is not possible to 're-run' history using the policy-makers' 'model' of the economy to test whether the policy decision could have been improved, relative to some welfare criteria. This is because there is no comprehensive model that is adequate for all situations. The Bank's view would be that it should be judged by the quality of its policy advice and the analysis that underlies it, not on particular features of a model which is a tool of analysis. One does not judge an artist by the quality of his brushes or paint but by the way in which he skilfully combines them.

For the Bank there is an additional reason why simulations or forecasts using the macroeconometric models may pose problems. Under the present monetary policy arrangements, the Bank gives advice based on what might happen if official short-term rates were to remain at the current level. As such, projections are based explicitly on constant nominal interest rates. This gives rise to two main issues: internal consistency and forecast validation.

It is important to maintain internal consistency between the exchange rate and interest rate projections. The yield curves

prevailing in the market at any moment imply future paths for short-term interest rates and exchange rates in each country. The relationship between interest rates and future exchange rates is determined by uncovered interest parity. Normally the market yield curve will imply that the market expects some future change in UK short-term interest rates. However, the assumption made in the Bank forecasts is that UK short-term interest rates remain unchanged for the next two years, but that interest rates in other countries evolve as implied by current yield curves. On this basis, market expectations implicit in the current yield curve are unlikely to be fulfilled. To avoid inconsistency, markets are therefore assumed to be surprised by the fact that official UK rates in the projection differ from the market expectation. The assumption of constant nominal short-term interest rates in the United Kingdom cannot be sustained in the longer term, because it leads ultimately to accelerating inflation or deflation. This nominal indeterminacy can be prevented by use of a simple reaction function for official short-term rates beyond the forecast horizon.

The issue of forecast validation is more difficult. Since the Bank's inflation predictions are based on the assumption of constant interest rates, its forecasts cannot be directly compared with other forecasts or with actual outturns. This issue is discussed below.

The second key element in making models more relevant to policy-makers is to incorporate uncertainty in a helpful way. The following section describes how this has been tackled at the Bank.

Forecast uncertainty

A difficulty in presenting policy-makers with model-based forecasts is that these are typically point estimates, which nearly always prove wrong. But policy-makers are interested in the risks on either side, or in the distribution of possible outcomes. In the past, stochastic simulations with models have been used to estimate an error band around forecasts, but these are usually so large (reflecting the least well-fitting of the model equations) that they are unhelpful to the policy-maker. Wallis et al (1984) found standard error bands of around 1% of GDP over a one-year horizon for some of the main UK models, and Ireland and Westaway (1990) found that this could increase to more than 4% over three years for the NIESR model. More recently Blake (1996), also for the NIESR model, has found standard errors by stochastic simulation of 0.8 percentage points for inflation after one year, increasing to 1 percentage point after two years. Corresponding GDP growth errors are 1.3 percentage points and 1.5 percentage points.

Another approach is to conduct scenario analysis to indicate possible outcomes under a variety of assumptions about either exogenous influences or economic behaviour. But these may not be very helpful if they cover a wide range of possibilities without giving any indication of the relative probabilities of each scenario, or if the scenarios do not relate to a binary choice (for example, the election of alternative political parties, each with distinct policy proposals).

The approach that has been developed at the Bank has a different emphasis. It distinguishes between general uncertainty and specific risks. General uncertainty is the uncertainty captured in the stochastic error variables in the model equations. Estimates of this are based on the previous forecast record, not on stochastic simulations with econometric models. These past errors have reflected the interaction of the model and forecaster's judgment and since judgmental intervention often reduces forecast error (Wallis and Whitley, 1991) this produces a smaller error band around forecasts than full stochastic simulation. Use of the forecast values rather than pure-model forecasts is consistent with a procedure in which the projections are not based solely on the forecasting model itself. We have described above how several models may be used to inform the forecast. It follows that there is no exact statistical representation of the underlying model which can be used. Use of forecast errors as a guide to uncertainty is not in itself new. The Treasury has regularly published mean errors alongside its forecasts and the NIESR also uses past forecast errors as a measure of uncertainty (Poulizac et al, 1996).

Ex post analysis of forecast performance should allow for the fact that the *ex ante* forecasts are conditional on unchanged nominal interest rates. If the projections formed in this way had led to a change in interest rates then the observed outturn would not necessarily be a good guide to the accuracy of the forecasts. Analysis of past forecasts can and should allow for this, preferably by recomputing the projection with endogenous interest rates. Current practice is to recalculate historical forecast errors as if nominal interest rates had been constant. This puts them on the same conditional footing as the projection itself.

Specific risk is the risk that structural change may be occurring, in other words the parameters of the model may be changing, or that there is uncertainty attached to the impact of particular shocks. For example, available evidence may be inconclusive as to whether there has been a structural change in real wage behaviour. Even if we are unable to reject the null hypothesis of no change, we may wish to allow for the possibility that real wages will be lower than indicated by the relevant estimated (behavioural) relationship. In this example we would say that the risks for inflation are skewed downward. Another recent example is the effect on consumers' expenditure of windfall gains to households as a result of the conversion of mutual institutions such as building societies to publicly quoted companies. In evaluating the likely impact of these conversions, there is little previous documented experience to act as a guide. In these circumstances the central forecast has to be based to a large extent on a priori reasoning. Such reasoning suggests that only a small proportion of the windfall gain will be spent in the short term. The risks to the central forecast in this case are skewed upward.

In principle, the overall risk around a forecast may be asymmetric. All that is required is that the underlying model is capable of a behavioural interpretation and that shocks are broadly independent (although some shocks might be expected to be correlated across different aspects of behaviour). Part of the appeal of the approach (which is Bayesian in spirit) is that it corresponds to the way in which policy-makers can contribute to forecast judgment. They can be presented with central assumptions (which in most cases will be based on the relevant behavioural equation in the macroeconometric model) together with evidence on why average historical experience may not be repeated (either because of structural change, new shocks, or differences in the marginal impact of a shock). There is nothing new in amending model equations to involve judgment; what is new is to make the judgmental decisions in agreement with policy-makers. The general approach is detailed further in Britton, Cunningham and Whitley (1997).

The macroeconometric models act as a benchmark for behaviour. The process works by considering risks around each of the main behavioural assumptions and projections of exogenous variables in a macroeconometric model. The overall risks to the inflation projection are a composite of the risks to the individual component projections. These can be summarised as net demand or supply risks if the behavioural equations of the model can be given a demand or supply interpretation. Ready-reckoners can then be used to estimate the impact of any shock to either demand or supply on inflation, using the properties of the model. But we have to accept that the resulting estimates are approximate.

It is possible, over all the factors in the model, that risks may turn out to be symmetrical either side of the central forecast. It is more likely that there are net risks either upward or downward for the Bank's inflation projection. But the central projection is seen as the mode, or single most likely outcome. This reflects the importance of having a central economic story behind the forecast, rather than attempting to minimise some statistical measure of bias. If the distribution is heavily skewed the expected (mean) outcome may be quite distant from the single most likely outcome.

The chart shows how this forecast uncertainty is presented in the *Inflation Report*. Since February 1996, we have published our inflation projection as a fan chart. This chart, which is taken from the February 1997 *Inflation Report*, shows our view of the relative likelihood of possible outcomes for inflation. That view is a combination of both our expectation of the most likely outcome for RPIX inflation and an assessment of the risks surrounding that central projection. The central band, shaded darkest, includes the central projection: we think that there is about a 10% chance that inflation will fall within the range described by that band at any date. The next deepest shade, on both sides of the central band, shows the 20% range; and so on, in steps of ten percentage points. Of course, it is

RPIX inflation central projection: February 1997



impossible to assess the probabilities with any precision, but this represents the Bank's best estimate.

The position of the mean relative to the mode depends on the degree of asymmetry of the risks. This approach uses the variance implicit in past forecasting performance and although it has a subjective element, it is conducted as part of a formal process and makes transparent how the policy-maker views the uncertainty and risks around economic forecasts.

Involvement of officials in the forecast process

A third key requirement for forecasts to be taken seriously in the policy process is that senior officials are part of the forecast process. Only in this way can they be persuaded to use the forecasts fully in policy advice and formulation. A collegiate approach is used at the Bank, as described by the Governor in his Loughborough speech in November 1996 (reported in the Bank's *Quarterly Bulletin*, February 1997):

'I am sometimes asked whose forecast exactly is it? Is it the analysts', or their managers' or the Directors', or the Governor's? The answer is that it is the Bank's with inputs at all those levels as well as points in between. In fact, we have a sequence of meetings at which we assess the 'news' since the last forecast (that's to say those developments that are not as we had expected), then we discuss the behavioural assumptions in the light of past relationships and the news in the current data, and we discuss the nature of the risks, then we review how the results are reflected in an initial forecast, in the light of which we may re-examine some of the assumptions of our assessment of the risks until we are all reasonably comfortable with the result. It is important, given the crucial role it plays in the process, that the forecast should be something that all those involved in its preparation should feel that they own.' (Page 101, italics added.)

In contrast, the forecasts produced in the Treasury are clearly the responsibility of the Chancellor. 'The forecasts are the Government's forecasts... it is for ministers to decide how far to accept officials' advice. This has been the case for many years' (Treasury and Civil Service Committee, 1991, page 6). This leaves it to the Chancellor to take or reject the forecast produced by the officials.

At the Bank there are regular meetings during the preparation of the Inflation Report forecast. The first meeting concentrates on the key issues that have arisen since the previous forecast. Central assumptions and risks are discussed but no numbers are presented at this stage. Emphasis is placed on the continuity of analysis and the relevance of new evidence and data. The next meeting sets out the central projection of inflation under the agreed central assumptions and the implied probability distribution derived from the agreed assessment of risks. The consistency of the analysis is discussed and this may lead to further changes in the projection or view of risks. Final projections are agreed at subsequent meetings. A key feature of the discussions is that the projections are formed from an agreement about the overall analysis of the economy rather than from committee decisions on each particular component of the forecast. The forecasters then translate the analysis into a quantitative framework.

The introduction of the new monetary arrangements in the United Kingdom since 1992 has provided a specific focus for the projection work and the way in which it is determined. In particular the process concentrates on issues that are relevant to the inflation outlook. This means that discussion and resources are not diverted to forecasting low priority variables. But the process that has been adopted for forecasting and analysis is flexible and could be adapted for other policy objectives or different monetary arrangements, subject to some of the key considerations outlined below.

For the approach to work effectively the Governor and Directors have to be prepared to spend time discussing economic analysis with the forecasters. For their part, the forecasters have to be able to identify the key issues clearly so as to facilitate a constructive discussion. One advantage is that over time both will tend to share the same analytical framework. Moreover, policy-makers become more familiar with the underlying models than they would from an abstract presentation of a single model and its properties. The risk approach stresses the ability to present the forecast as a central economic story and to distinguish separately the risks around the central case. This has more intuitive appeal than approaches that present a forecast as an amalgam of the central case and the net effect of risks. It also makes the risk assessment more transparent and enables senior officials to contribute to the necessary judgments.

A priori reasoning plays an important part in the process. For example, a new shock would require analysis of its expected effects on the behaviour of the economy, perhaps using stylised macro models or analytical micro-based models. The likely effects of the shock on key endogenous variables are then agreed in advance, at least in qualitative terms, including whether they are temporary or persistent. Macroeconometric models can be used to quantify likely effects. The flow is from analysis to numerical estimates rather than the reverse.

The consistency of the forecast over time is an important consideration. The modeller/forecaster has to be able to explain *ex ante* to the policy-maker how new information might change the projections. This might consist of new data, analysis or empirical research. In the absence of new information the policy-maker would expect the forecast to remain unchanged.

Summary and conclusions

This article sets out the reasons why the role of large macroeconometric models in the formulation of economic policy in the United Kingdom has been reduced. It is argued that much of the distrust of models has resulted from attempts to use macroeconometric models in an unrealistically comprehensive way. A more eclectic approach has been adopted at the Bank. Its main features are the use of a range of models to help address the many issues that arise; a framework for assessing forecast uncertainty; and the focus on one task (in this case a two year ahead inflation target). This new approach has been encouraged by a change in the monetary policy arrangements but also by the willingness to make changes in the way that projections are formed and discussed. The general spirit of the approach makes it amenable to alternative policy objectives or changes in the nature of the monetary arrangements. Knowing exactly why projections are required and how they are used also focuses attention more effectively. Opening models up to policy-makers and revealing where judgment is needed may be more likely to encourage than discourage the use of models.

References

- Astley, M and Garratt, A (1996), 'Interpreting sterling exchange rate movements', *Bank of England Quarterly Bulletin*, November, pages 394–404.
- Ball, R J (1978), Committee on Policy Optimisation Report, Cmnd.7148, London: HMSO.
- **Ball, J and Holly, S (1991)**, 'Macroeconometric Model-building in the United Kingdom', in (eds R G Bodkin, L R Klein and K Marwah), *A History of Macroeconometric Model-Building*, pages 195–230, Aldershot: Edward Elgar.
- Barker, T, (1985), 'Forecasting the Economic Recession in the UK 1979–1982: a Comparison of Model-based *ex ante* Forecasts', *Journal of Forecasting 4*, pages 133-51.
- Blake, A (1996), 'Forecast error bounds by stochastic simulation', National Institute Economic Review 156, May, pages 72–8.
- Blanchard, O and Quah, D (1989), 'The Dynamic Effect of Aggregate Demand and Supply Disturbances', American Economic Review 79, pages 655–73.
- Britton, E, Cunningham, A W and Whitley, J D (1997), 'Asymmetry, Risks and the Probability Distribution of Inflation' Bank of England, *mimeo*.
- Britton, E and Whitley, J D (1997), 'Comparing the monetary transmission mechanism in France, Germany and the United Kingdom: some issues and results', *Bank of England Quarterly Bulletin*, May, pages 152–62.
- Bryant, R C, Henderson, D W, Holtham, G, Hooper, P, and Symansky, S (1988), (editors) *Empirical Macroeconomics for Interdependent Economies*, Washington D C: Brookings Institution.
- den Haan, W J and Marcet, A (1990), 'Solving the stochastic growth model by parameterising expectations', *Journal of Business and Economic Statistics* 8, pages 31–34.
- Davidson, J E H, Hendry, D F, Srba, F, and Yeo, S (1978), 'Econometric modelling of the aggregate time-series relationship between consumers' expenditure and income in the United Kingdom', *Economic Journal* 88, pages 661–92.
- Deaton, A, (1981), 'On the usefulness of macroeconomic models', paper prepared for the *Bank of England Panel of Academic Consultants*, Bank of England.
- Fisher, P G and Wallis, K F (1990), 'The historical tracking performance of UK macroeconomic models, 1979–85', *Economic Modelling 20*, pages 179–97.
- Fisher, P G and Whitley, J D (1997), 'The Bank of England's Suite of Models', Bank of England, mimeo.
- Hall, S G (1995), 'Macroeconomics and a bit more reality', Economic Journal 105, pages 974-88.
- Henry, S G B, and Pesaran, B (1993), 'VAR models of inflation', Bank of England Quarterly Bulletin, May, pages 231–39.
- Holden, K (1989), 'Review of Britton', Economic Journal 99, pages 861-63.
- Ireland, J and Westaway, P F (1990), 'Stochastic models and forecast uncertainty in a forward looking model, *National* Institute Discussion Paper No 183.
- **Kydland, F and Prescott, E C (1977)**, 'Rules rather than discretion: the inconsistency of optimal plans', *Journal of Political Economy 85*, pages 473–91.
- Lawson, N (1992), The View from No.11, London: Bantam Press.

- Lucas, R E (1976), 'Econometric policy evaluation: a critique', in Brunner, K and Meltzer, A H (editors), 'The Phillips curve and Labour Markets', supplement to the *Journal of Monetary Economics*.
- Poulizac, D, Weale, M and Young, G (1996), 'The Performance of National Institute Economic Forecasts', *National Institute Economic Review 156*, May, pages 55–62.
- Sims, C A (1980), 'Macroeconomics and reality', Econometrica, 48, pages 1-48.
- Smith, R P (1990), 'The Warwick ESRC Macroeconomic Modelling Bureau: An Assessment', International Journal of Forecasting 6, pages 301–9.
- **Treasury and Civil Service Committee (1991)**, *Memoranda on Official Economic Forecasting, Session 1990–1.* 532:I, HMSO: London.
- Turner, D S, Wallis, K F and Whitley, J D (1989a), 'Using Macroeconometric Models to Evaluate Policy Proposals' in Britton, A (ed.) Policymaking with Macroeconomic Models, pages 103–50, Aldershot: Gower.
- Turner, D S, Wallis, K F and Whitley, J D (1989b), 'Differences in the properties of large-scale macroeconometric models: the role of labour market specifications', *Journal of Applied Econometrics*, 4, pages 317–44.
- Wallis, K F (1989), 'Macroeconomic forecasting: a study', Economic Journal, 99, pages 28-61.
- Wallis, K F, Andrews, M J, Bell, D N F, Fisher, P G and Whitley, J D (1984), Models of the UK Economy: A Review by the ESRC Macroeconomic Modelling Bureau, Oxford, Oxford University Press.
- Wallis, K F, Fisher, P G, Longbottom, A J, Turner, D S, and Whitley, J D (1987), Models of the UK Economy: A Fourth Review by the ESRC Macroeconomic Modelling Bureau, Oxford, Oxford University Press.
- Wallis, K F and Whitley, J D (1987), 'Macro Models and Macro Policy in the 1980s', *Oxford Review of Economic Policy* 7, No 3, pages 118–22.
- Wallis, K F and Whitley, J D (1991), 'Sources of Error in Forecasts and Expectations: UK Economic Models 1984–88', Journal of Forecasting 10, pages 231–53.

The information in money

By Mark S Astley of the Bank's Structural Economic Analysis Division and Andrew G Haldane of the Bank's Monetary Assessment and Strategy Division.

The monetary and credit aggregates are among many indicators used to consider future prospects for inflation. This article assesses the information contained in money and credit about future real activity and inflation. Some of the sectoral components of money and credit are found to have explanatory power over certain disaggregated components of spending. But none of the aggregates is sufficiently reliable to justify looking only at money when formulating an inflation assessment.

Introduction

In 1970 the Bank of England published two influential papers on money. The first, 'The importance of money' by Charles Goodhart and Andrew Crockett, is well-known. It set down the conceptual foundations underlying analysis of the monetary aggregates. And it provided some of the earliest econometric evidence on the robustness of money demand functions in the United Kingdom—the *sine qua non* of monetary targets.

'The importance of money' set in train a whole literature examining the stability of agents' demand for money balances in the United Kingdom. This reached its zenith during the decade of broad money targeting in the United Kingdom between 1976 and 1986. But with the demise of explicit monetary targets, money demand equations are no longer the fulcrum of the monetary policy framework. Money remains important, in that aggregate money determines the aggregate price level over the medium term. But its importance is no longer seen as being tied umbilically to money demand (in)stabilities.

The centrepiece of the new UK monetary framework, introduced in the autumn of 1992, is an explicit target for underlying inflation. No single indicator assumes primacy as a measure of monetary conditions. Instead, policy decisions are based on an eclectic mix of indicators monetary and real, quantitative and qualitative—which together offer a guide to future inflation. Monetary and credit aggregates are among these indicators. They help inform the authorities' assessment of future nominal demand—a job to which they are clearly well-suited if the velocity of money is reasonably stable. But to know how important a role the money and credit aggregates ought to play in the assessment of inflation, we first need to determine their information content over future real and nominal magnitudes.

One role for money is as an indicator of monetary conditions over the *medium run*, the period over which we

(1) This work is reported more fully in Bank of England Working Paper No 35, 'Money as an indicator'.

think of money determining inflation in a causal sense. That was how monetary targets were used in the United Kingdom towards the middle of the 1980s, when there was a shift away from strict intermediate monetary targeting. It is also how the monitoring ranges for broad and narrow money, introduced in autumn 1992, have been used. And increasingly, it is the way in which other central banks are choosing to interpret their monetary targets or monitoring ranges. For example, the Bundesbank's most recent M3 target has a longer-term orientation, with a growth path specified two years ahead.

But money and credit might also serve a *short-run* role, as a guide to real and nominal trends two to three years ahead. This issue was first addressed in the United Kingdom by the second paper published by the Bank in 1970, 'Timing relationships between movements of monetary and national income variables'. That paper, also by Andrew Crockett, sought to identify empirically the leading-indicator properties of the counterparts and components of money over future real spending and inflation in the United Kingdom. The current UK monetary policy framework lends itself naturally to this type of leading-indicator analysis. In the same spirit, this article presents some updated results on money-income correlations, analysing short-term relations between a range of monetary and credit aggregates and several disaggregations of nominal spending.⁽¹⁾ It asks whether and if so, when and why money and credit might provide us with information about short-run real and nominal trends in the economy.

Extracting information from the money and credit aggregates

The economic indicators monitored by the authorities may either contain *incremental* information that is not available from other sources, or may simply *corroborate* features observable elsewhere in the economy. Both types of indicator are of interest to policy-makers. And the money and credit aggregates can play either role. For example, to some extent they are simply demand-determined. Money is then no more than a mirror of events on the real side of the economy. Narrow moneybasically, cash in the hands of the public-largely falls into this category, since it is available on demand to the public. But in other instances money and credit may offer genuinely incremental information. This may derive from the greater timeliness of monetary data relative to national income data. More fundamentally, however, it may reflect a causal process at work. An example of this is the situation over the last few years, during which agents have built up broad money balances, perhaps as a response to rising real income and wealth. In this situation, higher money balances are felt to be foreshadowing higher future consumption growth. And that is indeed what has happened during the second half of 1996 and into 1997.

But how do we gauge the information content of the money and credit aggregates? And how do we choose among them? This requires some testing procedure. The approach taken here is to look at the *bivariate* relationship between money and credit and various real and nominal indicators. We ask: is this particular measure of money telling us anything about *future* nominal spending, beyond what is contained in lags of nominal spending itself? If the answer is 'yes', then we can trace out graphically the implied leading-indicator relationship from money or credit to income. This serves as a measure of the relationship's significance, timing and thus economic plausibility.⁽¹⁾

Leading-indicator tests clearly need to be interpreted cautiously. They tell us relatively little about whether the link from money to income is genuinely causal. Nor do they tell us whether a particular leading-indicator relationship-or lack of one-will persist in the future. For example, money-income relationships in the United Kingdom are likely to have been adversely affected by the effects of rapid financial liberalisation in the 1970s and 1980s, the period covered by our sample. If there are fewer structural changes in financial technology in the future, then significant money-income relationships may re-establish themselves. Because of this, our results are really only useful as a means of 'stylised fact-finding'; of determining which short-run money-income correlations have shown up systematically and significantly in historical data. They cannot infallibly predict the future-but then, nor can any empirical work.

Despite its theoretical limitations, leading-indicator information is nevertheless valuable as a guide to future activity and inflation. It is for this reason that the Bank of Canada, like the Bank of England, actively uses monetary indicator models when forming its inflation assessment, in addition to formal inflation forecasting.⁽²⁾ And though observed time-series correlations are not grounded in theory, they can be used as stepping stones to formal structural modelling of money-income relationships. For example, the most recently estimated money demand equations at the Bank were motivated partly by such correlations.⁽³⁾ Through these structural money demand relations, the short-run predictive role of money and its longer-run causal role can be coherently brought together as one.

So which money-income relationships do we consider? We take a lead from recent research, some of it undertaken at the Bank. On the *money* side, aggregate measures of money and credit are a natural starting point for the analysis: narrow money (M0), broad money (M4), bank credit (M4 lending) and Divisia M4 (a measure of the transactions component of broad money).⁽⁴⁾ But a key and long-running theme of Bank research is that sectoral disaggregation can help when modelling the behaviour of money and credit.⁽⁵⁾ So we also look separately at links between corporate, ie industrial and commercial companies (ICCs) and other financial institutions (OFIs), and personal sector money and credit holdings, and various measures of activity and prices.

On real variables, we also consider both aggregate and disaggregated measures of spending-real output, its (consumption and investment) components and inflation.⁽⁶⁾ Research suggests that certain measures of money and credit are more closely associated with particular components of spending: for example, narrow money and retail spending;⁽⁷⁾ personal sector M4 and consumption;⁽⁸⁾ and companies' deposits and output and investment.⁽⁹⁾ Below we perform 'horse races' between each of these bivariate (aggregate and disaggregated) money-income correlations in turn.

The information in money and credit

The strength of the correlations between money, credit and spending is summarised in Tables A–D. Those tables consider money-income correlations for narrow money (M0 and notes and coin); broad money (M4 and its disaggregations); lending (M4 lending and its disaggregations); and Divisia M4 (and its disaggregations). In each case, correlations are considered for aggregate and disaggregated measures of spending and for GDP deflator and RPIX measures of inflation. The last of these is, of course, the UK government's targeted measure of inflation.

⁽¹⁾

Again, the working paper version gives further methodological details. In summary, we use bivariate Granger-causality tests as a metric of money's leading-indicator properties, with co-integration between money and income accommodated where necessary. To map out the money-income relations, we use the impulse response functions embedded in the bivariate models. That is, we simulate the effects of money and credit on real and nominal variables by temporarily shocking the residuals from a bivariate money-income model. The working paper also discusses some forecasting and structural stability tests performed on the significant relationships.
 Longworth and Freedman (1995).
 Thomas (1996), Janssen (1996a).
 M0 comprises notes and coin in the hands of the public plus bankers' operational balances at the Bank of England. M4 comprises deposits held with UK banks and building societies by the domestic non-bank private sector. M4 lending comprises borrowing by the non-bank domestic private sector. TW UK banks and building societies. Fisher, Hudson and Pradhan (1993) provide a description of the construction and modelling of Divisia money in the United Kingdom.
 The earliest Bank work in this area is contained in Price (1972). More recent contributions include Fisher and Vega (1993), Dale and Haldane (1995), Thomas (1996).
 The aarliest Bank work in this area is contained in grace disaggregation of real and nominal variables. Breedon and Fisher (1996).
 Fisher and Vega (1993), Thomas (1996).
 Dale and Haldane (1995), Thomas (1996). estic private

⁽⁵⁾

A tick (\checkmark) in the table indicates that we can be 90% confident that the relationship between money and income is systematic and non-zero; and a double tick (\checkmark) indicates that we can be 95% confident of a systematic, non-zero correlation. A cross (X) signifies that there is weak (or no) evidence of a systematic correlation between money and income. The sample period over which we assess money-income correlations is mainly from 1969 to 1993.⁽¹⁾ We are looking for significant correlations at most three to four years ahead. In this way, our tests do not examine the medium-term role of money as a determinant of monetary conditions.

(a) Narrow money relationships

Table A considers correlations between M0 and notes and coin and various disaggregations of activity.

Table A

Narrow money relationships

	M0	Notes and coin
Nominal GDP	~~	~~
Real GDP	~~	~~
GDP deflator	~~	~~
Consumption	~~	~~
Durable consumption	~~	~~
Non-durable consumption	X	~~
Fixed investment	X	~
Stockbuilding	~~	~
RPIX inflation	~~	~~
Key:		
\checkmark = significant at the 5% level or	higher	
\checkmark = significant at the 10% level		
Insignificant		

The main points from Table A are:

- It is clear that using M0 instead of notes and coin hardly alters the basic results. Money-income relationships are slightly less clearly defined when using M0, owing to the volatility of bankers' operational balances at the Bank of England.
- Narrow money has a well-defined relationship with money GDP in the whole economy. And disaggregating money GDP, that relationship holds with both its real (activity) and nominal (inflation) components.
- The narrow money-*activity* relationship appears strongest with the consumption-related components of spending, for example with retail sales.⁽²⁾ These are likely to correspond most closely to cash-financed expenditures.⁽³⁾ But timing patterns suggest that the narrow money-spending relationship is principally a short-run phenomenon. For example, the effects of a shock to narrow money on real GDP have all but disappeared within four quarters.
- Narrow money has, if anything, an even stronger statistical relationship with both GDP deflator

and RPIX inflation.⁽⁴⁾ And, unlike its effect on real activity, the effect of a narrow money shock on inflation is long-lived, with a maximum impact after around eight to ten quarters. Chart 1 illustrates this. It traces out the relationship between notes and coin and RPIX inflation, assuming a 1% point shock to (the stock of) notes and coin in the first period. RPIX inflation outturns are persistently positive for around $2^{1/2}$ years. They have a peak response of around 0.5% points after two years. Since this transmission lag is around the same as for interest rates,⁽⁵⁾ this suggests that notes and coin could prove a potentially useful corroborative indicator of incipient inflationary pressures for monetary policy purposes.

Chart 1 **RPIX inflation response**



These well-defined leading-indicator relationships between narrow money and future inflation have also been found in previous studies-for example, by Williams, Goodhart and Gowland (1976), Henry and Pesaran (1993), Artis et al (1995) and Breedon and Fisher (1996). Because it is demand-determined, cash should in principle be (at best) a corroborative indicator. But in practice the explanatory power of narrow money appears to be incremental: as Breedon and Fisher (op cit) show, narrow money contains information beyond that contained in the variables typically thought to be its underlying determinants, such as interest rates and income. There are several possible explanations. One is that narrow money better captures total money spending because it contains information on the 'underground' economy, which is missed by national accounts data.

(b) Broad money relationships

Table B gives the results for the relationship between aggregate and disaggregated M4 and various disaggregations of nominal spending.

series began in 1977 Series began in 1377. Not shown in Table A, but given in Table 2 of the working paper version. Breedon and Fisher ($op \ cit$.) The relationship is significant at the 1% level. See, for example, Dale and Haldane (1995).

⁽¹⁾ Though for some of the series the sample is slightly shorter: for example, RPIX inflation figures are only available from 1974, and the Divisia

Table BBroad money relationships

	M4 deposits	M4 deposits of ICCs	M4 deposits of OFIs	M4 deposits of persons
Nominal GDP	x	~~	X	x
Real GDP	X	X	~	X
GDP deflator	X	~~	~~	X
Consumption	~	X	~~	~
Durable consumption	X	~	~~	X
Non-durable consumption	~~	X	~~	~~
Fixed investment	X	~~	~~	X
Stockbuilding	~~	~~	X	X
RPIX inflation	X	X	~~	~~

The main points are:

- Aggregate M4 has in the past performed poorly in predicting short-run movements in aggregate measures of spending and prices. There is virtually no evidence of any significant leading-indicator relationship between aggregate M4 and aggregate demand-nominal and real-in the economy over our sample. Or, put differently, the results suggest that the velocity of broad money has been unstable since the late 1960s. That is not particularly surprising. The sample covers a period of rapid and continuing financial liberalisation, during which we would expect the structural relationship between broad money and income to alter. Other countries that have undergone widespread financial liberalisation have also experienced a similar breakdown in simple aggregate money-income correlations, in particular during the 1980s.(1)
- But, as the Bank's recent structural money demand work has shown, disaggregating M4 money balances by *sector* helps improve the power of broad money to predict future spending in the short run. The M4 deposit balances of ICCs are an interesting case in point. From Table B, these possess systematic leading-indicator information on both the real and nominal components of money GDP. The nominal money-real activity link is particularly strong for measures of fixed investment and stock-building by companies. For example, Chart 2 illustrates the

Chart 2

Investment response



effects of a 1% point shock to ICCs' M4 balances on aggregate domestic fixed capital formation and on manufacturers' fixed investment. The relationships are systematically positive for around eight quarters, with a peak effect of between 0.2%–0.3% points. What might account for this relationship between ICCs' M4 and investment? One story is simply that ICCs increase money balances ahead of making planned-but 'lumpy'-investment outlays. Another, more indirect, explanation is that companies first purchase equity assets with their higher money balances. This in turn raises equity prices, lowers the cost of capital and thus stimulates investment spending. The latter sequence is highlighted in Thomas' (1996) structural modelling of companies' money demand decision-making. Whatever the precise mechanism, the ICCs' M4-investment link appears to be fairly robust and has been used by the Bank as an indicator of firms' future investment plans.

- The possibility of a monetary transmission channel working through asset prices is given added weight if we look at the relationship between OFIs' money holdings and activity. Many of the statistical relationships for ICCs' M4 also hold for OFIs' M4. For example, the link between OFIs' M4 and investment is of similar size and duration to that for ICCs. It is difficult to tell a simple behavioural story about such a relationship, as OFIs make largely portfolio-allocation, rather than direct expenditure, decisions. But one plausible explanation is that OFIs' money holdings are, over time, invested in other real and financial assets. As the price of these assets rises, so too does wealth and with it spending in the economy.
- Finally, looking at the personal sector's M4 balances, the only really significant link is to non-durable consumption. This accords with the findings of Fisher and Vega (1993) and Thomas (1996), both of whom model households' M4 jointly with consumption using a structural approach. Both of these studies conclude that the M4-consumption relationship is far from straightforward. The short-run correlations between M4 and spending can be either positive or negative depending on whether disturbances affect money holdings or consumption. Chart 3 illustrates this finding; it plots the response of consumption to a 1% point shock to personal sector M4. As we would expect, the relationship is positive-exogenously higher money balances boost spending-but is extremely short-lived.

(c) M4 lending relationships

Table C summarises the relationship between M4 lending and various disaggregations of nominal spending.

(1) For example, Friedman and Kuttner (1992) highlight the progressive breakdown of the link between M2 and nominal spending in the United States. Estrella and Mishkin (1996) report similar findings for both the United States and Germany.

Chart 3 Consumption response



Table CM4 lending relationships

	M4 lending	M4 lending to ICCs	M4 lending to OFIs	M4 lending to persons	M4 lending to persons consumption
Nominal GDP Real GDP GDP deflator Consumption Durable consumption Non-durable consumption Fixed investment	× × × × ×	× × × × × ×	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	× × ✓✓ ✓✓ ×	× × × × × × × × × × × × × × × × × × ×
RPIX inflation	×	×		X X	× ~~

The main points are:

- Aggregate measures of credit have in the past fared no better than aggregate M4 in explaining real activity and inflation over the short run. The reasons for this are probably the same. Financial liberalisation has removed many of the earlier restrictions on banks' ability to make loans to households and companies. As fewer agents have become credit-constrained, the credit-income link has probably become weaker, because agents can now substitute at lower cost between bank and non-bank sources of financing.
- But as with M4, a sectoral decomposition of credit reveals some more interesting patterns.⁽¹⁾ The most consistently systematic relationship is between personal sector lending and consumption. And within this, the strongest credit relationship is with durable consumption. This seems plausible, since durable goods are more likely to be financed by bank loans than by cash or deposits. Also, total personal sector lending has a stronger relationship with spending than either of its components-lending for house purchase and lending for consumption. This is consistent with households viewing these two forms of credit as close substitutes. For example, during the 1980s households used house purchase loans to finance consumptionfor example, through second mortgages collateralised against housing equity. More recently, when housing

equity has been smaller for many households, they have used consumption loans instead to finance spending.

• As Chart 4 shows, the relationship between personal sector credit and consumption is short-lived, which is to be expected if bank loans are financing, rather than genuinely causing, higher spending. The relationship is also very imprecise. But the link is broadly in line with the view that bank credit is 'special' for some sets of households—namely, those that cannot obtain other sources of financing except at substantial cost.

Chart 4 Consumption response



That view is further supported when we look at the lending relationships for ICCs and for OFIs. Few are statistically significant, and when they are, the graphical relationships lack any systematic pattern.⁽²⁾ Large firms and financial institutions do, of course, often have alternative sources of non-bank financing—such as capital market issues—into which they can switch at little cost. Bank credit is not 'special' for them. This may well explain the lack of any systematic credit leading-indicator relationships for these types of industrial and financial firm.

(d) Divisia M4 relationships

Table D summarises the Divisia M4 results.

Table D Divisia M4 relationships

	Aggregate Divisia	Corporate sector Divisia	Personal sector Divisia
Nominal GDP	X	~~	~~
Real GDP	X	~~	~~
GDP deflator	X	X	X
Consumption	~~	~	X
Durable consumption	~~	~~	~~
Non-durable consumption	X	X	X
Fixed investment	~~	~~	X
Stockbuilding	X	~~	X
RPIX inflation	X	 ✓ 	~~

The main points are:

• As with M4 and credit, there has in the recent past been little systematic relationship between *aggregate*

(1) This is in line with the findings of Dale and Haldane (1995), who argued that aggregate measures of credit (and money) obscure otherwise

informative short-run profiles from sectoral credit. (2) The stronger relationships are for OFIs' M4 lending, which may be further evidence of the importance of asset price effects. Divisia M4 and spending. Divisia is meant to capture the transactions services that money provides. It aims to remove the 'store of wealth' component of money, which has increased as a result of financial liberalisation, and to retain the 'medium of exchange' component, which ought to be correlated more strongly with current spending. In this way, the velocity of Divisia money should be freer from the destabilising effects of financial liberalisation. But the evidence from Table D suggests that Divisia is not wholly immune to the effects of liberalisation, since it is still difficult to uncover stable aggregate Divisia-income relationships.

- Sectoral disaggregation again helps matters.⁽¹⁾ At a sectoral level, many of the more significant relationships simply mirror those with M4. So, for example, the strongest link between personal sector Divisia and spending relates to personal consumption.
- Likewise, corporate Divisia⁽²⁾ has a strong link to future investment spending. This is illustrated in Chart 5. If anything, the link from Divisia to investment is stronger and more systematic than from M4, even though the timing and size of the effect is similar. This is as we would expect if Divisia is indeed a better proxy for the transactions services that money provides.

Chart 5 Fixed investment response



Conclusions

Even under a regime where inflation, rather than any measure of money, is the explicit target of policy, money and credit remain central to the conduct of UK monetary policy and to the control of inflation. Aggregate measures of money have a causal relationship with the price level over medium-term horizons and so serve as a metric of underlying monetary conditions. And, at the same time, money and credit may also be useful as an indicator of short-run developments in the economy.

The Bank's more recent results, discussed above, confirm this short-run indicator role. They suggest that, in certain circumstances, money and credit can offer a useful guide to likely developments in activity and inflation. To give a handful of examples, the relationships between narrow money and inflation; between companies' M4 money balances and future investment and stockbuilding; and between personal sector lending and durables consumption all exhibit well-defined and systematic patterns. An understanding of these relationships can help to inform policy analysis-and has already done so, for example in the Bank's Inflation Report. In particular, there appears to be clear merit in a sectoral analysis of money holdings when analysing their short-run indicator properties. This accords with the findings from previous studies. A sectoral decomposition helps highlight statistical links that are often obscured by aggregate measures of money and credit. And it also helps when telling behavioural stories about why these links might exist—perhaps as a prelude to examining them in a formal structural model. The Bank has instigated monthly collection of the sectoral decomposition of money, which will help in these modelling exercises.

But none of the monetary aggregates has in the recent past offered sufficiently robust early-warning signals to justify looking only at money, as would happen under a strict intermediate monetary-targeting regime. There is information in money, but in other indicators as well. The role of the monetary aggregates is best seen as a complement to, and sometimes no more than a corroboration of, the messages from these other indicators. This is a role that they are increasingly coming to play in other countries too, for example in the United States, Canada and Japan. There, as in the United Kingdom, the effects of financial liberalisation have in the recent past hindered any straightforward interpretation of the monetary aggregates. It is possible that a slowing of the pace of financial liberalisation may mean that, in the future, money has a better-defined relationship with nominal spending in the economy. But at present it is too early to know if such an outcome is likely. In the meantime, money still has an important role to play, over both short and medium-run horizons, when gauging incipient inflationary pressures-as originally intimated by Goodhart and Crockett.

Janssen (1996b) conducts some structural modelling of the demand for Divisia at a sectoral level, using the approach in Thomas (1996).
 For Divisia money, the transactions money holdings of ICCs and OFIs were not recorded separately at the time of the original study; they are grouped together here as the corporate sector. Since 1996 Q4, the Bank of England has begun publishing separate Divisia series for the ICC and OFI sectors.

References

Artis, M J, Bladen-Hovell, R C, Osborn, D R, Smith, G W and Zhang, W (1995), 'Predicting turning points in the UK inflation cycle', *Economic Journal*, Vol 105, pages 1,145–64.

Astley, M S and Haldane, A G (1995), 'Money as an indicator', Bank of England Working Paper No 35.

- Breedon, F J and Fisher, P G (1996), 'MO: causes and consequences', The Manchester School, Vol LXIV, pages 371-87.
- Crockett, A D (1970), 'Timing relationships between movements of monetary and national income variables', *Bank of England Quarterly Bulletin*, Vol 10, December, pages 459–72.

Dale, S and Haldane, A G (1995), 'Interest rates and the channels of monetary transmission: some sectoral estimates', *European Economic Review*, Vol 39, pages 1,611–26.

- Estrella, A and Mishkin, F S (1996), 'Is there a role for monetary aggregates in the conduct of monetary policy?', *NBER Working Paper No 5,845.*
- Fisher, P G and Vega, J L (1993), 'An empirical analysis of M4 in the United Kingdom', *Bank of England Working Paper* No 21.
- Fisher, P G, Hudson, S L and Pradhan, M (1993), 'Divisia measures of money', *Bank of England Quarterly Bulletin*, Vol 33, May, pages 240–55.
- Friedman, B M and Kuttner, K (1992), 'Money, income, prices and interest rates', *American Economic Review*, pages 472–92.
- Goodhart, C A E and Crockett, A D (1970), 'The importance of money', *Bank of England Quarterly Bulletin*, Vol 10, June, pages 159–98.
- Henry, S G B and Pesaran, B (1993), 'VAR models of inflation', *Bank of England Quarterly Bulletin*, Vol 33, May, pages 231–39.
- Janssen, N G J (1996a), 'Can we explain the shift in M0 velocity? Some time-series and cross-section evidence', *Bank of England Quarterly Bulletin*, Vol 36, February, pages 39–50.
- Janssen, N G J (1996b), 'The demand for Divisia money by the personal sector and by industrial and commercial companies', Bank of England Quarterly Bulletin, Vol 36, November, pages 405–11.
- Longworth, D and Freedman, C (1995), 'The role of the staff economic projection in conducting Canadian monetary policy', in *Targeting Inflation*, A G Haldane (ed.), Bank of England.
- Price, L D D (1972), 'The demand for money in the United Kingdom: a further investigation', *Bank of England Quarterly Bulletin*, Vol 12, March, pages 43–55.

Thomas, R S (1996), 'Understanding broad money', Bank of England Quarterly Bulletin, Vol 36, May, pages 163–79.

Williams, D, Goodhart, C A E and Gowland, D H (1976), 'Money, income and causality: the UK experience', *American Economic Review*, Vol 66, pages 417–23.

Features of a successful contract: financial futures on LIFFE

By Allison Holland and Anne Fremault Vila of the Bank's Markets and Trading Systems Division.

The success of a futures contract, defined as its long-term survival, has generally been linked to the existence of a large and volatile spot market and to a design that makes the contract highly effective for hedging purposes. This article examines the importance of these and other factors, using data on the financial futures contracts introduced by LIFFE between 1982 and 1994.

Introduction

Futures contracts are among the oldest actively traded derivative instruments. They are legal agreements between two parties under which one party agrees to deliver to the other a certain standardised quantity of an asset at a fixed price at some specified point in the future. The Chicago Board of Trade is thought to be the oldest futures exchange, though there are other claimants to this title. It was established in 1848 to trade agricultural commodities. Trading in corn forward contracts began in 1851 and led the way for the introduction of futures contracts in 1865, enabling farmers to agree a price for their crop in advance of the harvest. It is also generally accepted that futures in financial assets were first introduced in 1972 by the Chicago Mercantile Exchange. The trading volume of financial futures contracts now substantially outstrips that of commodity futures. The financial futures market has grown rapidly during the last decade, mainly because of the huge increase in demand for financial derivatives. But exchanges have also tried to increase their share of the market through product innovation, improvements in trading technology and, more recently, by creating alliances with other markets.

In this article, we explore the question of why some futures contracts fail (ie are withdrawn because of insufficient demand) but others succeed (ie establish and maintain viable levels of interest and continue to trade). To do so, we look at 16 interest rate and index futures contracts created by LIFFE between 1982 and 1994,(2) five of which were withdrawn. It is important to recognise that contract failure is a normal feature of futures markets and that this success rate is comparable to the performance of other exchanges. For example, the Chicago Board of Trade created 26 different financial futures contracts between 1987 and 1996, only 17 of which were still traded in 1996.

Early trading levels

Trading is usually measured in terms of volume or of open interest (the net number of outstanding contracts at the end of the trading period). For example, the Wall Street Journal only lists a contract on its financial pages if daily open interest in it exceeds 5,000 contracts and its daily trading volume exceeds 1,000 contracts.⁽³⁾ Of our sample, over half met the daily trading volume criterion in their first year of trading (see Table A), and after three years half of them met

Table A Contract details

Contract (a)	Years traded	Average daily volume traded in first year (b)
Long gilt	1982-date	962
Short sterling	1982-date	1,045
3-month US\$	1982-date	1,859
FT-SE 100	1984-date	438
Γ-bond	1984–93	1,254
Japanese government	1987–date	529
Bund	1988-date	4,850
3-month Ecu	1989–date	353
3-month DM	1989-date	5,374
3-month Sw Fr	1991-date	2,415
Italian government	1991-date	6,715
Ecu bond	1991-92	261
Eurotrack	1991-92	21
3-month lira	1992-date	2,290
Bobl	1993-94	4,379
Bonos	1993-93	223

See notes for a fuller description of contracts. Volume traded in a contract's first year; this may not be the same calendar year for all contracts.





Based on research carried out by Jo Corkish and Anne Fremault Vila while the latter was a member of the LSE Financial Markets Group. Because of data constraints we exclude the short gilt, medium gilt and FT-SE 250 futures contract from our analysis. One drawback of this is that it makes no allowance for differences in the face value of contracts and therefore we may not be comparing like with like.

Chart 2



both criteria (see Charts 1 and 2). These included the Treasury bond (T-bond) futures contract, which was later de-listed.⁽¹⁾ This shows that meeting these criteria in the early years of trading is no guarantee of continuing success. Moreover, failing to meet them (the long gilt contract did not meet the open interest criterion in any of its first three years of trading) has not necessarily led to failure.

Continuing success

If maintaining a viable volume of trading is our measure of success, can we say anything about the factors which are likely to drive this? Theory suggests that turnover in a contract is likely to be high when (i) the contract's design provides maximum correlation with the risk to be hedged ('hedging effectiveness') and (ii) the underlying spot market is large and characterised by volatile prices. We have also considered three additional factors: the creation of duplicate contracts by rival exchanges; the introduction of options on contracts; and the liquidity of the market, defined as the ability of the market to accommodate a large unexpected order without a significant impact on prices. Our findings are set out below.

Hedging effectiveness

One of the main economic functions of a futures market is to transfer risk. The stronger the relationship between returns in the futures market and those in the spot market, the better the hedge will be, since losses in one market will offset profits in the other. We can measure the hedging effectiveness of futures contracts by the coefficient of determination, the 'fit', of the regression $RS_t = \alpha + \beta RF_t + e_t$; where the spot returns (RS_t) and futures returns (RF_t) are defined for a variety of holding periods (the length of time the asset is held). Table B shows that hedging effectiveness increases with the length of the holding period. It also increases as failed contracts drop out of our sample (years six and ten), suggesting that failed contracts are less effective than successful contracts as hedging instruments.⁽²⁾

Table B Hedging effectiveness

Five-day holding period

	Total sample	e		Successful		
contracts	ntracts			(Lifetime > 10 years)		
Contract lifetime	Average HE	Rank correlation	Average HE	Rank correlation		
Year 1 Year 3 Year 6 Year 10	0.538 0.539 0.625 0.745	-0.09 0.13 -0.12 -0.20	0.762 0.642 0.755 0.745	-0.70 -0.30 0.60 -0.20		
Ten-day holding period						
Contract lifetime	Average HE	Rank correlation	Average HE	Rank correlation		
Year 1 Year 3 Year 6 Year 10	0.532 0.610 0.702 0.762	0.08 0.03 0.05 -0.20	0.724 0.718 0.804 0.762	-0.70 -0.30 0.60 -0.20		
20-day holding period						
Contract lifetime	Average HE	Rank correlation	Average HE	Rank correlation		
Year 1 Year 3 Year 6 Year 10	0.603 0.739 0.768 0.775	-0.01 0.06 0.29 -0.20	0.809 0.801 0.856 0.775	-0.70 -0.30 0.60 -0.20		

Notes: A perfect relationship between hedging effectiveness and turnover would be indicated by a correlation coefficient of 1. The significance of the correlation was tested in years 1 and 3 (the test is only valid when the number of contracts in the sample is greater than ten) but none of the coefficients was significant.

We tested the relationship between hedging effectiveness and futures turnover using Spearman's rank correlation coefficient. Table B shows that this correlation is surprisingly low and often negative. Testing for its significance, we find that the relationship between the two variables is insignificant. The level of hedging effectiveness therefore appears to reflect the success of the contract, but not to influence it.

Spot market characteristics, competition and options

The effects on trading volume of the size and volatility of the spot market, contract competition from other exchanges and the existence of an option on the contract were assessed using regression analysis on data for eleven contracts ('panel data estimation'). The methodology is explained in the box. Rank correlation coefficients were also calculated for spot market characteristics.

A priori we would expect hedging demand (and therefore futures turnover) to be positively related to the size and volatility of the spot market. If the proportion of the market that is hedged remains constant, then hedging demand will grow in line with the spot market. We might also expect this proportion to increase as volatility in the spot market increases. The expected effect of cross-listing of a product is less clear. As it is the introduction of a substitute good, its impact may be negative; however, it may create new trading opportunities, through arbitrage for example or by effectively extending the hours during which investors can trade. We expect that other related financial products, such as options, might behave like complementary goods and have a positive effect on futures turnover, perhaps by generating increased hedging demand.

The other contracts that failed in our sample were de-listed before their third year of trading.
 The hedging effectiveness of the successful sub-sample is higher than that of the whole sample at all points.

Panel data estimation

Quarterly data on turnover between 1982 and 1994 were collected on a panel of eleven contracts. However, because contracts were introduced at different times our panel is unbalanced. Each was included in the panel in its first full quarter of trading, so, for example, if a contract was introduced in May 1990 it would first appear in the panel in 1990 Q3. The change in quarterly futures volume $(DFVOL_{it})$ was the dependent (endogenous) variable.

We then tested two explanatory variables to see whether either was statistically important in determining futures success: changes in quarterly spot market capitalisation (DSVOL) and changes in spot market volatility (DSVOLAT). Volatility was defined as the quarterly average of daily closing price changes: $\log(C_t/C_{t-1})$.

A number of dummies were also constructed for: contracts with an option traded on them; those which were first-mover contracts; those with a dual listing on exchanges with no overlapping trading hours (COMPD);⁽¹⁾ and, finally, those with a dual listing in exchanges with overlapping trading hours (COMPS).⁽²⁾ Thus the panel estimation was:

$$DFVOLit = \alpha + \beta_1 DSVOL_{it} + \beta_2 DSVOLAT_{it} + \beta_3 D_{it} + w_{it}$$

where D_{it} refers to the dummy variables and the error terms are assumed to have zero mean and constant variance.

The model was estimated as a panel with common intercept and coefficients, using OLS with White heteroskedasticity consistent standard errors. An alternative specification which allowed for contract heterogeneity by including a contract specific error term, $w_{it} = v_i + \varepsilon_{it}$, (random effects model) yielded similar qualitative results, and has not been reported.

Donal data actimation					
Panel data estimation					
	Option effect	First-mover	effect	Competition	effect
DSVOL DSVOLAT	$\begin{array}{c} \hline 0.324 \text{x} 10^{-4} & (4.36)^{*} \\ \hline 0.888^{*} 10^{8} & (1.59) \end{array}$	0.297x10 ⁻⁴ 0.885x10 ⁸	(3.76)* (1.58)	0.247x10 ⁻⁴ 0.876x10 ⁸	(2.08)* (1.59)
Dummies: Option First move COMPD COMPS	-0.33x10 ⁵ (-0.43) r	0.115x10 ⁶	(2.22)*	-0.779x10 ⁵ 0.127x10 ⁶	(-2.0)* (0.84)
R squared	0.03	0.04		0.05	

Notes: The coefficients t-statistics are shown in brackets; an * denotes significance at the 95% level. The constant is not reported.

These contracts include the eurodollar, the euroecu, the euromark (cross-listed on the CME), the US Treasury bond and the FT-SE 100.
 These contracts include the euromark (cross-listed on MATIF), the euroswiss, the Bund and the BTP.

The main findings of our analysis were:

demand for futures contracts is significantly increased by growth in the spot market. Correlation coefficients (Table C) also show that the size of the spot market is positively correlated with the level of turnover in the associated futures contract and this relationship is, on the whole, significant. So it appears that a futures contract benefits from the existence of a large spot market;

Table C

Rank correlation coefficients

Contract lifetime	Size of the spot market	Spot volatility	
Futures volume Year 1 Year 3 Year 6	0.20 0.52 * 0.37	-0.38 -0.07 -0.17	
Year 10	-0.70	-0.10	
Futures value Year 1 Year 3 Year 6 Year 10	0.64 * 0.73 * 0.37 -0.70	-0.32 -0.14 -0.02 -0.10	

Notes: This table shows rank correlation coefficients, using daily data, for the LIFFE futures contracts listed in Table A and their underlying markets. An * indicates that the correlation is significant. A perfect relationship would be indicated by a coefficient of 1.

- an increase in spot market volatility also generates increased demand for futures contracts, but the effect is statistically insignificant. So there is weak support for the hypothesis that a volatile spot market is a necessary condition for the continuing success of a futures contract;
- there is evidence that the exchange which is first to list a contract gains a significant competitive advantage (first-mover advantage);
- the effect of competition from contracts listed on other exchanges differs according to whether the trading hours of the competing exchanges overlap. Competition from contracts with overlapping trading hours slightly increases volumes, but competing contracts with non-overlapping trading hours significantly reduces volumes. Overlapping trading hours creates new arbitrage opportunities. The positive effect of these will be enhanced because, in each instance of simultaneous trading, LIFFE was the first to list the contract. In most cases of non-overlapping trading hours the competing exchange was the first. This may suggest that the first-mover advantage more than offsets any increase in trading opportunities created by the extension of the trading hours of the contract; and
- the existence of an option on the futures contract does not significantly affect futures volumes. It should be noted, however, that lack of data prevents precise measurement of the demand for futures to hedge 'over-the-counter' (OTC) options or net swaps exposures, which is likely to have grown significantly. (Between 1988 and 1996, the notional principal outstanding in OTC swaps and interest rate options

increased at an average annual rate of 40.5%.(1) Some of these OTC deals will offset one another; but some of the remaining exposure is likely to be hedged with an exchange-traded futures contract.)

Market liquidity

Using a series of liquidity measures, we examined whether the evidence suggests that a successful contract is always liquid and also whether a liquid contract is always successful. First, we considered the ratio of futures volume to open interest.⁽²⁾ A high ratio, indicating that trading is high compared with the number of outstanding contracts, implies that agents can open and close their positions with relative ease. Table D shows that contracts such as the Bund or long gilt, which have continued to trade in sizable volumes, have high ratios; contracts such as the Bobl or the Eurotrack futures, which were de-listed after trading for only a year or so, have very low ratios.⁽³⁾

Table D

Ratio of futures volume to open interest

Per cent

	Year of trading				
Contract	1	2	3	6	9
Long gilt	0.68	0.62	0.68	1.06	0.67
T-bond	0.81	0.92	1.08	0.53	0.40
Bund	0.55	0.62	0.53	0.50	
Japanese government	n.a.	n.a.	n.a.		
Italian government	0.48	0.49	0.43		
Bobl	0.25	0.13			
Ecu bond	0.21	0.45			
Bonos	0.09				
Short sterling	0.49	0.20	0.19	0.30	0.21
3-month sterling	0.93	0.33	0.33	0.23	0.13
3-month Ecu	0.35	0.10	0.11	0.08	
3-month DM	0.28	0.17	0.16	0.14	
3-month Sw Fr	0.14	0.19	0.16		
3-month lira	0.13	0.09	0.12		
FT-SE 100	0.46	0.22	0.20	0.18	0.24
Eurotrack	0.08	0			
n a = not available					

As a second measure of liquidity, we examined the execution risk associated with twelve LIFFE contracts on two days of trading (2 February 1993 and 19 April 1994) using tick-by-tick data. Execution risk is determined by (i) the frequency of trade arrival (how long it will take to find a match) and (ii) intra-day price volatility (how much prices will move if there is a delay in finding a match). The risk would be expected to be lower for more liquid contracts. Contracts are classified here as either high frequency (at least one trade per minute in 1993 and two trades per minute in 1994), intermediate (ranging from one trade every 40 seconds to one every three minutes) or low (less than one trade every three minutes). Intra-day price volatility is calculated as the standard deviation of the absolute value of returns based on adjacent price changes (ie adjacent ticks).⁽⁴⁾ Table E shows that volatility is fairly uniform across all

Table E Market liquidity

2 February 1993

U	Daily volume	Number of trades	Trade frequency (trades per minute)	Volatility	Spread (per cent)
Bund	32,895	1,179	1.9	0.006	0.009
FT-SE 100	14,564	1,273	1.6	0.019	0.022
Long gilt Italian	36,734	736	1.3	0.016	0.032
government	13,161	951	2.5	0.008	0.011
Short sterling	31,504	490	0.9	0.005	0.006
3-month DM	24,143	395	0.7	0.006	0.008
Bobl	2,741	174	0.3	0.008	0.006
3-month Sw Fr	8,392	262	0.5	0.006	0.009
3-month lira Japanese	1071	58	0.1	0.007	n.a.
government	943	163	0.3	0.005	0.003
3-month Ecu	554	38	0.08	0.009	n.a.
3-month US\$	1155	28	0.05	0.005	n.a.
19 May 1994					
	Daily volume	Number of trades	Trade frequency (trades per minute)	Volatility	Spread (per cent)
Bund	132 221	127 310	4.4	0.006	0.008
	1,22,221	127,510		0.000	0.000
FT-SE 100	10,436	8,153	2.1	0.021	0.019
FT-SE 100 Long gilt Italian	10,436 107,495	8,153 57,275	2.1 3.0	0.021 0.017	0.019 0.01
FT-SE 100 Long gilt Italian government	10,436 107,495 44,615	8,153 57,275 42,254	2.1 3.0 2.7	0.021 0.017 0.008	0.019 0.01 0.01
FT-SE 100 Long gilt Italian government Short sterling	10,436 107,495 44,615 10,558	8,153 57,275 42,254 12,498	2.1 3.0 2.7 0.2	0.021 0.017 0.008 0.005	0.019 0.01 0.01 0.01
FT-SE 100 Long gilt Italian government Short sterling 3-month DM	10,436 107,495 44,615 10,558 20,753	8,153 57,275 42,254 12,498 19,751	2.1 3.0 2.7 0.2 0.4	0.021 0.017 0.008 0.005 0.005	0.019 0.01 0.01 0.008 0.008
FT-SE 100 Long gilt Italian government Short sterling 3-month DM Bobl	10,436 107,495 44,615 10,558 20,753 n.a.	8,153 57,275 42,254 12,498 19,751 n.a.	2.1 3.0 2.7 0.2 0.4 n.a.	0.000 0.021 0.017 0.008 0.005 0.005 n.a.	0.019 0.01 0.01 0.008 0.008 n.a.
FT-SE 100 Long gilt Italian government Short sterling 3-month DM Bobl 3-month Sw Fr	10,436 107,495 44,615 10,558 20,753 n.a. 4,517	8,153 57,275 42,254 12,498 19,751 n.a. 5,100	2.1 3.0 2.7 0.2 0.4 n.a. 0.2	0.021 0.017 0.008 0.005 0.005 n.a. 0.006	0.019 0.01 0.01 0.008 0.008 n.a. 0.008
FT-SE 100 Long gilt Italian government Short sterling 3-month DM Bobl 3-month Sw Fr 3-month lira	10,436 107,495 44,615 10,558 20,753 n.a. 4,517 4,257	8,153 57,275 42,254 12,498 19,751 n.a. 5,100 53	2.1 3.0 2.7 0.2 0.4 n.a. 0.2 0.0	0.000 0.021 0.017 0.008 0.005 0.005 n.a. 0.006 0.005	0.019 0.01 0.01 0.008 0.008 n.a. 0.008 0.007
FT-SE 100 Long gilt Italian government Short sterling 3-month DM Bobl 3-month Sw Fr 3-month lira Japanese	10,436 107,495 44,615 10,558 20,753 n.a. 4,517 4,257	8,153 57,275 42,254 12,498 19,751 n.a. 5,100 53	2.1 3.0 2.7 0.2 0.4 n.a. 0.2 0.0	0.021 0.017 0.008 0.005 0.005 n.a. 0.006 0.005	0.019 0.01 0.01 0.008 0.008 n.a. 0.008 0.007
FT-SE 100 Long gilt Italian government Short sterling 3-month DM Bobl 3-month Sw Fr 3-month lira Japanese government	10,436 107,495 44,615 10,558 20,753 n.a. 4,517 4,257 352	8,153 57,275 42,254 12,498 19,751 n.a. 5,100 53 2,543	2.1 3.0 2.7 0.2 0.4 n.a. 0.2 0.0 0.0	0.021 0.017 0.008 0.005 0.005 n.a. 0.006 0.005 0.006	0.019 0.01 0.008 0.008 0.008 0.008 0.008 0.007
FT-SE 100 Long gilt Italian government Short sterling 3-month DM Bobl 3-month Sw Fr 3-month lira Japanese government 3-month Ecu	10,436 107,495 44,615 10,558 20,753 n.a. 4,517 4,257 352 2,646	8,153 57,275 42,254 12,498 19,751 n.a. 5,100 53 2,543 56	2.1 3.0 2.7 0.2 0.4 n.a. 0.2 0.0 0.1 0.1	0.021 0.017 0.008 0.005 0.005 n.a. 0.006 0.005 0.006 0.005	0.019 0.01 0.01 0.008 0.008 0.008 0.008 0.007 0.007 n.a.
FT-SE 100 Long gilt Italian government Short sterling 3-month DM Bobl 3-month Sw Fr 3-month lira Japanese government 3-month Ecu 3-month US\$	10,436 107,495 44,615 10,558 20,753 n.a. 4,517 4,257 352 2,646 61	8,153 57,275 42,254 12,498 19,751 n.a. 5,100 53 2,543 56 6	2.1 3.0 2.7 0.2 0.4 n.a. 0.2 0.0 0.1 0.1 0.1 0.02	0.021 0.017 0.008 0.005 0.005 n.a. 0.006 0.005 0.006 0.005 n.a.	0.019 0.01 0.008 0.008 0.008 0.007 0.007 n.a. n.a.

frequency classes of contracts, in spite of wide differences in frequency of trading and volume of daily trading. So execution risk is not necessarily higher for intermediate or less actively traded contracts; even though there may be longer to wait for a trade to be executed, the probability of an adverse price movement occurring before execution does not appear to be any higher.

Third, we considered variable trading costs (the spread), as represented by the prices at which trades are done. The bid-ask spread compensates market makers (or 'locals'⁽⁵⁾) for three types of costs/risks: (i) order processing costs; (ii) inventory risk; and (iii) adverse selection risk. In futures markets, it is generally accepted that inventory risk is minimal, since locals take open positions only for very short periods of time. Adverse selection risk is also considered to be low, since information asymmetries are less pronounced in interest rate or index products (ie the probability that a counterparty has private information on an interest rate product is lower than on single equity products).(6)

The daily bid-ask spread was estimated for each contract using a standard measure developed by Roll⁽⁷⁾ which is calculated from transactions price data. It only reflects order-processing costs. The basic intuition behind it is that transactions prices randomly bounce between the bid and the ask quote (so the arrival of a buy order is as likely as a

- Adverse selection risk is also believed to be lower in open-outcry markets, such as LIFFE, where counterparties are known to each other in advance (6)

Source: International Swaps and Derivatives Association (ISDA).

⁽³⁾

Source: international SWaps and Derivatives Association (ISDA). This ratio measures the total number of contracts traded in a period relative to the size of open positions at the end of the period. It is also worth noting that the ratios of turnover to open interest for bond futures are generally higher than those for money-market instruments, perhaps indicating different sources of investor demand. Given that open interest primarily reflects hedging demand, a low ratio might indicate high hedging demand and a high ratio speculative demand. So volatility = standard deviation of $|\ln(P_n/P_{n-1})|$, where *n* is the *n*th tick. Locals are individuals who trade solely for their own account. Adverse selection risk is also believed to be lower in open-outery markets, such as LIEFE, where counterparties are known to each other in other

⁽⁷⁾ See Roll. (1984). 'A simple implicit measure of the effective bid-ask spread in an efficient market', Journal of Finance, 4, pages 1.127–39. The

estimator is defined as $S_R = 200 * \sqrt{-\cos(R_t, R_{t-1})}$ where $R_t = \ln(P_t/P_{t-1})$ is the logarithm of the return at time t.

sell order). This induces negative autocorrelation between successive price changes (or returns) and can therefore be used to infer the bid-ask spread. It should be noted, however, that it relies on two restrictive assumptions: (i) no serial correlation in trades, which would arise from the splitting of large trades, and (ii) constant expected returns over time, which may not hold in periods of rapid news arrival. If these assumptions are violated, the estimator will be biased downward. Nevertheless, any significant differences in spreads should be identifiable. The results in Table E show that estimated spreads are around one tick size for all contracts irrespective of daily volume or trade frequency.⁽¹⁾ So liquidity in terms of transaction costs is broadly constant across active LIFFE contracts.

These results suggest that successful contracts are liquid, however measured, but that liquidity does not necessarily ensure sufficient volume to guarantee success. In our sample, the contracts that failed were less liquid as measured by their ratio of turnover to open interest, but not significantly less liquid in terms of spreads or execution risk. This suggests that there may be a critical level of acceptance of the contract beyond which bid-ask spreads and execution risk vary relatively little. The liquidity of unsuccessful contracts, such as the Bobl, only deteriorated after trading volume had dropped to very low levels. So it appears that liquidity may be a consequence, rather than a cause, of contract success.

Conclusion

We have examined a number of factors that may be important in determining the success of a futures contract. Our findings show that continuing success cannot easily be inferred from a contract's first years of trading. As expected, contract success is highly correlated with the size of the underlying spot market, and to a lesser extent with its volatility. Where contracts are listed on more than one exchange, there appears to be a first-mover advantage which, in the case of simultaneously traded contracts, is reinforced by the creation of new arbitrage trading opportunities. And liquidity seems to be a feature of successful contracts, but does not always lead to success.

A further related issue is whether the creation of a futures market could help to boost liquidity in the spot market. This issue has been raised in recent discussion regarding liquidity in the index-linked gilt market.⁽²⁾ The results presented here show that a large spot market benefits the futures market and standard tests would support causation in this direction. Spot and futures demand may of course be determined simultaneously, in which case the reverse causality would also hold, but we do not test for this here.

These results may provide a useful perspective as European exchanges prepare themselves for the possibility of

Chart 3 Market share of the major futures exchanges in 1995(a)



Source: Individual exchanges

(a) Based on number of contracts traded on all the major futures exchanges in 1995.

Chart 4

Market share of the major futures exchanges in 1996(a)



(a) Based on number of contracts traded on all the major futures exchanges in 1996.

European Monetary Union. This will bring new challenges and new opportunities. LIFFE is the largest European futures exchange and currently the second largest of the 68 exchanges worldwide.⁽³⁾ In 1996 it captured 22.5% of all trading on the major futures exchanges, an increase of three percentage points on the previous year (see Charts 3 and 4) and more than the combined total of the Deutsche Terminborse (DTB) (Frankfurt) and Marché à Terme International de France (MATIF) (Paris). But the outlook for European futures exchanges is uncertain. Following monetary union, products denominated in the currency of participating countries will be superseded by (necessarily fewer) euro-denominated products. The European exchanges will need either to transform their existing contracts into euro form (as some have already indicated they will do) or to introduce new contracts in order to compete. So the viability of new products will still be vital to the continuing success of these exchanges.

185

The tick size (minimum price change) is 0.01% for most contracts except the FT-SE 100 contract (0.018%) and the long gilt contract (0.03%). See Bank of England (1996), *Index-Linked Debt*, papers presented at the Bank of England Conference, September 1995.

Based on the number of contracts traded in the first quarter of 1997.

Notes: Brief definitions of contracts⁽¹⁾

Long gilt: The UK long bond futures contract; notional coupon of 9%; traded in units of £50,000; deliverable gilts are those with 10–15 years remaining maturity. Traded 1982 to date.

Short sterling: The short sterling interest rate futures contract; traded in units of £500,000; based on the British Banker's Association Interest Settlement Rate (BBAISR) for three-month sterling deposits at 11.00 am on the last trading day. Traded 1982 to date.

3-month US\$: The three-month eurodollar interest rate futures contract; traded in units of \$1,000,000; based on BBAISR for three-month eurodollar deposits at 11.00 am on the last trading day. Traded 1982 to date.

FT-SE 100: The FT-SE 100 index futures contract; valued at \pounds 25 per index point; cash settled based on the average level of the FT-SE 100 index between 10.10 am and 10.30 am on the last trading day. Traded 1984 to date.

T-bond: The American Treasury bond futures contract; notional coupon 8%; traded in units of \$100,000; deliverable Treasury bonds are those with at least 15 years remaining maturity if not callable and at least 15 years to the first callable date if callable. Traded 1984 to 1993.

Bund: The German government bond futures contract; notional coupon 6%; traded in units of DM 250,000; deliverable Bundesanleihens (bunds) are those with $8^{1/2}-10$ years remaining maturity. Traded 1988 to date.

3-month Ecu: The three-month Ecu interest rate futures contract; traded in units of ECU 1,000,000; based on BBAISR for three-month Ecu deposits at 11.00 am on the last trading day. Traded 1989 to date.

3-month DM: The three-month euromark interest rate futures contract; traded in units of DM 1,000,000; based on BBAISR for three-month euro Deutsche Mark deposits at 11.00 am on the last trading day. Traded 1989 to date.

Japanese government: The Japanese government bond futures contract; notional coupon 6%; traded in units of 100,000,000; all open positions on LIFFE at close of business will be closed out automatically at the first subsequent opening price of the Tokyo Stock Exchange. Traded 1987 to date. (Note: The original contract began trading in 1987. This was replaced by the new Japanese bond contract in 1990.)

3-month Sw Fr: The three-month euroswiss interest rate futures contract; traded in units of Sw Fr 1,000,000; based on BBAISR for three-month euroswiss franc deposits at 11.00 am on the last trading day. Traded 1991 to date.

Italian government: The Italian government bond futures contract (BTP); notional coupon 12%; traded in units of Lit 200,000; deliverable Buoni del Tesoro Poliennalis (BTPs) are those with 8¹/₂–10 years remaining maturity. Traded 1991 to date.

Ecu bond: The Ecu bond futures contract; notional coupon 9%; traded in units of ECU 200,000; deliverable ECU bonds are those with 6–10 years remaining maturity. Traded 1991 to 1992.

Eurotrack: The Eurotrack 100 index futures contract; valued at DM 100 per index point; cash settled based on the average level of the FT-SE Eurotrack 100 index between 11.00 am and 11.20 am on the last trading day. Traded 1991 to 1992.

3-month lira: The three-month eurolira interest rate futures contract; traded in units of Lit 1,000,000,000; based on BBAISR for three-month eurolira deposits at 11.00 am on the last trading day. Traded 1992 to date.

Bobl: The German medium-term government bond; notional coupon 6%; traded in units of DM 250,000; deliverable bunds are those with $3^{1/2}-5$ years remaining maturity. Traded 1993 to 1994.

Bonos: The Spanish government bond futures contract; notional coupon 10%; traded in units of Pta 20,000,000; deliverable bonds are those with 7–10 years remaining maturity. Traded in 1993.

(1) For full contract specifications refer to LIFFE.

The first year of the gilt repo market

The gilt repo market began in January 1996, and in March 1997 the Bank started conducting daily money-market operations in gilt repo. This article reviews the growth and structure of the market, looks at the uses of gilt repo that have contributed to this growth, and describes its impact on the gilt market and the sterling money markets in terms of greater liquidity, lower financing costs, improved hedging opportunities, and the development of a liquid market in secured money.

Background

'Repo' is short for 'sale and repurchase agreement', where one party agrees to sell bonds or other financial instruments to another party, with an agreement to repurchase equivalent securities in the future, under a formal legal agreement. Repo transactions have been increasingly used in domestic and international securities markets since the early 1990s; analysis and market comment suggested that gilt repo could contribute to the liquidity and efficiency of the gilt market, providing trading opportunities familiar to those active in other markets. The Bank recognised the possible benefits, but was concerned to avoid the disruption seen in other markets caused by malpractice such as failing to take account of accrued interest when valuing stock (for example, the case of Drysdale Securities in the United States). However, in the Bank's judgment, these difficulties could be addressed by using standardised, sound legal documentation covering the rights and obligations of both counterparties, and by developing market practices designed to reduce risk. Against this background, and with agreement reached in principle on possible tax reform that would be necessary to facilitate it, the Bank published a consultative paper on gilt repo in November 1994; shortly afterwards, the Inland Revenue published options for the necessary tax reforms.

Until 1996 there had been long-standing arrangements in the gilt market for stock borrowing and lending to help facilitate the gilt-edged market makers' (GEMMs') performance of their market-making obligations, in the course of which a GEMM might be required to sell a stock it did not hold. GEMMs were the key intermediaries allowed to borrow stock for the purpose of covering a short position (ie temporarily acquiring a gilt in order to fulfil a contract to sell the gilt to a counterparty); stock could be borrowed only through the intermediation of the Stock Exchange money brokers (SEMBs); and only from lenders approved by the Inland Revenue (typically longer-term investing institutions, although it was also open to GEMMs and other wholesale market players to lend stock). Gilt loans were usually made against collateral such as other gilts or certificates of deposit (CDs), as well as against cash.

In addition to facilitating trading in gilt repo, the 1996 reforms liberalised gilt stock lending by removing the restrictions on who could borrow and lend stock, on the requirement that such deals be intermediated and on the purpose for which the deals could be done. The authorities sought to ensure that there would be a 'level playing field' between the two types of transaction.

During 1995, the necessary tax changes were agreed, and the Stock Exchange rules were amended to allow anyone to repo, lend or borrow stock, with any counterparty, for any purpose. The Bank worked closely with the relevant authorities to secure these changes. Market practitioners and regulators, working with the Bank, drew up recommended market practices (set out in the Gilt Repo Code of Best Practice), a legal agreement recommended by the Code, and settlement conventions. The recommended legal agreement comprised the PSA/ISMA Global Master Repurchase Agreement⁽¹⁾ with an annex covering special features of gilts, including the widely used delivery-by-value (DBV) facility in the Central Gilts Office settlement service. Several aspects originally covered in the annex, such as repo transactions through an agent, were subsequently incorporated into the updated PSA/ISMA Agreement (issued in November 1995). The Code, legal agreement and a report on settlement were issued in November 1995,⁽²⁾ ahead of the start of the market in January 1996. At the same time, work on the gilt-edged stock lending agreement (GESLA) sought to ensure that the two agreements dovetailed, to facilitate netting across the two transaction types. The revised GESLA was issued in December 1995.

Uses and types of repo

GC and specials

Gilt repo has several different uses. A gilt repo is in effect a simultaneous transaction in securities and secured money, and as such may be used for a variety of purposes. As a form of secured money, in which transferred gilts function as collateral, it may constitute both a secure means of placing cash and a competitive means of financing holdings of gilts. Placing and receiving funds against gilts where the

(1) The Agreement drawn up by the Public Securities Association of the United States and the International Securities Market Association, based in

Copies of these papers are available from The Secretariat, Gilt-Edged and Money Markets Division, Bank of England, Threadneedle Street, London, EC2R 8AH.

gilts to be received as collateral are not specified is known as 'general collateral', or GC repo. Alternatively, a market participant may require a particular gilt, for example to cover a short position taken on as a proprietary position or in the course of market making; a holder of that stock may add to his return on it by repoing it out. Such a transaction is called a 'specific' repo, and the repo rate of interest on the transaction will normally reflect the relative scarcity of the stock in the stock lending and repo market. Typically, the specific repo rate for stocks that are widely available has been around 5 to 10 basis points below the GC rate. The difference would allow the holder of a stock required by a borrower, inter alia, to place the cash at GC and earn a modest profit. Where a stock is particularly difficult to obtain, and its repo rate diverges from the prevailing GC rate by more than about 5 to 10 basis points, it is said by the market to be 'trading special'. The special value of a stock in the repo market is expressed in basis points below or 'through' the GC rate, reflecting the profit which the repoer of a special stock can prospectively make by investing the cash received in a GC transaction.

GC and special repos can both be used to raise cash, for example to manage a temporary cash flow shortfall, or to undertake a financial investment. A common use of gilt repo is to finance long positions in gilts; by undertaking a stock purchase and at the same time repoing out that stock (frequently repoing it back to the vendor), an investor can simultaneously take on *and* finance a long position in the market, thus using repo to 'leverage up' its book, using a very small initial outlay to make a much larger investment. Table A gives one example of this type of transaction. This is commonly done by investors seeking exposure to the market, or to a particular segment of the market, with minimal financing costs. Securities houses are active users of repo to finance long positions for their own book and for clients.

Matched books

Principals and principal intermediaries with large volumes of both repos and reverse repos are said to be running '*matched books*'. These matched books may comprise repos and reverse repos of broadly matched maturities, with their profit coming from the small margin between the rate at which they transact in the professional market and the rate they pay to, or charge, their clients. Alternatively, these books can be a way for firms to mismatch maturities and so take a proprietary view (for their own account) of prospective interest rates. Firms may also choose to arbitrage between secured and unsecured money, depending on their credit standing and the spreads between repo and unsecured rates.

A variation on these approaches is *collateral switching*. For example, a firm may borrow a stock from a stock lender against collateral composed of CDs. The stock is then repoed into the market and the cash raised is used for an investment (for example, to pay for the CDs transferred as collateral in the stock loan). The principal intermediary earns the interest on the CDs, minus the fee paid on the stock loan and the repo interest. So, provided there is sufficient spread between the interest received on the CDs and paid on the gilt repo, the principal intermediary can cover its direct and indirect costs associated with the

Table A

Example of a repo financing trade

Position of Party A	Transaction flow	Position of Party B
Party A contracts to buy £100 million of gilts from Party B.	A owes B £100 million. B owes A gilts.	Party B contracts to sell £100 million of gilts to Party A.
Party A contracts to repo the £100 million of gilts to Party B to finance its purchase.	A owes B gilts. B owes A £100 million.	Party B contracts to buy the gilts from Party A.
	The two transactions net out, so no actual transfer need be made across the CGO.	
Party A has locked into a secured financing rate for a term of its choosing, to facilitate its exposure to the cash gilt market.		At the termination of the repo financing trade, Party B is to re-sell to Party A gilts bought in the (reverse) repo at the pre-agreed price.
	When the second leg of the repo is completed, the transactions can be reversed; there is still no requirement for a transfer across CGO.	

transaction and also earn a profit. In effect, it has used gilt repo to finance an investment in CDs. This may be profitable partly because the intermediary may be better placed than end-users of the market to identify particular stocks that are in tight supply and so are likely to command a 'special' repo premium greater than the stock lending fee. The intermediary may also take on a yield curve exposure, if the CDs are of greater maturity than the repos. The service provided to the market by the intermediary enables the stock lender to earn additional returns on its portfolio while using the stock lending form of transaction that it may prefer, and to provide either specific stocks or general collateral to repo market players, so contributing to gilt market liquidity.

Gilt repo activity and the yield curve

It was noted above that the maturities of the repo and reverse repo sides of a matched book may be mismatched, allowing market participants to take positions on the evolution of the short end of the yield curve. It has been found so far that in practice gilt repo trading has been more active when the yield curve is upward sloping, with overnight GC trading at lower rates than those for one or two weeks or a month. This has allowed an intermediary to enjoy positive cash flow by borrowing funds overnight on repo, rolling the transactions over, and lending the funds for a week or longer. In so doing, the 'mismatched' intermediary is exposed to unexpected movements in overnight rates during the period for which the position is taken.

If period rates in the money markets were determined only as the average of expected overnight rates, such position-taking would not be expected to be profitable in the long run. There may be several reasons why in practice such position-taking may be profitable in the short to medium term. Most importantly, there may be institutions placing funds in the market that are unwilling or unable to tie up their funds longer than overnight: they may face internal or external restrictions; they may be uncertain about their future cash flows and hence place a premium on retaining liquidity; or they may anticipate a near-term cash outflow. Intermediaries, who in effect charge to provide liquidity services, may be able to profit by bidding down the rates that they are prepared to pay for overnight funds, which they then place for longer periods. Other borrowers of funds may not take advantage of the relatively cheap overnight funding because of transaction costs, imperfect knowledge of the market, or structural reasons such as, for example, the liquidity guidelines under which banks operate. It is also possible, in the short period in which there has been active gilt repo trading, that periods when the yield curve has sloped upwards have coincided with times of greater uncertainty and divergence of views among market participants about prospective interest rate changes (though this need not always be the case). Gilt repo provides a liquid and secure means in which participants can trade on the basis of their different views.

Hedging through repo

Hedging positions in other markets is one of the main motives for some participants' involvement in gilt repo. This has been particularly evident in the sterling bond market, where underwriters have benefited from the ability to hedge the interest rate risk on their (long) underwriting positions by taking an offsetting short position in a gilt (ie selling a gilt they do not own), and using (reverse) repo temporarily to cover their short position to enable them to deliver the gilt. Gilt repo has enabled underwriters to short the exact gilt against which the bond they are underwriting is to be priced, improving the quality of their interest rate hedge. Previously they may have used less exact hedges, such as the long gilt future.

Other uses of gilt repo include arbitrage against the long gilt futures contract on the London International Financial Futures and Options Exchange (LIFFE). A formal basis trading facility has been available on LIFFE since October 1996. Basis trading arises from the difference between the current clean price of a stock (the price excluding accrued interest) and the clean price at which the stock is bought through the purchase of a futures contract. The difference between these two prices is known as the gross basis. Though much of the gross basis can be explained by the difference between the running yield on the gilt and the current repo rate, a residual amount, known as the net basis, is due to unquantifiables such as the delivery option implicit in the design of the futures contract. Traders take positions on the prospective size of the net basis. There has been active trading, at times, of the spread between swaps rates and gilt yields (mostly of three to seven years' maturity) and between unsecured short-term interbank rates and the repo rate on which traders take a position when they believe that the prevailing spreads are unsustainable.

The growth of the market

Based on the figures collected by the Bank,⁽¹⁾ the gilt repo and stock lending market grew in its first two months to nearly £50 billion of repos and stock lending outstanding, of which some £35 billion was in repos. Stock lending activity, which was liberalised at the same time as gilt repo, continued at levels comparable to those prevailing in 1995 (around £14 billion outstanding). After a period of consolidation in the spring, the market resumed its growth over the summer and autumn, rising to reported outstandings of nearly £85 billion in November 1996. Further growth took the market to nearly £95 billion in February 1997, of which over £70 billion was in repos (see Chart 1).

Between November 1996 and February 1997 the growth in repo activity moderated. Within this period, activity fell in December, according to the monthly data reported by banks for compilation of the monetary aggregates (see the box on

⁽¹⁾ The Bank collects quarterly data on a voluntary basis from market participants, including banks, securities firms, insurance companies, etc. Although the data are broadly based, they cannot capture the full extent of the market; only one side of any transaction with a non-reporter will be captured, while a transaction between two non-reporters will not be captured at all. Non-financial firms based overseas are least likely to report data to the Bank. The data in this article supersed those published in the April edition of *Bank of England: Monetary and Financial Statistics*; the updated data will be included in the May edition.
Chart 1 Repo market outstandings^(a)



page 193). It is thought that a number of banks and their customers, such as securities houses, sought to reduce their balance sheet size at end-December, to avoid adverse assessment by influential market analysts and credit rating agencies, some of whom apparently use simple measures of performance, such as return on balance-sheet assets, rather than looking at risk-adjusted capital usage and returns. It is also possible that market participants avoided taking on large repo positions to avoid the risk of having to close out or cover a position in thin trading over the holiday period, when the market would be less liquid. By the end of February, repo and reverse repo outstandings reported under the voluntary quarterly arrangements had risen above their November 1996 levels, with no significant change in the reporting population, although repo outstandings reported in the monetary data remained lower than in November, perhaps partly because of the increased use of netting of their reported positions by banks. As discussed above, the growth in activity to end-November, and possibly also in February, may have been linked to the steepening of the yield curve (see Chart 2).

Figures from the Central Gilts Office (CGO), the settlement service run by the Bank, appear to support the broad story of the growth of the repo market (Chart 3). CGO data cannot distinguish repos from outright sales or purchases. But the number of transactions being settled in CGO increased sharply between 1995 and 1996 before levelling off somewhat. That the increase was not greater probably reflects the fact that repos used as financing trades need not involve any transfers across the settlement system, since a firm purchasing stock and simultaneously repoing it back to the seller in order to finance its purchase would have made two simultaneous transactions, a purchase and a sale (with a commitment to a later repurchase), which would net out, with neither being entered as a transfer through the CGO system (see Table A).

Data collected on turnover in the gilt repo market suggest that average daily turnover in gilt repo is at least £20 billion.

Chart 2 Unsecured interbank rates: since 1 October 1996(a)



Chart 3 CGO weekly volumes



During the quarter to end-February, reported turnover was slightly below that reported for the previous quarter, probably mainly because of the downturn in repo activity around the end of the calendar year.

Gilt repo and other sterling money markets

The gilt repo market has developed alongside growth in the existing, unsecured money markets (see Table B). In just over a year, there is said to have been a substantial shift in the trading patterns of the short-term money markets from unsecured to secured money; market participants estimate that gilt repo now accounts for fully *half* of all overnight transactions in the sterling money markets. Financing of long positions by securities firms and other financial institutions is believed to account for a large part of this overnight repo. At times, the GC rate has traded *above* the overnight interbank rate at the end of the day, even though repo transactions are secured. This may be because firms borrowing through repo may have limited access to unsecured (and cheaper) finance, and because the repo market is less liquid late in the day.

Table B Sizes of sterling markets^(a)

£ billions

	CP(b)	Treasury bills	Commercial bills	CDs	Interbank(c)	Gilt repo	Gilt stock lending
1995 Dec.	6	16	17	61	114	0	14
1996 Feb. May Aug. Nov.	7 8 8 7	11 11 8 4	20 19 18 20	69 70 74 81	118 122 128 132	37 35 55 65	12 16 19 23
1997 Feb.	8	3	20	86	129	71	21

Outstanding amounts at the end of each period. Data are collected by the Bank for market monitoring and for the compilation of the monetary aggregates. Commercial paper. Interbank data exclude interbank gilt repo business. (a)

(b) (c)

The CD market has grown substantially, partly because the growth of the gilt repo and stock lending market has contributed to demand for CDs for use as collateral in stock loans. A further reason for the increase in CD issuance is the response of the major UK banks to new supervisory guidelines on liquidity management, which focus on the liquid assets available to a bank to cover the possible withdrawal of deposits that could occur over a period of days in the event of an institution-specific disruption in the market. One way for banks to reduce their potential short-term outflow is to raise more longer-term funding through period CDs.

The volume of Treasury bills outstanding has fallen since late 1995. Treasury bill issuance through the weekly tender varies depending principally on the official forecast of the autonomous influences on the prospective money-market position over the period ahead.

One potential effect of gilt repo on the money market is its possible association with a reduction in the volatility of overnight unsecured interest rates (see Chart 4), although it is too early for this evidence to be conclusive. One possible explanation for the sustained reduction in volatility is that repo has provided an alternative funding mechanism to many market players, which may have reduced pressure on the unsecured market in overnight funds and enhanced the ability of financial intermediaries to distribute liquidity.

Having monitored the steady growth in the scale and depth of the gilt repo market, the Bank issued a consultative paper in December 1996 on reforms to its money-market operations to include daily operations in gilt repo and to extend its range of counterparties. The new arrangements were introduced from the beginning of March 1997.⁽¹⁾ The Bank will study the impact of these new operations.

Impact on the gilt market

The main objective of introducing a gilt repo market was to enhance the liquidity of the gilt market and hence the attractiveness of gilts. There is evidence that market liquidity has improved, with firms able to transact larger deals than previously without moving market rates or spreads against them, and anecdotal evidence suggests that interest in gilts has broadened.

Chart 4 **Overnight Libor less base rate**^(a)



Turnover data reported to the London Stock Exchange (LSE), which do not include gilt repo trades, show the increase in turnover in the cash gilt market (see Charts 5 and 6). Average daily turnover by value on the LSE grew by 17% in the year to March 1997, compared with the 12%

Chart 5 Average daily gilt turnover: values



Chart 6 Average daily gilt turnover: bargains

Thousands 3.5



⁽¹⁾ The article on pages 204-7 explains the reforms

increase in the value of gilts outstanding over that period. At the same time, the average size of customer transaction (including retail trades) increased from £1.8 million in 1995/96 to £2.2 million in the year to March 1997. In the wholesale market, gilt trades of between £50 million and £100 million are now common, with trades of up to £200 million not unknown. Large investors are thus better able to effect large trades when making strategic portfolio changes. Market participants see gilt repo as an important factor in encouraging and facilitating these developments.

Reports of larger transaction sizes and improved liquidity in the gilt market are also supported by data from the settlement systems. The gross *value* of trades through CGO settled by the settlement banks on behalf of their customers (measuring one side only of the cash transfer) increased sharply during 1996 to approach the levels transferred through the Clearing House Automated Payment System (CHAPS), used for same-day transfer of funds (see Chart 7). This increase, compared with the levelling-off in the number of transfers through CGO, reflects the increasing transaction size in both gilt outright and gilt repo transactions.





Gilt repo has also contributed to improvements in the gilt-edged market-making function. The possibility of undertaking gilt repo with any counterparty has enhanced the ability of GEMMs to make markets in gilts, by improving their access to stock to cover short positions and lessening the cost of so doing, and by reducing the cost of financing their long positions, from above Libor to Libid minus a margin. These improvements underpin the role of the GEMMs and the service they provide to the gilt market. The average cost of borrowing stock has also fallen. These lower financing and borrowing costs are also available to other market participants, although all repo and stock lending market participants can face temporarily higher costs if a stock trades at very special rates, which will also influence its price in the cash market.

One likely consequence of an improvement in gilt market participation and liquidity is more effective arbitrage activity, and it was expected that the changes in 1996 might contribute to this by extending to the whole market the ability to take short positions in gilts, although other developments, such as tax reforms, would also contribute. One indication that gilts are now less likely to trade at anomalous prices is the modest decline in the average absolute divergence (over five days) of stocks from the yield curve estimated by the Bank (see Chart 8). The chart is generated by taking the absolute value of the observed yield of each gilt minus the fitted yield, and averaging all observations in a five-day period in the early part of each month (to avoid auctions).

Chart 8 Divergences of gilt yields from fitted yield ouryg



Market structure

The UK market comprises both gilt repo and gilt stock lending. Although there are institutions that undertake only one type of activity, many trade actively in both areas. For example, an institution that is short of a particular gilt may cover its short position (which could result from either an outright sale or a repo) in *either* the gilt repo or the gilt stock lending market. Given the level playing field between gilt repo and gilt stock lending, all market participants are free to choose whichever transaction type best suits their business. Some institutions prefer to use repo because they feel that the special value of tight stock is more rapidly and more accurately reflected in the repo than the stock lending market. Others prefer to use stock lending because their existing systems and control procedures can more readily accommodate stock lending than repo. For example, they may have no cash reinvestment capability nor experience of managing interest rate risk and may therefore prefer to receive collateral against a stock loan for a fee, rather than interest-bearing cash against a repo. They may also believe that for their own business the overhead costs of setting up and maintaining a repo capability are not justified.

The institutions incorporating the activities of the former SEMBs are among the main institutions active in both repo

The impact of the gilt repo market on the monetary statistics

The introduction of the gilt repo market has made it more difficult to analyse the monetary statistics over the past year (see, for example, the Bank's May 1996 Inflation *Report*, page 11). The aggregate data, as well as those for the other financial institutions (OFIs) sector were affected, but there was no effect on the data for the personal sector or industrial and commercial companies, because they were not active in the new market. In the Inflation Report, analysis of the inflationary implications of the M4 data has, in part, focused on the sectoral behaviour of broad money. Nevertheless, it is helpful to examine the effect of gilt repo on the aggregate M4 statistics and the OFIs' sector. Table A compares the quarterly flows of aggregate-and OFIs'-M4 and M4 lending with the flows in gilt repo and reverse repo. This shows the large initial effect of the gilt repo market on the M4 statistics.

Table A

Contribution of gilt repo and gilt reverse repo to M4 and M4 lending flows^(a)

£ millions, quarterly flows

	<u>1995</u> Q4	<u>1996</u> Q1	Q2	Q3	Q4	<u>1997</u> Q1
M4 OFIs' M4 Gilt repo	14,492 4,385	16,677 8,719 9,650	13,095 4,424 -1,489	16,430 9,013 193	13,005 2,826 1,142	28,558 15,686 826
M4 lending (b) OFIs' M4 lending Gilt reverse repo	15,247 3,489	20,151 7,265 10,519	15,974 3,427 1,181	15,277 4,139 1,023	10,858 -818 -3,482	25,430 16,328 4,823

(a) The aggregate M4 and OFI data shown here are seasonally adjusted(b) Excluding securitisations.

Institutions have taken advantage of repo as a new and cheaper means of generating liquidity and this has led to a *structural* increase in the volume of OFIs' deposits and loans. These institutions also *substituted* gilt repo and reverse repos for other M4 deposits and loans. It has been difficult to disentangle the structural increase in aggregate and OFIs' M4 and M4 lending from the substitution effects, as it is impossible to know what would have happened in the absence of gilt repo.

The Bank's estimate is that in 1996 Q1 around £6 billion of the increase in M4 and M4 lending reflected a structural increase in OFIs' deposits and loans (twelve-month growth rates of M4 and M4 lending excluding this structural effect, and seasonally adjusted, are shown in Charts 1 and 2). Between 1996 Q1 and the end of the year, the gilt repo market continued to grow and gilt repo business replaced, or added to, other forms of wholesale funding. This increased demand for gilt repos appeared to reflect banks' increased need for wholesale funds to finance higher demand for loans. In December 1996 there was a sharp fall in gilt repo activity but this was mainly attributed to end-of-year balance sheet effects. This effect has largely unwound since then.

Chart 1 M4 including and excluding the structural effects of the gilt repo market



Chart 2 M4 lending including a

M4 lending including and excluding the structural effects of the gilt repo market



There do not appear to have been any further sizable structural increases in gilt repo activity affecting M4. Instead, institutions appear to have substituted readily between gilt repo and other forms of wholesale funding. For example, in some months when gilt repo activity has been relatively low it appears to have been replaced by CDs and as a result M4 growth rates have remained high. This suggests that banks have acted as liability managers, raising wholesale funds as cheaply as possible to finance their desired level of lending.

In January 1997 the arithmetic effect of the structural increase in gilt repo dropped out of the calculation for the twelve-month growth rates for M4 and M4 lending. Since then the monetary statistics have been relatively free of the distortions associated with the introduction of the gilt repo market. The use of gilt repo in the Bank's daily money-market operations from the beginning of March 1997 does not appear to have had any significant impact so far on the growth rates of M4 and M4 lending.

and stock lending, and in providing a service of arbitraging between the two. They have been able to build on their existing relationships with the traditional stock lending institutions to borrow stock from them and to repo or lend it on to others in the market. Various other institutions have also been developing their relations with stock lenders to try and improve their access to stock that may be in demand and therefore trade special.

Market making in repo

Some of the former SEMBs and a number of other institutions that run large matched books have been providing what can be seen as akin to a market-making function in repo. In establishing the gilt repo market, the authorities concluded that it would not be necessary to have formal market makers in gilt repo. It was thought that active dealers making prices in repo would emerge naturally if their services were likely to be valued, without the need for a structure of obligations and benefits of the kind prevailing in the gilt market, into which the authorities issue debt.

Aside from brokers, there are over 20 institutions, mostly banks and securities houses, which quote repo rates on request, usually on both specials and GC, though many will quote rates only for their own customer base. All these institutions have large, though fluctuating, volumes of repos and reverse repos outstanding. Some firms periodically put out pages of indicative GC repo rates on the screen services, such as Reuters and Bloomberg.

Brokers

A number of the wholesale sterling brokers are active in gilt repo. Unlike some other broker business, such as unsecured deposits, gilt repo (and stock lending) requires counterparties to have signed legal documentation in place before they undertake trades with each other (undocumented 'repos'—sell/buy backs—do not offer legal protection to both counterparties, which is reflected in the higher capital requirements for such transactions under the United Kingdom's implementation of the Capital Adequacy Directive, and in the Code of Best Practice, which discourages their use). No repo legal agreement is necessary with the broker, who introduces the two counterparties to each other's business. All types of broked business, including repo, require credit lines with the counterparty to be in place.

Data collected by the Bank from gilt repo brokers show considerable growth in flows through brokers during the first year of repo. Comparing the brokers' data with the gilt repo turnover data reported to the Bank suggests that the proportion of business going through brokers rose during the year to account for roughly a third of all reported gilt repo turnover. Possible reasons for this increase are the rising number of signed legal agreements in place (which increases the probability that a user of a broker will locate a counterparty with whom they have a signed legal agreement) and the growing expertise of brokers, although no firm conclusions can be drawn.

Brokers tend to specialise in different aspects of the gilt repo market. For example, some concentrate on GC repo, and others on specials and specifics; some on very short maturity transactions and others on longer-term trades. Brokerage is typically set at around 1 basis point (0.01%) of the total nominal amount of the bond transferred in a general collateral gilt repo, and 2 basis points for specific and special repos. Brokerage is paid by both sides to a gilt repo. Comparison with brokerage in other markets is difficult because volume discounts are common.

Market participants

Gilt repo began as a predominantly interprofessional market, with sterling money-market players and participants in existing repo markets tending to be the first players to sign legal documentation with each other. Since then the range of participants has gradually broadened.

Principal intermediaries, typically those incorporating the former SEMBs, have continued to play a significant role in the gilt repo market, as have some of the major UK banks, European and US banks, and international securities houses based in London. Banks, including discount houses, accounted for around 70% of reported repo and reverse repo outstandings in August and November 1996, but securities houses and others increased their share somewhat in February 1997. (Chart 9 shows the position in February 1997.) The activities of the second-tier players have increased during the first year of repo, and the overall client base has broadened to include building societies, overseas banks and securities houses, hedge funds, mutual funds, and overseas central banks. Stock lending activity has increased and participation in it broadened. Some institutional investors and corporates have reportedly begun to undertake

Chart 9

Outstanding amounts at end-February 1997 by practitioner^(a)



gilt repo transactions, but their involvement has so far been limited.

One factor which may have constrained the use of gilt repo is that tri-party repo has not developed in the United Kingdom to the extent that it has in, for example, the US market. In a tri-party repo, an investor places stock with a custodian who manages their repo activities for them, subject to counterparty, margin, collateral quality and other limits specified by the investor. The custodian handles all settlement, investment of cash, and re-margining arrangements, and pays repo interest to the investor for the use of their stock, thus reducing the need for infrastructure investment and specialist personnel. Tri-party services are already on offer in the United Kingdom, and it remains to be seen whether these services prove attractive to UK firms and institutions.

Patterns of trading

Specials

The emergence of 'specials' trading is a natural part of a repo market. One of the purposes of introducing a gilt repo market was to allow the demand to lend and borrow stocks to be cleared by the price mechanism, to improve overall gilt market efficiency. It is therefore natural that when stocks are in demand, for example because firms want them to cover underwriting positions, the special premium on obtaining them rises.

The Bank has examined the relationship between the specialness of a stock and its price in the cash gilt market. The more special a stock is in the repo market, the cheaper it becomes for investors to finance their holdings of the stock by repoing it out. So investors will be encouraged to buy the stock to repo it out, unless the cash price is expected to cheapen sufficiently relative to (those of) other stocks to wipe out the financing advantage. This would typically require that the stock stands 'dear' to a yield curve estimated from all gilt yields, or dear relative to its recent history. Conversely, where a stock is expected to cheapen in relative terms in the cash gilt market, perhaps in anticipation of an auction of that stock, the covering of short positions taken as a result will tend to make the stock trade special in the repo market. The stock will remain special until existing holders either sell their stock or make it available for repo or lending, pushing down the cash price or reducing the special premium. Charts 10 and 11 illustrate the special rates observed on some gilts.

The Bank welcomes the functioning of the price mechanism in the specials market, to the extent that this arises as a natural result of market supply and demand, while reserving the right for market management purposes to reopen or repo a stock if conditions in the repo or cash markets become disorderly. The market's Code of Best Practice says that participants in the gilt repo and stock lending market 'must not in any circumstances enter into transactions designed to limit the availability of specific gilt-edged

Chart 10 Special rates on selected stocks^(a)



Chart 11 Special rates in early 1997



stocks with the intention of creating a false or distorted market in the underlying securities'. As part of its routine monitoring of the market, the Bank monitors the stocks that it receives in the course of its money-market operations, and can at its discretion require counterparties to replace stock.

Maturities

Gilt repo activity continues to be concentrated at the very short end of the yield curve with most trading (around 90%) at overnight to one week's maturity (Table C). During its first year, however, gilt repo liquidity has gradually extended out along the curve. Even though the *proportion* of trades at longer maturities has varied relatively little (Table D), the growth in the absolute volume means that liquidity has improved considerably; trades of up to three-months' maturity are now common, and three-month repo rates are routinely quoted with just a 5 basis point spread between the repo interest rates quoted for taking and placing cash via repo. Trades of six-months' maturity are not unusual, with trades going through daily, but with quotes less readily available than for the shorter maturities.

Table C Turnover by maturity, December 1996 to February 1997^(a)

Per cent

	On call and next day	2–8 days	9 days– 1 month	Over 1 month	Total
Repo	70	20	7	3	100
Stock lent	89	9	1	0	100
Reverse repo	68	22	6	4	100
Stock borrowed	84	8	6	2	100

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

Table D

Maturity breakdown of outstandings over time^(a)

Per cent

	On call and next day	2-8 days	9 days– 1 month	1–3 months	3–6 months	Over 6 months	Total
Repos							
1996 Mav	20	34	23	15	7	1	100
Aug.	19	33	33	11	4	1	100
Nov.	19	36	22	19	2	2	100
1997 Feb.	20	29	33	15	3	0	100
Reverse re	pos						
1996 May	20	30	20	23	6	2	100
Aug.	22	29	29	14	5	1	100
Nov.	21	34	21	20	3	2	100
1997 Feb.	18	32	26	21	3	0	100

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

Trading strategies affect the maturities of trades undertaken. For example, a trader wishing to take a position on interest rates at any maturity would enter a repo trade of equivalent maturity. Trades tied into LIFFE futures contracts will be undertaken up to the delivery date of the contract, and some specific trades may involve a gilt up to its redemption date. The volume of these strategic, longer-term trades will not always be significant compared with the volume of financing trades and other very short-term trades being undertaken each day.

Stock lending, by contrast, is traditionally undertaken for 'open' maturities; ie the maturity date is not specified, but either party can choose to terminate the transaction on any subsequent day. A lot of special repos are also traded with open or overnight maturities (when the repo is in fact often 'rolled' forward), but special repos are said to account for a higher proportion of repos at the longer maturities than at the shorter ones. There is anecdotal evidence of repos of six months or more in some special stocks; in this case, the borrower of the stock may either be hoping that the relative price of the stock will fall, or that it would become significantly more special during the life of the repo transaction, enabling them to lend or repo the stock out profitably.

Market practice

Conduct in the gilt repo market is guided by the Gilt Repo Code of Best Practice, which sets out standards of conduct in the gilt repo and stock lending market and describes some of the main market conventions agreed among participants in the gilt market, the money market, and existing repo markets before the gilt repo market started. Adherence to the principles set out in the Code has reportedly been good. In particular, the vast majority of market participants appear to have recognised the need for adequate legal documentation for transactions—whether in repos or in stock loans—and have ensured that such documentation is in place before trading. This has helped establish the reputation of the market.

As agreed at its last meeting before the start of gilt repo trading, the Gilt Repo Code of Best Practice Working Party is being reconvened to review the Code after a year's experience of the market. There are relatively few issues that need to be considered by the Working Party. One relates to partial deliveries, where less than the full amount of a contracted trade is delivered to the counterparty on the agreed date. Partial deliveries of stock are allowed in the gilt repo market with the consent of the counterparties. This is the opposite to standard practice in the cash gilt market, where partial deliveries are acceptable under Stock Exchange rules unless otherwise agreed (although in practice they are rare). The Working Party will consider whether this difference of emphasis has caused any problems in practice.

A further matter raised by market participants that the Code Working Party will consider is whether or not a penalty should be imposed on a party failing to deliver in an overnight repo. There is currently no penalty, other than the effect on the party's name in the market.⁽¹⁾ One possibility, for example, if counterparties felt sufficiently strongly, would be to add to their legal agreements a clause imposing an agreed automatic penalty for failures to deliver where no stock is delivered during the life of the repo. Nevertheless, failed deliveries continue to be rare in the gilt and gilt repo markets.

Overall impact of gilt repo

The precise impact of gilt repo is impossible to gauge, because of course we cannot know what would have happened in its absence. The ability of all market participants to short gilts, and to take and finance or cover readily their desired positions in the gilt market has improved the efficiency and liquidity of the gilt market, with larger bargain sizes being routinely traded, GEMMs and others more readily and more cheaply financing their positions, and tentative evidence that the efficiency of price formation in gilts has been enhanced. Gilt repo has also

⁽¹⁾ Since an overnight repo is due to be returned to the repoer on the following day, there is no point in delivering the stock the day after, as it would need to be returned immediately. By contrast, in the case of a failure to deliver on an outright sale of stock (or on a longer-term repo), the seller is obliged to deliver the stock as soon as possible after the intended delivery date, as the purchaser still wants it. This will be expensive to the seller (or report) because, for each day's delay in delivering it, they have to pay an extra day's accrued coupon interest on the stock when they buy it in the market, but they will be bound by the price originally agreed, which includes accrued interest only up to the contracted delivery date.

benefited other sterling markets, in particular, the sterling bond market, where the interest rate exposure on an underwriting position can now be more easily hedged by taking a short position in a gilt and using gilt repo to acquire the gilt for onward delivery.

The development of a liquid market in secured money, through the use of gilt repo, has broadened the range of funding and money placement options available to financial and non-financial firms, and in principle has increased the security and reduced the capital cost of conducting such business. It may also be associated with a reduction in the volatility of overnight interest rates. The Bank has also been able to incorporate gilt repo into its daily open market operations in the money markets.

These developments in the sterling markets all contribute to the market's perception of the gilt market and to the willingness of investors to invest in gilts. The gilt repo market was intended to enhance the attractiveness of the gilt market to investors and so reduce the costs to the government of issuing debt. Although no calculations can be performed to quantify any effect precisely, the improvements to gilt market liquidity, the increases in turnover, and the considerable size of the gilt repo market itself all suggest that recent developments in the gilt market have successfully increased investor interest.

The gilt-edged market: the Bank of England's relationship with the gilt-edged market makers and inter-dealer brokers

The Bank of England announced in December 1996 that it would no longer require the gilt-edged market makers (GEMMs), its counterparties in the gilt market, to be separately capitalised firms. This change, which took effect from 3 March 1997, allows firms to merge their specialist gilt-edged market-making subsidiary into their main operating entity if they so wish. The Bank's counterparties must, however, continue to satisfy a range of obligations. These obligations and the facilities available to market makers are set out in the following paper. The paper also covers the role in the gilt market of the inter-dealer brokers, who provide a service to the GEMMs and continue to be subject to supervision by the Bank.

This paper sets out the Bank of England's relationship with the gilt-edged market makers (GEMMs) with which it transacts business and describes the arrangements that apply to the inter-dealer brokers (IDBs) operating in gilts. It replaces the description of the arrangements set out in the Bank's paper of April 1985 ('The future structure of the gilt-edged market') and subsequent market notices, and reflects the ending of the requirement for separate capitalisation and the associated arrangements for prudential supervision of GEMMs by the Bank. The arrangements are subject to review and modification in the light of experience.

I Gilt-edged market makers

The liquidity of the gilt-edged market continues to be underpinned by the presence of competing market makers which undertake to make, on demand and in any trading conditions, continuous and effective two-way prices in gilts at which they stand committed to deal.

The Bank will consider applications from firms that wish to offer a gilt-edged market-making service and enter into a counterparty relationship with the Bank in gilts. Applicants must be able to satisfy the obligations set out below and must be members of the Securities and Futures Authority (SFA). To ensure that the core of the gilt-edged market is subject to Stock Exchange trading rules, applicants must also be subject to the rules of the London Stock Exchange for their gilt business. Details of the application process are provided in Section IV of this paper.

Acceptance by the Bank as a GEMM does not qualify an institution to participate in the Bank's money-market operations. Those who wish to be considered as money-market counterparties and who believe they meet the requirements are invited to contact the Head of the Gilt-Edged and Money Markets Division of the Bank.⁽¹⁾

Obligations

Firms are accepted by the Bank as GEMMs if they agree to meet a number of obligations on a continuous basis. The

aim of these obligations is to ensure that GEMMs contribute to the liquidity of the secondary market and provide appropriate support to the primary issuance of government debt. The obligations are as follows:

(a) Market making

The basic obligation of GEMMs is to make, on demand and in any trading conditions, continuous and effective two-way prices in gilts at which they stand committed to deal, in appropriate size as discussed in advance with the Bank, thereby providing continuous liquidity for the investing public.

The Bank will monitor closely each GEMM's performance against its undertaking, taking account of the role it plays in the market, based on data provided by the GEMM and continuing discussions with management; failure to live up to that undertaking would ultimately result in the ending of the relationship with the Bank and the termination of the associated facilities. The essential purpose of this obligation, which is mirrored in the rules of the London Stock Exchange, is to ensure that GEMMs provide, in all trading conditions, a market-making service to users of the market generally, rather than providing a dealing service that is largely confined to a narrow group. In assessing whether a GEMM is providing a service to the market in general, the Bank may also take into account the degree of distinction between the firm's market-making activity and the activity of other non-market-making proprietary trading areas in the same group and the relative scale of activity in these areas.

The market-making obligation described above applies specifically to gilt-edged stocks. The Bank encourages those accepted as GEMMs to make markets in as wide a range of listed sterling debt securities as possible. GEMMs are expected to make markets in *all* gilts, including conventionals, index-linked and floating-rate gilts. Although it is recognised that the depth of liquidity is currently less in index-linked than conventional issues, GEMMs should stand

⁽¹⁾ Gilt-Edged and Money Markets Division, Bank of England, Threadneedle Street, London, EC2R 8AH. Further details of the arrangements for money-market operations are given in the Bank's paper 'Reform of the Bank of England's operations in the sterling money markets', issued in February 1997 and in Operational Notices which may also be obtained from this address, or by telephone on 0171–601 3604.

ready to make prices and, over time, to demonstrate an appropriate level of participation in index-linked market activity. Once the gilt stripping facility is introduced, GEMMs will be expected to make a market in strips as part of their general market-making obligations. In assessing the fulfilment of the market-making criterion, the Bank will take special account of the position of those GEMMs that serve smaller investors and their brokers.

(b) Participation in primary issuance

Although there are no formal underwriting arrangements for gilts, the Bank expects all GEMMs, as part of their commitment to the market, to participate actively in gilt issuance via auctions and taps and, in particular, to bid on a competitive basis at auctions.⁽¹⁾

The Bank allots auction stock to individual bidders at its absolute discretion. In particular it may decline to allot stock to an individual bidder if it appears that to do so would be likely to lead to market distortion. As a guideline, successful bidders should not expect to acquire for their own account at auction more than 25% of the amount on offer. In applying this guideline to a GEMM, the Bank will take account of sales to clients and to other GEMMs, whether made directly or via the inter-dealer brokers. 'Own account' will be taken to include the position of the group as a whole, not just the market-making business, with the exception of any Chinese-walled entities. The Bank will discuss the coverage of this guideline on a case-by-case basis with the GEMMs.⁽²⁾

(c) Provision of data to the Bank and acceptance of the Bank's monitoring arrangements

The Bank expects GEMMs to provide it with relevant information on gilt-market developments regularly, both via contact with the Bank's dealing room and through periodic meetings with the management of each firm.

GEMMs are also expected to provide statistical data to the Bank. The Bank's interests in collecting these data are two-fold: first, to monitor general market conditions; and second, to monitor the compliance of GEMMs with their obligations. The Bank provides detailed reporting specifications to GEMMs as part of the application process and updates them as necessary. In brief, they cover: a GEMM's daily gilt positions and futures and options business; 'when issued' trading and auction positions, including large customer business; weekly turnover statistics; and a bi-annual summary of profit and loss and capital.

As the market-making activity may be part of a wider business, the Bank will discuss with each of its counterparties the extent of the business which should be reported under these arrangements. The Bank expects GEMMs to have appropriate systems to be able to provide the specified data on a continuing basis. Such systems, and the reports they generate, should be subject to review on a periodic basis by a GEMM's internal audit function.

GEMMs that are active in gilt repo are also required to contribute to the Bank's quarterly statistical survey of the gilt repo market.

The Bank will liaise with the SFA, the London Stock Exchange and other authorities responsible for the regulation of the GEMMs. Information held or received by the Bank under the arrangements described in this paper may be used or disclosed by the Bank for the purposes of any of its functions and may be disclosed to any supervisory authority to enable or assist that authority to discharge its functions.

The facilities available to GEMMs

To assist those market participants that are willing to take on the market-making obligations, and that demonstrate the capacity to do so, the Bank will offer the following facilities. These facilities are not available to other participants in the gilt market.

(a) Dealing relationship with the Bank

As part of its operations in the primary and secondary markets, the Bank is prepared:

- to receive *telephone bids in auctions* from GEMMs, on their own behalf or for clients, direct to the Bank's dealing room;
- to receive bids from GEMMs for any gilt sales offered by *tap*;
- to receive bids from GEMMs at any time between 9.00 am and 5.00 pm for any stock that the Bank may have in its portfolio and that has been made available for resale via the '*Shop Window*'. It is entirely at the Bank's discretion whether or not to accept bids;
- to bid a price of its own choosing for *stock with three months or less to maturity* offered to it by GEMMs;
- to bid a price of its own choosing for *index-linked stock* offered to it by GEMMs;
- at its discretion to undertake *switches of stock* proposed to it by GEMMs. The Bank will normally undertake switches only between stocks of the same type (eg conventional, index-linked, floating-rate) and maturity area; and
- to bid a price of its own choosing for stock where the amount in issue is too small for a two-way market to

The GEMMs can also each make a single non-competitive bid at auctions up to limits specified by the Bank.
See the Bank's Operational Notice 'Official Operations in the Gilt-Edged Market' issued in June 1996.

be expected to exist (eg the *rumps of certain stocks* that have previously been subject to conversion offers).

Further details of these facilities are set out in the Bank's Operational Notice, 'Official Operations in the Gilt-Edged Market', issued in June 1996.

(b) Access to inter-dealer brokers

A number of competing inter-dealer brokers (IDBs) provide dealing facilities in gilts between the GEMMs. The essential purpose of these arrangements is to enable the GEMMs to unwind stock positions that arise from their market-making activities with investors or their agents. Access to the gilt IDBs is available only to the GEMMs. Under London Stock Exchange rules, GEMMs may make information received from the IDBs available only to those staff directly engaged in meeting the market-making obligations of the GEMM. This includes the gilt sales force.

The Bank monitors the working of the IDB arrangements on an ongoing basis.

(c) Stripping and reconstitution facilities

Following the introduction of the gilt stripping facility (planned for autumn 1997), any member of the Central Gilts Office (CGO) will be able to hold strips in the CGO. The facility to strip and reconstitute gilts will, however, be available only to GEMMs. GEMMs will be expected to make a market in strips as part of their general market-making obligations.

GEMMA reference prices

As part of an initiative by GEMMA (the Gilt-Edged Market Makers Association), the GEMMs submit their closing prices in gilts to the Bank each day. The Bank collates the information and publishes an average price for each stock on the wire services. These prices (the reference prices) are used in the CGO system for valuation purposes and by the market as a whole. On behalf of GEMMA, the Bank reviews periodically the accuracy and timeliness of each GEMM's contribution to these prices.

II Inter-dealer brokers

As explained above, the arrangements under which a number of competing IDBs provide dealing facilities to the GEMMs have an important role in contributing liquidity to the gilt market.

IDBs are expected to provide a service to the GEMMs as a whole, and not to be confined to a narrow group. The Bank seeks to satisfy itself on a continuing basis that each IDB is fulfilling that requirement.

The Bank is prepared to consider an application from a firm provided that it can demonstrate that:

- it has the capacity—in terms of capital and of management and operational resources—to perform this function; and
- a broadly based demand for its services exists among the GEMMs.

Where an IDB has ownership links with a GEMM or broker dealer, competitive pressures may make it more difficult for it to demonstrate the necessary broadly based demand for its services among the GEMMs. The Bank would not, however, rule out such links.

The form of the Bank's prudential supervision of the IDBs and the information the Bank needs for that purpose are described in more detail in the Annex to this paper. A definitive description is also available in the Bank's Blue Folder—'Supervisory arrangements for core participants in the gilt-edged and money markets'.⁽¹⁾

III Settlement

The CGO provides a computerised book-entry transfer system for the secure and efficient settlement of transactions in gilts. An upgraded system is to be introduced during 1997 which will facilitate the settlement of gilt repo and strips and incorporate a number of new features including more flexible membership and account management arrangements.

Membership of the CGO is open to all gilt market participants. To ensure that full use is made of the protection offered by the CGO assured payments system, the Bank requires all GEMMs and IDBs to be members of the service.

Under current CGO arrangements GEMMs and IDBs must be direct members of the system. Once the CGO upgrade is introduced, different membership structures will become available including, in particular, the possibility of sponsored membership. The Bank expects that, in many cases, GEMMs will wish to remain direct members of the system, so as to retain full control over the timing of the settlement of their trades. There is no objection to a GEMM sponsoring the membership of other group companies. The Bank is also content for a GEMM itself to become a sponsored member subject to assurances that the ability of the GEMM to settle its business will not be compromised. In particular, the Bank expects that a GEMM:

- will have agreed with its potential sponsor that the GEMM will have priority access to the sponsor's facilities whenever necessary;
- is otherwise satisfied that any timetable constraints involved in the use of the sponsored membership route will not inhibit the GEMM from fulfilling its role as a provider of liquidity to the gilt market; and

⁽¹⁾ Available from the Capital and Wholesale Markets Division, Bank of England, Threadneedle Street, London, EC2R 8AH, or by telephone on 0171–601 4682.

• has adequate contingency arrangements for access to the CGO in the event of a systems failure by the sponsoring member.

A GEMM will probably find it easier to meet these requirements if the sponsoring member is itself a group company, but that is not a requirement.

IV Application process

An important objective of the Bank's arrangements is to promote competition among GEMMs and among IDBs. To that end, the Bank encourages participation in the gilt-edged market by all those who are able to demonstrate adequate capacity to perform the functions described in Sections I or II. The Bank is prepared to accept applications from prospective GEMMs or IDBs at any time. Those interested in applying should approach the Gilt-Edged and Money Markets Division of the Bank for preliminary discussions and will be asked to provide certain standard information as the basis for further discussion. In considering an application, the Bank will, where appropriate, liaise with the SFA, the London Stock Exchange and other relevant authorities.

Applications from firms wishing to become gilt IDBs will need to be supported by evidence of a broadly based demand for their services in the form of letters from GEMMs indicating a willingness in principle to use their service.

Annex

Prudential supervision of inter-dealer brokers

This annex explains the role of the IDBs in the gilt market, and describes the framework of prudential supervision that the Bank applies to these firms.

Inter-dealer brokers

The IDBs have an important role in contributing liquidity to the gilt market by allowing GEMMs to unwind, between themselves and on an anonymous basis, stock positions that arise from their market-making activities with investors or their agents. IDBs are expected to provide a service to the GEMMs as a whole, and not to be confined to a narrow group. The Bank seeks to satisfy itself on a continuing basis that each IDB is fulfilling that requirement.

The activities of IDBs, in addition to inter-dealer broking in gilt-edged securities, may include inter-dealer broking in: certain sterling fixed interest, floating-rate interest and index-linked securities, together with a range of Ecu-denominated securities; sterling money-market instruments; exchange-traded futures and options contracts relating to these instruments, together with repo and stock borrowing and lending transactions in the same instruments; warrants on gilt-edged stock; negotiated options on gilts and non-gilt sterling debt securities; and sterling-denominated forward rate agreements and interest rate swaps.

The confidential indications of GEMMs' positions acquired by IDBs in the course of their business means that IDBs are not permitted to take positions in securities or instruments in which they act as IDBs. Moreover, management and staffing of the inter-dealer broking entity must be separated from that of other position-taking entities within a group.

IDBs should be insulated as far as possible from any adverse development in other parts of any group to which they may belong. The Bank requires that IDBs be separately established in a member country of the European Economic Area as companies or partnerships with dedicated capital. The Bank also seeks assurances from substantial shareholders that they accept ultimate responsibility for the liabilities of the firm. An IDB may not, without the agreement of the Bank, have as a partly or wholly-owned subsidiary any other entity operating in financial markets.

IDBs wishing to use closed-circuit screens as a means of communicating with the GEMMs may install their own equipment or they may use the Stock Exchange's Integrated Data Network (IDN) or a commercial service. In any of these cases, they will be required to allow the Stock Exchange authorities to have, for monitoring purposes, access to the prices and amounts they are quoting.

Supervisory arrangements for the IDBs

The Bank requires the IDBs to be members of both the London Stock Exchange and the SFA. This ensures that the IDBs are subject to appropriate rules for the regulation of trading practices and for proper professional standards. The Bank is responsible, with the SFA, for the prudential supervision of the IDBs. The Bank's supervision is complemented by a close familiarity with the business of each IDB, developed by quarterly bilateral discussions. Compliance with the Bank's rules means that those SFA rules relating to financial supervision are largely disapplied from the IDBs. However, the remainder of the SFA rules continue to apply in full, and in particular those relating to the conduct of business. The Bank liaises on regulatory matters with the SFA, the London Stock Exchange, and other authorities, and may in this context exchange information with them to assist them in the execution of their respective regulatory responsibilities.

IDBs are required to accept full responsibility for both sides of each transaction undertaken. They must operate on a matched principal basis at all times and immediately cover positions arising from error or non-delivery. In the case of a delayed delivery of stock purchased by an IDB, the IDB may in turn delay delivery of the stock, but will remain ultimately responsible for it.

As investment firms, the IDBs are required at all times to meet minimum capital requirements, as set out in the EU Capital Adequacy Directive (93/6/EEC). The Bank has established prudential requirements that are superequivalent to CAD. These are set out in the Blue Folder-'Supervisory arrangements for core participants in the gilt-edged and money markets'. The Bank's provisions include an additional capital test for the IDBs, whereby the total value of uncompleted transactions (counting both sides of transactions separately) is restricted to a maximum of 800 times their capital base. This test will, under normal circumstances, deliver a higher level of capital than the minimum CAD requirements. The multiplier test reflects the Bank's view that the main risks that the IDBs run will tend to be proportional to the total amount of their uncompleted transactions. The two main sources of risk are:

• the risk of being held responsible for losses arising from adverse price movements following a misunderstanding with a GEMM. In the event of such a misunderstanding, the IDB must, immediately on discovery, buy or sell the stock as appropriate to eliminate any accidental exposure that has arisen; and • the risk that, on an adverse price movement, a counterparty fails to complete a transaction to which it had previously agreed. Again, the IDB must, immediately on discovery, buy or sell stock as appropriate to eliminate any exposure that may arise.

However, the Bank recognises that there may be occasional sharp peaks in the market demand for the IDBs' services and it is prepared—exceptionally and under conditions set out in the Blue Folder—to accommodate requests for an IDB to undertake business above the 800 multiplier, subject to the capital remaining at all times above the CAD minimum requirements.

Systems and controls and reporting

The Bank seeks to satisfy itself that IDBs have adequate methods of identifying and controlling the risks they face. In particular, firms are expected to monitor continuously their uncompleted transactions, and to ensure that CAD minimum requirements can be calculated and monitored as necessary.

The Bank requires IDBs to make regular supervisory reports to it, as detailed below. The Bank also requires immediate reporting of any differences arising from misunderstandings with GEMMs as described above, where the loss to the IDB exceeded 10% of its capital, and of any delay in completion of a previously agreed transaction by a counterparty that had not been notified to and agreed in advance by the IDB. In addition to these reporting requirements, the Bank reserves the right to call for supplementary information at any time.

As detailed in the 'Arrangements for supervisory reporting'

for IDBs, firms will be required to make the following electronic reports to the Bank:

(a) Daily reports

- Details of any failed transactions, positions, losses arising from broker error, and unconfirmed trades.
- Auction-related turnover reported during 'when issued' periods.
- CAD capital requirements on request.

(b) Weekly reports

• Details of unsettled transactions, turnover by maturity and transaction type, capital base and usage, and large exposures.

(c) Monthly reports

• Capital base details and profit and loss.

(d) Quarterly reports

• CAD capital requirements and details of any large exposures.

In addition to these electronic reports, the IDBs are expected to submit a full paper-based quarterly balance sheet and profit and loss account, and, annually, copies of: audited financial statements; a reconciliation of these statements to the Bank's quarterly returns; the auditor's report; and the internal control letter to the SFA.

The Bank of England's operations in the sterling money markets

On 3 March the Bank introduced reforms⁽¹⁾ to its daily operations in the sterling money markets, through which it implements monetary policy. The changes relate to the mechanics of its day-to-day operations in the money markets; they do not alter its basic approach to implementing monetary policy, which remains to manage short-term interest rates through open market operations.

The Bank made changes in three areas: it extended the range of instruments in which it conducts its daily open market operations to include gilt repo; it broadened the range of counterparties able to participate directly in these operations, to include market participants active in either or both of the gilt repo and bill markets; and it made some consequential changes to the arrangements through which it provides liquidity at the end of the trading day to adjust for any late imbalance in the market. This article describes the arrangements for the Bank's money-market operations, including those aspects which have not been changed.

The primary aim of the Bank's operations in the sterling money markets is to steer short-term market interest rates to the levels required to implement monetary policy. Subject to meeting that aim, it operates so as to help the banking system to manage its liquidity effectively. The Bank also seeks to foster the development of efficient and competitive sterling markets, given their importance in the wider financial system.

The Bank's approach is broadly similar to that of central banks in many other countries with developed financial systems. In its money-market operations the Bank satisfies the marginal liquidity demand of the banking system as a whole, through open market operations conducted on a transparent basis in prime-quality market instruments. The price at which it supplies liquidity in these operations constitutes the level of official interest rates and exerts a powerful influence on short-term market rates, steering them to a level consistent with official monetary policy.

The structural position of the money market

The market's need for refinancing from the Bank depends on transactions between three sets of players—(i) the Bank itself, (ii) the central government, whose main bank accounts are held at the Bank, and (iii) all other players, including the commercial banks and their customers. The main liability on the Bank's balance sheet is the note issue. In addition, banks and others hold deposits at the Bank.⁽²⁾ Any increase in notes held by banks or their customers has to be paid for; unless deposits at the Bank can be run down, the market will have to seek refinancing from the Bank for this purpose.

Because the Bank is the central government's main banker, government transactions also affect flows between the Bank

and the market. Government expenditure involves payments from the government's accounts at the Bank; tax receipts and the proceeds of government borrowing in the market mean payments to the government's account at the Bank. From year to year the government aims to finance its borrowing requirement from the market (by issuing gilt-edged securities and National Savings instruments), so that these flows even out. But at any particular time during a year, government receipts may exceed government payments, draining money from the market into the government's account at the Bank. At such times the market has additional need of refinancing from the Bank. By the same token, at such times the government is able to repay borrowing from the Bank (the 'Ways & Means advances').

The Bank manages its balance sheet in such a way that the market is normally obliged to come to it for refinancing. The assets the Bank acquires in its money-market operations are short-term claims, and a proportion mature each day in the Bank's hands. Except for maturing Treasury bills, the market is then obliged to redeem these claims, and, other things being equal, has to look to the Bank for further refinancing to be able to do so. In this way the Bank turns over the assets acquired in its money-market operations, and has a repeated opportunity day by day to determine the level of interest rates.

The fulcrum of the system is the 'maintenance requirement' on the settlement banks. These are the banks that hold settlement accounts at the Bank, on which they have to maintain positive balances at the end of each day. (In practice they target their end-of-day balances to be slightly greater than the bare minimum in order to cover themselves against uncertainties in their daily cash flows.) Although

 The reforms are described in the Bank's February 1997 paper, *Reform of the Bank of England's operations in the sterling money markets.* Including balances on settlement accounts (used to settle payments between banks and their customers) and Cash Ratio Deposits (non-interest-bearing deposits which banks in the United Kingdom accept an obligation to hold, and which provide income to the Bank). the Bank holds accounts for some other banks, the vast majority of banks in the United Kingdom hold accounts with the settlement banks; final daily cash settlement within the commercial banking system, and between the banking system and the Bank of England, occurs over the settlement accounts of these banks at the Bank of England. In its money-market operations the Bank, by providing the liquidity needed by the market, enables the settlement banks to achieve the required positive end-of-day balances on these accounts. In this way it is the marginal supplier of liquidity to the banking system.

To ensure that there is a steady demand from the market for liquidity, the Bank drains liquidity from the market by issuing Treasury bills each week. Whether the bills are bought by the banks or their customers, payment ultimately involves a transfer from the settlement banks' accounts at the Bank to the government's account. The size of the weekly Treasury bill tender may vary depending on the official forecast of the autonomous influences on the prospective money-market position over the period ahead.

Each morning at 9.45 am the Bank publishes the official forecast of the daily shortage on its pages on the wire services. The forecast gives details of the main influences affecting the position of the money market, including government transactions, changes in the note issue, the amount of maturing refinance that has to be repaid to the Bank, and the deviation from target of the settlement banks' balances on their accounts at the Bank. This forecast is kept up to date throughout the day and, where necessary, updates are published before the Bank's noon and 2.30 pm rounds of operations, and before the time at which its late repo facility for settlement banks may be made available (3.50 pm). The Bank publishes more information on the market's demand for liquidity than virtually any other central bank. Publication of the daily forecast and updates, together with publication of the amount of liquidity supplied in each of its operations (see below), helps promote the transparency of the sterling money markets, by ensuring that market participants are aware of the official estimate of the banking system's liquidity position throughout the trading day.

Open market operations

The Bank aims to meet the banking system's marginal liquidity needs each day via its open market operations. In principle it need not use open market operations: the Bank's ability to influence market interest rates depends on it supplying the marginal liquidity demanded by the market, rather than on the way in which liquidity is supplied. But the Bank uses open market operations because it wishes to foster the development of private sector markets in high-quality assets and to give banks an incentive to use these markets to manage their liquidity. Typically the market's position is one of a shortage of liquidity, which the

Bank generally relieves via open market operations conducted at a fixed official interest rate.⁽¹⁾

The Bank conducts its open market operations in short-term money-market instruments. These instruments need to fulfil certain requirements. They need to be of prime credit quality; actively traded in a continuous, liquid market; held widely across the financial system for the management of its sterling liquidity; and available in adequate supply. Accordingly, the Bank undertakes open market operations through repo of gilts, marketable HM Government foreign currency debt, and eligible bills (Treasury bills and eligible local authority and eligible bank bills), and through outright purchase of these bills.

The Bank conducts its daily⁽²⁾ open market operations at 12.00 noon and at 2.30 pm, with an additional early round of operations undertaken at 9.45 am if the forecast size of the daily shortage warrants it. By holding up to three rounds of open market operations, the Bank manages the pace at which it provides money-market liquidity during the day. The 2.30 pm round in particular is designed to be as late in the day as possible, consistent with the timetable of the relevant settlement systems, to ensure that the Bank can remain the marginal supplier of liquidity to the market up to the end of the trading day and make use of later and more accurate forecasts of the market's liquidity needs. The Bank publishes the aggregate amount of liquidity supplied in each of its open market operations on its pages on the wire services shortly after the conclusion of each round.

The maturity of the Bank's dealing operations in repo is around two weeks, with minor variations on occasion to smooth the future pattern of forecast daily shortages/surpluses. In addition, in each of its operations, the Bank is prepared to buy outright bills with a residual maturity up to the longest-dated repo invited. In steering market interest rates at a maturity of around two weeks, the Bank is able to exercise its influence over the range of short to medium-term rates that are its focus in implementing monetary policy. These include one to three-month money-market rates, and rates such as the commercial banks' base rates, and bank and building society mortgage rates. Other factors, including competitive pressures in the mortgage and retail deposit markets, may influence the level of such rates, but the actual level and the expected path of the Bank's repo rate should be the most significant consideration.

The techniques described above are employed when the banking system is forecast to be short of liquidity on a particular day. On days when a surplus of liquidity is forecast the Bank will 'mop' the surplus, by inviting counterparties to its open market operations to bid for outright purchase of short-dated Treasury bills of one or more specified maturities.

⁽¹⁾

The Bank may choose to operate on a variable-rate basis through a tender, although it has not yet done so. If the Bank were to conduct a variable-rate tender, the form of the tender would be announced at the time or in advance. The Bank also has available a twice-monthly gill repo facility to supply liquidity to the market at maturities of up to about one month, in order to reduce the amount of liquidity which would otherwise need to be supplied in the daily operations. The facility was inroduced on a formal basis in January 1994, and was in operation until April 1997, when the liquidity provided through the facility was allowed to run off. The facility is retained in abeyance for use if necessary.

Counterparties

The Bank stands ready to deal in its daily operations with a wide range of financial institutions active in the gilt repo and/or bill markets, provided that they satisfy a number of functional criteria which are designed to ensure both that the Bank's operations function efficiently and that the liquidity supplied is available as smoothly as possible to all market participants. The Bank is prepared to sign legal agreements and accept as counterparties banks, building societies and securities firms that satisfy the Bank that they are subject to appropriate prudential supervision and that:

- have the technical capability to respond quickly and efficiently to the Bank's operations;
- maintain an active presence in the gilt repo and/or bill markets, thus contributing to the distribution of liquidity around the system;
- participate regularly in the Bank's operations; and
- provide the Bank with useful information on market conditions and developments.

The Bank does not consider it necessary to impose a formal underwriting commitment, but looks to its counterparties to participate actively in the weekly Treasury bill tender, given the importance of the tender in the management of the money market.

The Bank expects the functional requirements to be met on a continuous basis, and monitors compliance with them by its counterparties. The Bank reserves the right to cease dealing, temporarily or for longer periods, with any counterparty at its own discretion. The Bank is prepared to take on new counterparties at any time provided that they fulfil the functional criteria.⁽¹⁾

Late repo facility for settlement banks

In its open market operations the Bank aims to supply the net amount of liquidity needed by the market (ie the official forecast of the daily shortage) by the end of its 2.30 pm round, and expects its counterparties to manage their individual liquidity needs sufficiently closely to enable it to meet this aim. Nonetheless, liquidity may need to be provided later, either because of a late change in the official money-market forecast or because of unforeseen variations in market participants' positions. For this reason the Bank is prepared to make available a late repo facility to the settlement banks which provide wholesale payments services to the rest of the market and which need to balance their settlement accounts at the Bank at the end of each day, to meet late changes in the market's net liquidity requirement. The late repo facility provides overnight liquidity against the same paper which is eligible for use in the Bank's open market operations.

Shortly before 3.50 pm each day the Bank publishes its last forecast of the day's shortage, and whether the settlement bank facility is to be made available. If so, the settlement banks may apply for liquidity between 3.50 pm and 3.55 pm. The Bank is prepared to supply liquidity to any settlement bank, normally up to the amount of any late increase in the banking system's need for liquidity that has been identified since the 2.30 pm forecast update. The Bank publishes the total amount of liquidity supplied via the facility on its pages on the wire services shortly after 3.55 pm.

An individual settlement bank is not permitted to apply for more than the total of the forecast shortage remaining at that stage, but the Bank does not place any other predetermined limits on individual banks' access to the facility. The Bank pro-rates bids for funds from the settlement banks if they exceed the amount it considers necessary to provide. It is intended that the facility will normally be used only for shortages unforeseen at the time of the 2.30 pm open market operation and arising unexpectedly thereafter. The Bank is prepared to withdraw the facility from any settlement bank that seeks to use it other than for its intended purpose, in which case the charge on any resulting shortfall in that bank's settlement account at the Bank at the close of business would be more heavily penal.

For a maximum of two years from March 1997, the Bank also offers a late repo facility for those discount houses (specialist money-market banks which were the Bank's main counterparties under the previous operating structure) that are subject to the transitional provisions which have been made available to them while they restructure their businesses. The discount house facility is broadly similar to the late lending arrangements that were available to them under the previous system. Between the announcement of the result of the last open market operation at 2.45 pm and 3.20 pm, these discount houses may apply for late liquidity, by way of repo, in amounts up to twice their capital and at a rate $\frac{1}{4}$ % or more above the repo rate applied in the open market operations. The Bank has complete discretion on how to respond to such applications, and does not normally supply more than its estimate of any remaining liquidity shortage in the market as a whole.

By extending the range of instruments in which it deals and broadening the range of its counterparties, the Bank has used the opportunity presented by the successful introduction of the gilt repo market to undertake a substantial development of its money-market operations. The Bank believes that the new arrangements enhance the scope for banks and other sterling market participants to manage their day-to-day liquidity. They should also promote further use of gilt repo as a high-quality secured money-market instrument and, more generally, help develop efficient and competitive sterling markets. The new

(1) Institutions which are interested in becoming counterparties should contact the Head of Gilt-Edged & Money Markets Division, Bank of England, Threadneedle Street, London, EC2R 8AH. arrangements are consistent with the direction and spirit of the preparatory work for monetary union published by the European Monetary Institute in January,⁽¹⁾ which is relevant to any further development of the Bank's operations, whether or not the United Kingdom participates in monetary union. The Bank is monitoring the working of the new arrangements carefully, and is keeping under review the possible need for further adaptation. Any such changes will be announced in published Market Notices, and described in the 'Operation of monetary policy' article in future *Quarterly Bulletins*.

 'The Single Monetary Policy in Stage Three: specification of the operational framework'. The proposals are discussed in an article, 'Monetary policy implementation in EMU: a Bank of England perspective on the EMI's proposals', on pages 57–62 of the February 1997 *Bulletin*.

Executive summary of the single monetary policy in Stage 3

This is a summary⁽¹⁾ published by the European Monetary Institute (EMI) of its report on the alternative strategies for conduct of a single monetary policy by the European System of Central Banks (ESCB) in Stage 3 of Monetary Union. This follows the article (by David Rule of the Bank's Gilt-Edged and Money Markets Division) in the previous edition of the Quarterly Bulletin which gave the Bank's views on the EMI's proposals for the operational framework.

This report, which was prepared with the assistance of the EMI's Monetary Policy Sub-Committee, discusses issues related to the choice of a monetary policy strategy for the ESCB in the third stage of Monetary Union. The decision on the strategy for Stage 3 will have to be taken by the ESCB, in line with its independent status, on the basis of the economic environment and financial market structure prevailing in the euro area. Nevertheless, the EMI has an important role to play in preparing this decision by analysing possible strategies for the ESCB and by ensuring that the technical infrastructure needed for the efficient pursuit of monetary policy strategies is available as from the start of Stage 3.

The assessment of alternative monetary strategies should be guided by the general principles of effectiveness, accountability, transparency, medium-term orientation, continuity, and consistency with the independent status of the ESCB. Among these principles, effectiveness is of a more general nature, as the other principles can, in a way, be seen as contributing to the effectiveness of a strategy.

In the assessment of a strategy for the ESCB, the likely environment for monetary policy in Stage 3 and the specific situation at the start of Stage 3 will also have to be taken into account. One key feature of the ESCB's environment is that, due to the prospective size of the euro area and the fact that participating countries will trade to a significant extent with one another as evidenced by the high degree of intra-EU trade, exchange rate developments will most likely constitute less of a concern for the conduct of monetary policy than is currently the case for many individual national central banks. Furthermore, the ESCB will be confronted with a situation in which there will be structural differences across participating countries as well as cross-country differences in economic policies. A further important aspect, which is crucial for the choice among various monetary policy strategies, is the characteristics of the average monetary policy transmission process in the euro area. Yet, the uncertainty about the transmission process is also one of the main characteristics of the specific situation of the ESCB at the start of Stage 3. Further challenges for the ESCB arise from the fact that it will have no track record of its own at the start of its operations and that it will have to devise its

strategy taking into account the need for integration of new Member States into Monetary Union over time.

Several candidates for the ESCB's strategy have been examined by the EMI. For different reasons, it would not be advisable for the ESCB to pursue a strategy based on an exchange rate, interest rate or nominal GDP variable as an intermediate target. The analysis in this report therefore concentrates on only two strategies, namely monetary targeting and inflation targeting.

While pure forms of monetary and inflation targeting can be clearly distinguished at a theoretical level, their application in different countries has shown that several variants integrating elements of both strategies exist, with the borderlines between them sometimes being blurred. Common to both strategies is that they are based on the same final objective, price stability, that they are forward looking, and that they typically employ a wide range of indicators to assess the appropriateness of the stance of monetary policy. The main factor distinguishing the two strategies is the role played by monetary aggregates.

A detailed assessment of the two strategies against the guiding principles mentioned above and in light of the specific environment and the starting situation of the ESCB indicates that no unconditional recommendation can be given at this stage for the strategy of the ESCB. It can be argued that particular advantages of a monetary targeting strategy are that it clearly indicates a responsibility of the central bank for developments that are more directly under its control and that it can be interpreted by the public on the basis of observable information, in a transparent manner. In addition, monetary targeting would provide for continuity with regard to the strategy that was pursued by the anchor country in the ERM before the start of Stage 3. At the same time, it is recognised that the stability of money demand in the euro area is a crucial factor for determining the scope for monetary targeting. In this respect, stability of money demand is also important in guaranteeing that the ESCB actions can be confidently interpreted by the public as following a consistent scheme, thus ensuring that the strategy provides a clear anchor to

Source: European Monetary Institute. Extract from the report 'The single monetary policy in Stage 3—Elements of the monetary policy strategy of the ESCB', published February 1997. Copies are available from the EMI Press Office: fax 49 69 2722 7404.

inflation expectations.

In fact, the uncertainty concerning the empirical properties of money demand in the euro area is the main argument against a monetary targeting strategy, as damage to the credibility of the ESCB could not be excluded if monetary aggregates turned out to be highly volatile at the start of, or during, Stage 3. With respect to an inflation targeting strategy, it is argued that this strategy directly stresses the responsibility of the ESCB for achieving and maintaining price stability. Furthermore, policy actions under such a strategy can be consistently and directly linked to prospective price behaviour, which, if the strategy is credible, will affect public expectations in a favourable way. It should be noted, however, that, to be successful, inflation targeting also requires stable relationships between various economic and financial indicators, on the one hand, and future inflation, on the other.

While there is no need to determine the precise details of the ESCB's strategy at this stage, five key elements can be identified that would be a useful part of any strategy of the ESCB. These elements should include, first, the public announcement of a quantified definition of the final objective of 'price stability'. Second, the ESCB should announce specific targets against which its performance can be assessed. Third, the ESCB should monitor a broad set of economic and financial indicators. Fourth, within these indicators, monetary aggregates should play a prominent role by publicly setting either target or monitoring ranges for their growth if money demand is sufficiently stable in the long-run. Fifth, the ESCB should be able, at least for the internal preparation of its policy decisions, to make its own forecasts for inflation and other economic variables.

The above elements can be combined in different ways. They would allow the ESCB the pursuit of both monetary and inflation targeting strategies and could also be used in frameworks which put strong emphasis on monetary targets while using supplementary elements from inflation targeting strategies, or *vice versa*. Discussing all the options for combining key elements would be premature at this stage since their assessment will largely depend on the circumstances prevailing in Stage 3. It should rather be left to the ESCB to decide on the importance it wishes to attach to each of these key elements in the actual implementation of its policy.

In the implementation of a monetary policy strategy, there are many detailed issues on which the ESCB will have to take a decision. The main choices concern the precise identification of the target variable, the length of the target horizon, the width of the target range, and the response of the central bank to deviations from the target. Also crucial to the strategy is the communication with the general public. Finally, the ESCB will need to be equipped with the statistical and analytical infrastructure needed to provide guidance for the conduct of monetary policy.

In the remaining time before the establishment of the ESCB, the EMI will undertake further empirical research related to monetary policy strategy. Studies need to be undertaken on the area-wide monetary transmission process, on the properties of various variables as leading indicators for inflation, and on the properties of different monetary aggregates in terms of their stability, controllability and predictability. In view of the uncertainty about countries' membership in Monetary Union, these exercises will be conducted for different groupings of EU Member States. Furthermore, these exercises will also consider the likely impact of EMU on the empirical relationships. The EMI will also study, prior to the establishment of the ESCB, certain implementation aspects arising for the ESCB in the case of the entry of additional countries into Monetary Union after the start of Stage 3.

The financing of technology-based small firms: an update

By Adrian Piper and Melanie Lund of the Bank's Business Finance Division.

In October 1996, the Bank published a report on the problems faced by technology-based small firms. (1) A summary of the main findings and recommendations was published in the February Quarterly Bulletin. This article outlines recent discussion of this issue and highlights areas where the Bank intends to carry out further work.

This article is in five sections. The first describes the immediate response to the Bank's report; the second summarises the recommendations made by the CBI in a report published in parallel with that of the Bank; the third sets out some of the highlights of the conference held by the Bank, CBI and the Royal Society; the fourth outlines a further report by the House of Lords Select Committee on Science and Technology. The final section sets out the Bank's current plans for further work on the issue.

Response to the Bank's report

Over three and a half thousand copies of the report have been distributed so far, with much international interest via the Internet. The Bank has received many letters in response, which have helped to highlight some of the problems faced by technology-based small firms, and have outlined a number of initiatives already under way.

Several meetings have been held with overseas delegations: for example, the Australian Industry Research and Development Board and the Australian Minister for Industry, Science and Tourism came to the Bank to discuss international experiences of financing technology-based firms and how Australian Government programmes might be developed to encourage private investment in venture capital. The Australian Government has since announced the establishment of a Small Business Innovation Fund based on the Small Business Investment Company programme in the United States. Officials from the Dutch Ministry of Economic Affairs also visited the United Kingdom to discuss the role of the public sector in promoting technology-based firms.

CBI report⁽²⁾

This report, published in February, was the culmination of the CBI's study on technology-based small firms, which ran in parallel with the Bank's work. At the start of the research it was agreed that the CBI would focus primarily on the issues of management, training and corporate alliancestopics aligned naturally with its membership profile. The

report's key observations and recommendations are summarised below.

Building management teams

Technology-based firms, like all other businesses, need a strong management team if they are to achieve commercial success. But though the managers of these firms have the necessary technical knowledge, they often lack business skills. They need help to build management teams around the firm's founders and new product ideas, but have difficulty in attracting experienced managers. To address this:

- the public and private sectors could consider setting up a 'Business Boost' group to help potentially viable businesses strengthen their management team and attract the finance they need. This builds on suggestions made by the Bank, and could involve the British Venture Capital Association (BVCA) and the British Bankers' Association (BBA), as well as the Department of Trade and Industry (DTI).
- Business Links (one-stop business support agencies operated by local partnerships) could help to build experienced teams around technological developments ('empty hive' initiatives).
- the regulation of Approved Share Option Schemes, which could attract more experienced managers from industry into these firms, should be reviewed.

Developing entrepreneurship and market focus

Although Business Links could offer training for technology-based small firms to bridge the skills gap in terms of marketing and sales, it was felt that lack of entrepreneurship was partly a result of the current education system. The CBI supports the Bank's recommendations for closer links between university science, engineering and technology departments and business schools, as well as improved ties between universities and industry. This would recognise industry collaboration as another career path in

A copy of the full report can be obtained by writing to the Business Finance Division, Bank of England, Threadneedle Street, London EC2R 8AH, or by telephoning Public Enguiries on 0171–601 4878. Questions relating to the content of the report should be addressed to the authors, Adrian Piper (0171–601 4117) and Melanie Lund (0171–601 4430). (1)

⁽²⁾ "Tech Stars-Breaking the Growth Barriers for Technology-based SMEs", Confederation of British Industry, February 1997.

academia and increase the involvement of students on programmes such as the Teaching Company Scheme.

Realising the potential of corporate alliances

Many technology-based small firms are either unaware of the potential benefits of alliances with other businesses or are wary of such links. The report sets out key steps in forming these alliances. The CBI is also considering ways of implementing the Bank's recommendation to set up a centre of expertise in corporate alliances to raise awareness and spread best practice, possibly in collaboration with the DTI.

Raising finance

This section closely reflects the findings of the Bank's report, but makes some additional recommendations on fiscal issues:

- to allow small and medium-sized enterprises (SMEs) to offset research and development expenditure against other tax streams;
- to give tax relief on costs of raising equity for reinvestment in one's own company and for corporate venturing activity; and
- to hold full debate on the reform of Capital Gains Tax, to encourage investment in growth businesses.

The final recommendation of the report is that the DTI should set up a unit to help spread best practice and co-ordinate support for fast-growth technology-based firms ('Tech Stars').

Partners in Business Conference

The recommendations in the Bank's report were primarily put forward for further debate. It was therefore proposed to co-host a conference with the Royal Society and the CBI as an opportunity to discuss the recommendations made by the Bank and the CBI, and also as a further step in the Royal Society's 'City, Science and Technology Dialogue' (which began in September 1995, with the active encouragement of the Governor). The conference took place on 3 March at the Royal Society. It brought together representatives from the scientific, financial and business communities to discuss the way forward in promoting technology-based small firms.

The Deputy Governor opened proceedings, along with Sir Aaron Klug, President of the Royal Society, and Adair Turner, Director General of the CBI. The Deputy Prime Minister, Michael Heseltine, and Barbara Roche, Shadow Minister for Small Firms, also addressed the conference. The following summarises the main points made.⁽¹⁾

• The United Kingdom has one of the most creative science bases in the world, but it has not reached the

same level of practical innovation. And although the UK financial system is highly enterprising, it remains difficult for some technology-based firms to secure finance.

- Fast-growing technology-based firms need high quality management (as highlighted in the CBI report), particularly when they are trying to obtain finance. The current skills gap and ways of attracting and retaining the right people were discussed.
- Business Angels (individual investors of high net worth with commercial experience) are an important and increasing source of finance and business advice. Opportunities and funding need to be better matched, and the complementarity between the formal and informal venture capital markets should be developed.
- Few long-term fund management institutions have significant investments in private companies, and only a small proportion of these are in technology-based firms. The challenge for firms is to convince these institutions that they are an attractive business proposition, either as a direct investment or indirectly through venture capital funds.
- Although the clearing banks cannot be expected to provide risk capital to technology-based small firms, they can help to direct businesses towards source of finance, as well as providing other banking services.
- The potential benefits of developing corporate alliances were explained. There need to be strong networks around technology-based firms to create the linkages that will facilitate an increase in the number of alliances.
- The Small Firms Merit Award for Research and Technology (SMART) and Support for Products Under Research (SPUR) awards were applauded as valuable public sector contributions to the promotion of technology-based firms. They are seen as an accreditation of a business and a useful lever for other sources of finance.
- A call was made to ensure that Venture Capital Trusts fulfilled their original objectives, and did not become just a vehicle for supporting lower-risk investments.
- The Government's approach to public purchasing might be developed to encourage more innovative small firms.

The Bank will continue to collaborate with the CBI and the Royal Society on these issues.

House of Lords Select Committee on Science and Technology

On 21 March 1997, the House of Lords Select Committee on Science and Technology published a report on *The*

A longer summary of conference proceedings is available on request from the Business Finance Division, Bank of England, Threadneedle Street, London, EC2R 8AH.

Innovation-Exploitation Barrier, which followed an earlier report *Innovation in Manufacturing Industry*, produced in 1991. The report concentrated on innovation, the point at which inventions are exploited for commercial interest, and on the links between universities and small businesses.

The Select Committee drew on the reports produced by the Bank and the CBI. In particular, the Bank's report was used as the primary source of written evidence on financing issues. Oral evidence was given by Pen Kent, former Executive Director of the Bank, and Adrian Piper, one of the authors of this article.

The Select Committee concluded that, although more finance had become available to exploit new ideas by small start-up companies, there was still evidence of a market failure in the provision of seed capital. The main findings and recommendations, particularly on the issue of finance, are outlined below.

- It was recognised that Business Angels were an important source of risk capital and of hands-on business advice. However, there were problems of awareness and information dissemination. To address these, it was recommended that the role of Business Angels should be examined further by Government, universities and financial institutions. Particular attention should be paid to Business Angel introduction services, with the possibility of a national network.
- It was recommended that the DTI should examine the due diligence issue further, as the relatively high costs are a barrier to investing small amounts. Concern was also expressed about recent moves by the largest accountancy firms to limit their liability on venture capital due diligence.
- The United States Small Business Innovative Research Program (SBIR)—which sets aside a fixed percentage of government contracts for small innovative firms—was seen to have an accreditation effect and to attract private investors. Although it was recognised that the existing SMART and SPUR award schemes had a similar effect in the United Kingdom, it was recommended that the Government should examine ways in which its existing schemes might be used to support innovation, along the lines of the SBIR programme.
- The Government's Foresight⁽¹⁾ exercise was thought to be useful in identifying broad research priorities, and in developing a network of contacts in academia and industry. However, the Select Committee was concerned about the lack of awareness among small firms of the existence of this initiative. It recommended, therefore, that Government and industry should raise the awareness of innovators, both within academia and outside, and make future Foresight reports more accessible to small businesses.

- Based on experience of industrial clustering, it was thought that a critical mass had to be achieved before new firms were attracted in significant numbers. It was felt that this was relevant to the success of science parks, in addition to organisational and sectoral considerations. The Select Committee also recommended additional research into the effectiveness of business incubators (which support and nurture start-up firms) in promoting technology-based small firms and industry-university relations.
- Emphasis was placed on developing business skills and promoting management education among scientists and technologists, as well as improving the scientific and technological understanding of financiers. To this end it was recommended that business schools should play a greater role in teaching management skills to science and engineering students, and that financial institutions should be encouraged to develop an awareness of science and technology.

Further work

The Bank is pursuing a number of its recommendations with government departments and private sector bodies.

The Bank's report recognised that the clearing banks were not a natural source of risk capital for technology-based firms. But they could provide such firms with working capital and banking services from an early stage. They also have an important role to play in developing packaged finance. The provision of working capital will need to take into account the viability of the business, which would also require a better understanding of the risks involved—high technology should not necessarily be equated with high risk. Moreover, the downside risks might be reduced by encouraging access to the Small Firms Loan Guarantee Scheme for technology-based small firms. The Bank is discussing with the main clearing banks how they are developing their approach to this type of firm.

The Bank's report noted the reluctance on the part of institutional investors, such as pension funds and insurance companies, to have any significant involvement in this area. This was partly because investors were looking for a higher rate of return than that suggested by the British Venture Capital Association's performance figures. But these figures largely reflected a number of under-performing funds from the 1980s. Potentially more successful funds had a high proportion of their portfolio unrealised and had been valued conservatively. How the information on returns might be improved is under discussion. It was also suggested to the Bank that the current legislative environment in the United Kingdom might impede institutional investment in technology-based small firms. This issue is also being examined.

The Bank and the CBI highlighted the potential benefits to technology-based small firms of developing corporate

⁽¹⁾ The Foresight programme brings together business people, scientists and Government representatives to identify wealth creation and quality of life opportunities in markets and technologies, and the actions and investments required to exploit these opportunities.

alliances. It was recommended that further research should explore the extent of corporate venturing currently undertaken in the United Kingdom and firms' strategies in this area. In March 1997, Withers, a City firm of solicitors, published the findings of a survey of leading UK firms on this topic. The results were interesting, although they were based on a relatively small sample. The Bank intends to build on this evidence through its regular programme of visits to major UK companies.

In spite of the increase in the supply of informal venture capital, Business Angels in this country play a less prominent role in the financing of technology-based firms than in the United States. As mentioned earlier, there is an information barrier to the successful matching of investment opportunities and investors. It is hoped that this will be improved by building on the current combination of national and local introduction networks. It was also suggested that the Financial Services Act represented a regulatory barrier. The Bank will look further into this issue.

In the summer of 1996, the Enterprise Panel (set up by the Treasury in 1995) reported on the current position of business incubation in the United Kingdom. One of its recommendations was the establishment of a national centre to raise the profile of business incubation and to disseminate best practice. It is expected that this initiative will be taken forward this year. The Bank, which is represented on the Panel by one of the authors of this report, will monitor developments.

A progress report on these issues will be given in the Bank's fifth annual report on Finance for Small Firms, due to be published in January 1998.

International regulatory structure: a UK perspective

In this speech,⁽¹⁾ the **Deputy Governor** considers the current debate on regulatory structure—both in the United Kingdom and internationally. In doing so, he takes as given that effective regulation needs input from market practitioners if it is to offer appropriate protection to the public without stifling innovation. The **Deputy Governor** looks first at the existing regulatory structure in the United Kingdom, and the proposals for change. He explores the case for a model comprising three agencies, focused on financial services, banking, and insurance; and he argues that the synergies between a supervisory function and other central bank responsibilities continue to justify keeping banking supervision within the Bank of England. The **Deputy Governor** goes on to consider the international regulatory structure—stressing its particular importance for the United Kingdom given London's international financial groups requires consolidated supervision; he also says that the United Kingdom is keen to examine the practicability of introducing the concept of a 'lead regulator'.

It is conventional, and polite, to say at the beginning of a speech of this kind that one is delighted to have been asked to speak about the structure of financial regulation. But I cannot bring myself to do it.

This lack of enthusiasm for the topic is, I hope, not an emotional response. It is rationally based on two prior beliefs. First, that the relationship between structure and effectiveness is loose. I know of little evidence that structural reforms are quickly followed by enhanced effectiveness of the activity in which agencies are engaged. Second, I believe that regulatory structure should follow market structure, rather than the other way round. Regulators should respond to changing markets which, in turn, respond to changing customer demand and new product availability, rather than seeking to dictate either. So we should always ask ourselves whether the regulatory framework we adopt makes sense to market participants, rather than requiring them to structure their business to fit some government-imposed view of how product delivery should be organised.

But I recognise that, in practice, we cannot avoid constant attention to the maintenance of the regulatory framework. Though good structure will not necessarily generate effectiveness, a faulty, out-of-date framework will certainly make it very hard for regulators to do their job well. And, of course, our financial markets are heavily conditioned by the legislative and regulatory framework in which they have developed. (That is particularly true in the United States. It is hard to imagine that, absent Glass-Steagall, Regulation Q and all the rest, the financial landscape in North America would look as it does today.) So I conclude that the debate on regulatory structure should be a constant dialogue between the markets and the regulators, but with a prejudice in favour of the former. Our ultimate task as regulators is to ensure that markets work efficiently, and in the interests of consumers.

Against that background, how is this dialogue proceeding in the United Kingdom at present?

I should first say a little about the objectives we see for financial regulation. We think of five: to protect the economy against systemic risk; to protect individual depositors, investors and insurance policy holders against loss from the failure of their intermediary; to protect customers against business misconduct; to assist society at large in the fight against crime (for instance by making sure that firms have in place systems to detect and report laundered drug money and other proceeds of organised crime); and, last but not least, to create and sustain fair markets.

Described bluntly, these objectives make the job of regulators look impossibly daunting. But of course they are not absolute aims. Regulators cannot, and should not, offer blanket assurances to investors and depositors. They cannot, because the tools and resources to do so are simply not available. And they should not, because it would be quite wrong to remove from investors and firms the responsibility for assessing, taking and monitoring financial risks. This is a very important point, which Alan Greenspan has helpfully underlined on a number of occasions recently.

UK regulatory structure and proposals for change

Across the world we see a lively debate on how the regulatory cake should be cut. There has been change in France. The Australian Government has set up the Wallis Commission to look at the institutional arrangements there.

(1) Given at the Federal Reserve Bank of Atlanta 1997 Financial Markets Conference, on Saturday 22 February.



Reforms are in progress in Japan, and here in the United States there are proposals for change. Similarly, in the United Kingdom, a number of proposals have been put forward to amend, or in some cases fundamentally reorder, our regulatory structure. But before describing these proposals, perhaps a brief description of the British system would be in order.

Responsibility for financial regulation in the United Kingdom is divided between two government departments. Most falls to the Treasury, but prudential supervision of insurance companies comes under the Department of Trade and Industry (DTI). The DTI carries out its supervisory responsibilities using its own staff; the Treasury, on the other hand, sets the legal framework and policy directions for regulation, but leaves most of the detailed regulatory functions to others. Under the 1987 Banking Act, the Bank of England carries out prudential supervision of banks. Under the 1986 Financial Services Act, the Treasury delegates its powers to the Securities and Investments Board (SIB), which in turn recognises a number of front-line regulators.

These front-line regulators cover different sections of the market. One, the Securities and Futures Authority (SFA), is responsible for securities houses; another, the Investment Management Regulatory Organisation (IMRO), for fund managers. These two regulators undertake both prudential supervision and conduct of business regulation. The third, the Personal Investment Authority (PIA), is responsible for the retail sector, and has principally a conduct of business remit though it is also responsible for the prudential supervision of independent financial advisers (IFAs). So, in effect, there is a layered approach to the regulation of financial services in the United Kingdom, with different powers held at each level.

(To complete the picture, the Building Societies Commission supervises building societies—though the largest of them are now converting to bank status. And the Department of Social Security is responsible for the supervision of occupational pension schemes.)

This brief description of the legislative framework might lead one to suppose that the UK system is primarily statutory—yet the securities side is often described, at least by comparison with the US system, as one of self-regulation. Indeed, some argue that it is excessively so and therefore unreasonably lax.

We would reject that last charge. And, in practice, the distinction between statutory and self-regulating is not black and white. The UK system has elements of both. Prudential supervision of insurance firms is carried out directly by a government ministry, which is unambiguously government regulation. Banking supervision is carried out by the Bank. Constitutionally, this is not 'government' regulation, but rather regulation by a public body authorised by a specific Act of Parliament. Certainly no one describes what we do as self-regulation, even though the Bank is itself a bank.

On the investment side, the picture is more complicated. The SIB's governing board includes people who are active in financial services, but they are appointed by the Treasury and the Bank (indeed I am one of them) and are required to act in the public interest. Again, this does not look like self-regulation. But the Act itself calls the various front-line regulators 'self-regulating organisations' (SROs). Their boards include a high proportion of active practitioners, elected by the industry to represent its views. Practitioners are also heavily involved in policy discussions, rule-making and enforcement. But like the SIB, the SROs operate indirectly under statute, and have a duty to regulate in the public interest.

So we have no self-regulation in the strict sense, but rather a variety of statutory and statute-backed bodies with practitioner involvement, each with different relationships with the industry and government. Effective regulation needs input from market participants if it is to offer appropriate protection without stifling innovation. But to retain the confidence of the investing public, regulators must also must persuade them that regulation puts their interests first, not those of the firms and their shareholders.

The system we now have can undoubtedly achieve an appropriate balance between market sensitivity and consumer confidence; it has, in many respects, worked well. But it has been stress-tested in some difficult episodes: the Maxwell affair, the private pension mis-selling saga, the collapse of BCCI, Barings Bank and Sumitomo. These episodes have taught us something about the strengths and weaknesses of our system, just as the savings and loans crisis and the Daiwa New York problem have done in the United States. And markets themselves have moved on. The financial landscape today is almost unrecognisable from the one which informed legislators' views in the early 1980s. So it is not surprising that there is criticism of the existing structure and pressure for change.

Critics of the existing UK system object on three counts: that the failures of the last decade demonstrate that it cannot cope with strains and crises; that it is unnecessarily complex, with overlapping and sometimes even conflicting responsibilities; and that it has failed to keep pace with changes in institutional and market structures. I do not aim today to give a comprehensive assessment of the validity of all these arguments. And, as in the United States, there is a heavy political dimension to this debate. But I would make a few observations.

The UK system is complex, though no more so than the equivalent arrangements in some other countries with similarly sophisticated financial markets. Those who argue for simplification point to duplication of function and cost, especially between the SIB and the front-line financial services regulators. There is undoubtedly a case to answer in that area, as both the SIB and the SROs would acknowledge. But the UK legislation explicitly dictates a two-tier structure.

It is also true that institutions now tend to be involved in a variety of different businesses. Banks own securities houses, fund managers and insurance companies; insurance companies are diversifying into banking, and so on. So though there should always be a lead regulator, looking at the overall position of the business, institutions still face the costs of complying with the requirements of several regulators.

But the question underlying these arguments about complexity and overlap is more fundamental. Should

regulation be based around institutions (it is institutions which fail, after all) or around functions or types of business needing specialist regulatory knowledge? The UK system is organised neither along wholly functional nor wholly institutional lines. In today's markets, where firms are a mass of subsidiaries and business units, no major market participant deals with a single regulator across all its businesses. Similarly, no regulator has unique responsibility for regulating one function of each business. The insurance operation of a firm, for example, is covered by separate prudential and conduct of business regulators.

Most people involved in financial regulation would recognise this problem. But resolving it is not straightforward, as shown by the wide variety of proposals for change. Some proponents of reorganisation would like to make all financial regulation the responsibility of a single government department—the Treasury. They suggest that this would clear up accountability for the legislative framework and for the powers and sanctions in the regulatory regime, and create consistency of regulatory approach across sectors. Straightforward administrative tidiness may also be a factor. There may be merit in these arguments, but such questions are for the Government to determine.

Most of the discussion about UK regulatory structure has concentrated on the area covered by the SIB and the SROs, where the arguments about duplication of function, unnecessary cost and poor communication are most often heard. The various alternative models all feature some degree of consolidation, and some would go as far as to fold all the main financial services regulators into a single body. Others propose two bodies, each reporting directly to the Treasury, one for wholesale business and one for retail, acknowledging the different regulatory imperatives of the two sectors, especially in the conduct of business field. This would reduce the number of domestic regulators large institutions would have to deal with, and better match regulation to function.

Even more radical changes have been proposed, encompassing not only the SIB area, but the prudential supervision of banks and insurance companies as well. One model, colloquially known as 'Twin Peaks', would replace the present system with two commissions: a Financial Stability Commission, with responsibility for systemic risk, the prudential supervision of all major institutions, and conduct of business regulation of wholesale activities, and a Consumer Protection Commission, which would be in charge of conduct of business regulation in retail markets, as well as detecting market manipulation and insider dealing. It would also carry out prudential supervision of those stockbrokers and fund managers who deal with private clients, and of independent intermediaries.

Underlying this model is the contention that the traditional separation between banking, securities and insurance is breaking down and so the difference between institutions and functions is less meaningful. I am not persuaded of this—though the activities of banks and securities firms do overlap at the margin, this is not true of the core activities. Banks in particular continue to have a number of distinctive characteristics. First, the risks associated with the maturity transformation seen in their balance sheets. Banks experiencing a drain in their liquidity, perhaps a classic 'run', could face insolvency through the forced realisation of illiquid assets at 'fire-sale' prices. Second, there is the risk of contagion—problems at one bank can spread to others, not just through direct financial linkages but also because without timely, transparent information on bank assets, depositors become concerned about other (similar) banks. Finally, banks play a central role in payments systems, including payment flows generated by foreign exchange trading.

I conclude that there is enough that is special about banks for their prudential supervision to be retained as a separate activity in any new regulatory structure, and that this argument at present outweighs the case for change. Whether this should be a function of the central bank is a separate question. Some argue that other central banking responsibilities (such as the conduct of monetary policy) make for conflicts of interest and so supervision should not be carried out by the central bank.

I am not persuaded by these arguments either. Nor am I aware of many examples where the suggested conflicts between a supervisory role for the central bank and its other responsibilities have arisen in practice. Indeed, there are important synergies between the supervisory function and other central bank responsibilities. It makes sense for the 'micro' supervision of individual banks in the system to be carried out by the same body that carries out the 'macro' function of maintaining the stability of the financial system as a whole—stability that is essential if monetary policy is to be executed effectively and efficiently.

It is no accident that in all major countries the central bank has a significant role in banking supervision, even if in some cases others have been given the legal powers to carry out the front-line tasks. Having tried their best as supervisors to limit the likelihood of failure, when faced with it central bankers are uniquely well-placed to provide assistance to the institution in trouble, the market, or both. Those who wish to separate banking supervision from central banking must acknowledge that there are certain things that only the central bank can do, and that therefore there needs to be a strong link between the central bank and any new regulator.

The logic here might point instead to a 'Holy Trinity', rather than a 'Twin Peaks' model, with three agencies, focused respectively on financial services, banking and insurance. That might allow the most sensible, albeit incomplete, match of regulation to function and institution. It would also evolve fairly readily out of the present structure. This last point is not trivial, since the cost and disruption caused by reorganisation would be considerable and reflect the degree of change. The process would inevitably



generate uncertainty among firms and the public, and make the regulatory system more difficult to manage meanwhile.

This argues for building on the present arrangements if at all possible, rather than starting again with an entirely new structure that could take years to settle down.

Moreover, what matters to the financial system and the public is that regulators are effective. Effectiveness needs, at the very least, good communication between supervisors. Whether structural change (including bringing functions together under one umbrella) would improve communication and co-operation and so increase effectiveness is a key question, and the answer is far from clear.

We have been making considerable efforts recently to enhance communication between different UK supervisors. This has involved putting in place Memoranda of Understanding. But we have also sought to achieve cross-membership of some of our most important institutions. For example, Sir Andrew Large, the Chairman of the SIB, has become a member of the Bank's Board of Banking Supervision and, reciprocally, I have joined the SIB. Though one should not exaggerate the importance of individual appointments of this kind, they do help to create a climate of co-operation, signalling to the respective staffs of the two institutions that they are expected to work together as closely as possible, and to the outside that they can expect this to happen.

The approach to regulation in the United Kingdom

The discussion of regulatory approaches is often phrased in terms of rules versus judgment or, as academics tend to put it, rules versus discretion. Should supervisors simply set the rules, and shoot those who break them? Or does that create too rigid a framework, which stifles initiative and imagination? There is no simple answer. The Bank of England imposes an increasing number of rules: it has, for example, implemented detailed regimes for capital adequacy introduced by the Basle Committee and the European Union. We set capital requirements to cover the more readily quantifiable risks; we enforce limits on banks' large exposures to individual counterparties; we have rules on banks' liquidity; and we seek to ensure that banks have robust systems and controls, as well as management with the skill and integrity to ensure, to use the US phrase, that the bank is 'safe and sound'.

But our judgmental approach—allowing supervisors the discretion to exercise informed judgment within approved guidelines-still contrasts with that of many other regulators. This flexibility allows us to be tough where appropriate, but to avoid inappropriate requirements. Most fundamentally, perhaps, we can ask questions, and try to use all the information at our disposal to form a judgment of the risks facing depositors and investors, as well as of the quality of a bank's management. So in addition to enforcing rules and looking for problems, we can help management. We can spread knowledge of best practice: asking banks about the full range of risks they face (including those-like reputational and settlement risk-that they would often rather ignore); and pointing out to complex groups the extent to which their managerial and organisational systems have moved away from their legal structure.

The Bank is also commonly viewed as doing relatively little on-site supervision. But this depends on how you define the term. Accountants are well aware that the Bank does, for example, make extensive use of reports prepared by auditors—who, of course, operate on-site—to assess the adequacy of internal controls. In particular, the Bank regularly instructs banks to appoint reporting accountants to report on systems and controls, and on the accuracy of prudential returns.

The Bank's supervisors also spend a growing amount of time on-site. Since 1986, Review Teams have carried out focused visits to banks to evaluate the risks in an institution as well as the systems in place to identify, monitor and control them. And in 1995 we introduced a Traded Markets Team to focus on banks' pre-processing models, which can be recognised under the CAD (Capital Adequacy Directive), as well as sophisticated risk modelling techniques used by the banks to manage treasury activities. These teams make short, highly focused visits to banks, based on a great deal of preparatory work, not just between team members and the line supervisors but also by the bank itself in providing detailed answers to a series of questions.

The Bank has also recognised the need to be more systematic in its approach to risk assessment and has announced its intention to introduce a more formal approach, known as the RATE model, to identify—using a series of qualitative and quantitative measures—the risks faced by each bank. RATE is an acronym for the three stages of the process: Risk Assessment, Tools of supervision and Evaluation. By performing periodic risk assessments, we shall aim to gain better understanding of the quality of management, the characteristics of the business and the risks the banks face. The greater degree of consistency across banks in the new approach will allow the Bank to be more focused in performing its supervision: the tools of supervision will be targeted at the areas of greater risk and concern in individual banks.

A better understanding of the risk profile of each supervised institution will assist the Bank in setting risk asset ratios. As you all know, Basle sets a minimum capital ratio of 8% of risk-weighted assets. The 8% ratio is sometimes interpreted as a 'one-size-fits-all' standard. But the Bank sets the trigger capital ratio for each authorised bank at, or above, the 8% floor and considers adjusting that trigger ratio whenever it sees a substantial change in the bank's risk profile.

Where does this all leave us in comparison with other regulators? I suggested earlier that our flexible, judgmental approach is somewhat distinctive. But we are no longer, if indeed we ever were, outliers on the supervisory spectrum. While the Bank has decided to implement a more systematic approach to risk assessment, other supervisors—who traditionally operate a rule book—are (in a fast moving market place characterised by rapid product innovation) moving towards regimes with more scope for supervisory judgment.

But this convergence does not necessarily mean that international supervisors are right. They may all be converging on an inappropriate model. Indeed some would argue that regulators do as much to create problems as to solve them: that regulators create perverse incentives—even as we speak bankers may be designing products purely to exploit anomalies in our rules. Why not let the market regulate itself and concentrate on rules of disclosure, obliging banks to publish accurate information on their capital adequacy and risk profiles, and leaving the rest up to the market—perhaps with some safety net for small depositors and investors?

To answer that question, it may be helpful to go back to first principles. Back in 1958, Modigliani and Miller demonstrated that in a frictionless world a firm's capital structure cannot affect its value. In the real world, however, departures from the M&M assumptions—such as taxes, bankruptcy costs and agency costs-may influence the capital decision of any firm; capital may after all be costly. Furthermore, banks differ substantially from most other firms because their soundness and safety is crucial to maintaining systemic stability; without (costly) capital requirements some will exploit their position by taking large risks with little of their money, in the hope that the taxpayer will bail them out. In other words, some may believe that they are (partially) insulated from potential market discipline. So from a regulatory perspective, banks must be required to have capital to absorb the possible losses that result from risk-taking and still remain solvent.

It is tempting to conclude that the only problem is a perception of a government-funded safety net for large banks; remove that and our problems will be solved. But systemic risk cannot be wished away that easily, even though the UK regulators have shown that they do not rescue every bank that gets into problems. So while we try to stay clear from ever more detailed rules, we do not believe everything can be left to the market; certain minimum 'regulatory' capital standards are in our view necessary. Of course, we must aim for a credible and comprehensible regime that does not require constant updating and elaboration, is not immensely costly, and is reasonably consistent. The value-at-risk (VAR) approach is an attempt in that direction. It recognises that there is a crucial role for judgment in supervision and does not prescribe the key qualitative factors in legalistic detail. But it does set out the parameters to ensure that there is a framework to deliver broad consistency and also some degree of prudence.

Some have argued that regulators should go further than the VAR approach: rather than defining the key parameters and endorsing particular model types, why not leave it to the banks, and give them an incentive to improve their internal models as much as possible? Under this pre-commitment approach a bank would specify the maximum portfolio loss on its trading activities and this would become the institution's market risk capital requirement. Banks exceeding their pre-committed maximum loss would be penalised, for example through financial penalties or corrective supervisory action.

In some ways pre-commitment can be seen simply as a means of ensuring that supervisors work with the grain of a firm's business, and monitor ratios that are seen as meaningful by management. To that extent, we support it. But there are potential drawbacks. It could amplify the moral hazard problem: if the bank wins, its shareholdersas well as its traders under their bonus packages-pocket the profit, and if it loses, the regulator/taxpayer ends up with the bill. A penalty would not act as a deterrent to a bank prepared to gamble its capital because that bank would not be affected by such a penalty when it failed. And regulators could over time become less familiar with banks' risk management systems, which might make them less effective in a crisis. Early supervisory intervention is more difficult if supervisors only become aware of problems after the limit has been breached. It may be possible to devise an approach to pre-commitment that avoids these potential handicaps. But for now our attitude remains somewhat hesitant.

Finally, a discussion about rules is not complete without touching on the question of a 'level playing field'. When banks and securities houses do similar business it seems only fair to apply similar capital rules. But the total business of banks and securities houses is still vastly different. Much of a bank's regulatory capital is held against credit risk. By contrast, securities houses invest primarily in liquid, marketable assets, with illiquid assets typically only 2% or so of the total, and the bulk of a securities firm's regulatory capital tends to be held for market risk purposes. So it is not obvious that we need to set the same detailed rules for banks and securities houses. That is not to say that we should entirely ignore differences in supervisory regimes, but rather that we should focus on areas where those differences are on a scale that seriously distorts competition. In other words, we should spend rather less of our time discussing risk weights, and rather more discussing risks.

Globalisation and the regulatory response

How far do these general principles, which I have discussed so far in relation to the United Kingdom, apply to regulatory structures in a global environment? The biggest institutions now span 50 or more countries and may have 300 or more entities within the group. This has been a feature of banking since at least the 1970s. But, partly owing to the development of whole-book VAR models, firms are now also tending to centralise the controls and management for all these far-flung entities, consolidating similar risks being run in different subsidiaries. This leads to a matrix management structure, and allows the head office to exercise much stronger control over the volume of a particular type of risk being run across the group. (For example, for some UK banks, the management of their global foreign exchange book will be in London during London office hours, then it will switch to the US operation but under strict limits set by London; after the United States close it will move again, to the Far East, but still under the control of limits set by London.)

So for global groups, the control of the activities in the various scattered legal entities now hinges on the adequacy of centrally located controls. In a way this is simply an extension of the vulnerability of banking entities to problems arising elsewhere in the group, but in this case, solvency of individual entities will depend on the adequacy of systems and controls located elsewhere.

One obvious question is why firms do not dispense with such a plethora of legal entities and operate a simpler branch structure. The answer seems to be that differences in tax structures and even regulatory requirements in some countries still encourage the use of legal entities in different jurisdictions.

I do not think that the regulators should try to discourage greater central control of risk: where a firm is running one type of risk in different locations it must make sense for the total risk to be controlled centrally. But this does create a problem for supervisors, because supervision has to be structured along legal entity lines (given that it is legal entities that fail), and each supervisor must therefore take a view about the soundness of the entity in its jurisdiction, even where this hinges on controls located elsewhere.

Regulators' first response to centralised controls has been an increased focus on information sharing, and on agreeing respective responsibilities. In the banking sector, at least, they have also supplemented solo supervision of individual entities with consolidated supervision of groups as a whole. The initial focus of the Basle Committee on Banking Supervision, set up by the central bank governors of the G10 countries in 1974, was to define the role and responsibilities of home and host supervisors of internationally active banks. These were set out in the 1975 Concordat, which has been updated on a number of occasions since. Securities supervisors too have a long tradition of international cooperation, including arrangements for information sharing and mutual assistance in enforcement, with IOSCO playing a key international role. There is also a long history of discussion between Basle and IOSCO.

Individual supervisors in both the banking and securities industries have chosen to reinforce co-operation arrangements through formal bilateral agreements with their overseas counterparts. Partly as a consequence, there has been an increasing number of informal meetings between line supervisors with operational responsibility for different parts of financial groups.

The importance of international regulatory co-operation is now widely acknowledged and is on the agenda of inter-governmental meetings. At last June's G7 summit in Lyon, the heads of state called for maximum progress before the Denver summit in June 1997 on 'enhancing co-operation among the authorities responsible for supervision of internationally active institutions, importantly by clarifying their roles and responsibilities'. Ahead of the Lyon Summit, Basle and IOSCO announced a joint initiative to strengthen co-operation in this area, referring to the work of the Joint Forum of banking, securities and insurance supervisors, set up to promote information exchange on international financial conglomerates and consider establishing for each a lead regulator.

The need to meet the challenge of supervising multi-functional global financial conglomerates is particularly significant for the United Kingdom because of the extent to which the London markets are international. The failure of one or more major overseas firms may cause systemic problems in London, where at the end of last year overseas banks accounted for 57% of the total assets of the UK monetary sector, with US banks contributing 8%. Moreover, almost three quarters of the 478 banks taking deposits in the United Kingdom are branches or subsidiaries of overseas financial institutions, including 37 from the United States. US firms have, of course, particular importance in certain markets. Our April 1995 derivatives survey showed US firms (including securities houses) accounting for around 40% of turnover in both foreign exchange and interest rate derivatives.

One can argue that an individual regulator can successfully meet his own objectives by seeking to build firewalls between his entity and the rest of the group to which it belongs. These might include restrictions or even prohibitions on both financial exposures and operational interlinkages. In addition capital adequacy and other requirements might be set at a more onerous level than if the potential for parental support was taken into account.

Such measures may be the best that can be achieved at present; they certainly provide host supervisors with a measure of comfort. But they are, and always will be, a second best. For example, there will always be a risk of reputational contagion. Counterparties might refuse to deal with a member of a failed group because they fear that the firewalls may be flawed, or that cultural or control weaknesses are repeated in that entity also. Second, as the firm will incur additional costs to comply with these ring-fencing arrangements, while possibly at the same time being denied the risk-reducing benefits of group-wide controls, it is unlikely to provide the most efficient solution. Concern about these deficiencies has heightened as we have learned more about how many global financial groups are managed. The lack of overlap between legal entities and the management of business lines means that the amount of true ring-fencing possible for a globally managed institution is open to debate.

The Bank has always believed that effective supervision of financial groups must involve consolidated supervision. As Alan Greenspan said in his recent testimony to the Congressional Sub-Committee on Financial Institutions and Consumer Credit, 'Risks managed on a consolidated basis cannot be reviewed on an individual legal entity basis by different supervisors'. It is important to define the term 'consolidated supervision'. The underlying philosophy is that for, say, a bank operating in a large financial group, one must look not only at the soundness of the bank itself but also of the group as a whole. This requires both a quantitative and a qualitative assessment.

The quantitative element involves examining the financial strength of the whole group. The basic measures are capital adequacy and large exposures. At the Bank, we look at these against the minimum standards set out in the EU Directives and against the more stringent criteria that we have developed and apply to individual banking groups to take account of their particular circumstances. It is worth noting that the EU Directives and the Basle Capital Accord both set these minimum standards on a consolidated basis only.

The qualitative element involves assessing factors such as the group's risk management process, internal systems and controls, capability of key personnel, culture and business strategy. Any supervisor will hardly need reminding that, in the Barings case, weaknesses in a subsidiary in just these areas brought about the collapse of the parent.

Consolidated supervision is a relatively widely understood concept involving the range of activities set out above. Alan Greenspan has also talked of 'umbrella supervision', which he described as a 'realistic necessity for the protection of our financial system'. I also referred earlier to a 'lead regulator', though the term 'co-ordinating supervisor' is gaining currency in some quarters. As noted, one of the tasks of the Joint Forum is to define this role, on which there have been extensive discussions. Among the possibilities suggested have been:

• Carrying out a quantitative and qualitative assessment of the group as a whole;

- taking a primary role in managing emergencies;
- facilitating the exchange of information between the relevant regulators in a group; and
- (in the longer term) considering how supervisors' efforts could be better co-ordinated when looking at (for example) controls.

It should be stressed that the existence of either a lead regulator or a consolidated supervisor in no way affects the legal responsibilities of the individual regulatory authorities for regulating the different group entities. The objective is not to shift the balance of supervisory responsibility from host to home supervisors. Rather, the intention is that each host authority should be able to carry out its responsibilities more effectively by relying to some extent on the work of others.

We are keen to examine the practicability of allowing one co-ordinator to carry out the role defined above. Enthusiasm from the United States has been more muted, although commercial banks are, of course, already subject to consolidated supervision; I know there are political issues at stake too. I would hope, nevertheless, that these important issues can be considered carefully.

Conclusions

Though I have attempted to identify some features of regulation on which we might well agree, I doubt whether there is such a thing as an 'optimal' regulatory structure. Each country has its own legacy of supervisory structures and approaches. But an appropriate international structure is one that works as seamlessly as possible and has clear lines of responsibility (at least, that is what we expect from international banking groups' controls). One co-ordinating regulator for each institution could play a crucial role in such a structure. The number of regulators is, in my view, less important. No one has yet suggested that we should set up one body worldwide to carry out all supervision. So whatever our own vision of an optimal regulatory structure, it will have at its centre a requirement for supervisors from different disciplines and in different countries to communicate effectively with one another. This weekend's conference is a good opportunity to do that.

Bond yields and macroeconomic behaviour

The **Governor** reviews⁽¹⁾ trends in bond yields over the last four years. He notes that an important influence on the downward movement of yields in the last two years has been the broadly based consensus on the importance of macroeconomic policy discipline. This has been accompanied by sustained expansion of the world economy, although there have been quite marked differences among individual countries. Cyclical differences in short-term interest rate prospects explain differences among yields at the short end of the curve, but longer-term economic performance—and particularly inflation—is not expected to be very different between almost all of the major countries. But a comparison of yields also indicates that some considerable uncertainty remains about the prospect for EMU, in particular about its initial membership, but also about the extent of the discipline it will involve.

I am honoured to have been invited to open this third Euromoney International Bond Congress. I remember with great pleasure launching your initial Congress in October 1994 in the Barbican.

I remember our debate at that first Congress particularly well. The context then was one in which yields had fallen very sharply to unusually low levels almost everywhere during 1993, only to go back up just as sharply during 1994.

One concern at the time was that we were facing a global capital shortage, with increasing demand from the emerging, transitioning and developing countries at a time of strengthening economic activity and large government deficits across the industrial world. Real yields at ten-year maturities—measured by our own indexed gilts—had indeed risen in 1994, by ³/₄% or more, to close to 4%. But *nominal* yields had risen substantially more—by something like 2% in the major markets—reflecting increased uncertainty no doubt, but clearly also worsening inflationary expectations.

In my remarks on that occasion, I ventured to suggest that bond markets might just be exaggerating at least the inflationary risks, by underestimating three factors in particular:

- First, the commitment of governments and central banks all around the world to disciplined macroeconomic polices.
- Second, the restraining effect of both the level of real yields and structural unemployment, particularly in Europe.
- And third, the counterinflationary effect of global competition and technological innovation.

Now I seem to recollect that this suggestion was met by a degree of scepticism. That was not at all surprising. You

had all heard that sort of optimism from the authorities before!

But, the fact is that since around the time of that first Euromoney Congress bond yields have nevertheless trended fairly consistently lower, and are now in many cases close to or even below the low point they had reached around the end of 1993. *Real* yields, again measured by our own indexed gilts, have fallen back to a little more than 3¹/₄%; and the first US indexed bond issue yields much the same. And *nominal* yields have fallen by 200 basis points or more in continental Europe and Japan—though rather less in the United States and the United Kingdom. There has been more excitement in the foreign exchange market, with the dollar in particular first weakening against the yen and the major continental currencies until the spring of 1995 and then progressively recovering.

These developments were certainly influenced by the factors that I mentioned a moment ago. In particular they have been influenced by the continuing broadly based consensus—in countries all around the world, and across a large part of the political spectrum within countries—on the importance of macroeconomic policy discipline.

Macroeconomic policy is no longer seen as an instrument for short-term demand management, which can be used to trade-off the conflicting demands of growth and stability in the short run. It is now much more widely understood and accepted that the rate of growth that can be sustained, or the level of employment that can be achieved and maintained in anything other than the short run, depends fundamentally on the structural, supply-side characteristics of the economy, and not just on the level of demand. So today's orthodoxy assigns to macroeconomic policy the job of keeping demand in line with the capacity of the economy to meet that demand in the medium and longer term.

(1) In a speech given at the Euromoney International Bond Congress on Tuesday 25 February 1997, Queen Elizabeth Conference Centre.

Within this overall framework, monetary policy is allocated the specific task of achieving and maintaining effective price stability. This is not, as some commentators still seem to suggest, simply some doctrinaire end in itself. Inflation is seen rather as a symptom of imbalance between demand and supply in the economy. So what we are essentially aiming to do through monetary policy is to anticipate the emergence of that imbalance and head it off before it becomes entrenched. If we are successful in that, inflation will be lower, there will be less need for violent interest rate movements than in the past, and the economy will grow at a steadier, and more sustainable and predictable, rate. That, in turn, will encourage more rational longer-term economic decision-making and investment, which will help indirectly to improve underlying supply-side performance.

Similarly, today's macroeconomic orthodoxy requires fiscal policy to be directed to restricting government borrowing to levels that can be sustained into the medium and longer term, without either forcing up real yields or implying the prospective need for progressively rising tax rates—which could otherwise damage the development of private sector economic activity.

Now in some respects we have made considerable progress over the past two years and more. Inflation in many countries—including virtually all the industrial countries but not confined to them—is now consistently lower than it has been for ages. That in itself has contributed to lower interest rates and to the lower nominal bond yields that I have described. But in addition to that, fiscal consolidation, which has lowered the combined government deficits of the G7 countries from around \$600 billion in 1994 to around \$540 billion last year, has helped to reduce real yields, notwithstanding the continuing demand for capital from the developing world. And the really good news is that this macroeconomic discipline has been accompanied by sustained economic expansion, with world GDP as a whole growing at an annual rate of some $3^{1}/2\%$ -4%.

Of course there have been quite marked differences in the performance of individual countries within this overall picture. Some of the transition economies have seen a brutal contraction of output which is only now beginning to stabilise. And there have been marked fluctuations in the growth rates of some of the emerging countries. Growth in parts of Asia, for example, is now moderating, cyclically, to a more sustainable pace; while parts of Latin America continue to recover from the set-back they suffered two years ago.

Among the industrial countries, too, economic developments have diverged over the past two years. In the United States and in this country, for example, inflation has been contained to around 3%, with continuing growth and low or falling unemployment. And this pattern looks set to continue. In Japan and on the continent of Europe, on the other hand, while inflation has been even lower, activity has been disappointingly weak, and unemployment on the continent at least has risen to quite frightening levels. And although there is now the prospect of a moderate pick-up in activity in these countries, that is not yet assured. Japan, which is in many respects a unique case, faces substantial fiscal consolidation. And in Europe, too, the prospects are clouded by pressure to bring budget deficits down sufficiently to meet the Maastricht convergence criteria this year, notwithstanding the weakness of the domestic economies and an environment of longer-term structural inflexibility.

These divergent developments go a long way towards explaining recent differences in the behaviour of both bond markets and exchange rates.

In the United States and the United Kingdom, the sustained expansion of domestic demand and output has generated market expectations of an essentially cyclical rise in short-term interest rates. Sluggish economic activity elsewhere, on the other hand, means not only that short-term interest rates are significantly lower in Japan and the core European countries; but it also means that they are thought, by the market, to be less immediately likely to rise. This cyclical difference in the short-term interest rate prospect largely explains the pronounced yield differential between the United States and the United Kingdom and the other countries at the very short end of the curve. Out to two years, for example, yields in the United States and United Kingdom are within 1/2% either side of 6%, whereas yields in Germany and France are below $3^{1/2}$ %, and they are below $\frac{1}{2}$ % in Japan. These differences in the short-term interest rate prospects feed through into yield differentials on longer-term bonds, and changes in them also help to explain the recent movements in exchange rates.

But rather more interesting is the relative slopes of the yield curves further ahead, where the implied *future* yield differentials become much narrower. If you look at the 5–10 year maturity area—that is to say the implied five-year yield five years ahead, US and UK yields are only about 1% above present short-term yields, at around 7%; but they are 3% or more above present short-term yields in Germany and France, also at around 7%; and they are 3% higher than short-term yields even in Japan, at 3³/₄%. The implication is that, if you abstract from immediate cyclical influences, longer-term economic performance—and particularly performance with respect to inflation—is not expected to be very different between the major countries, though Japan remains an outlier.

It is difficult to know what interpretation to put on this observation. The fact that the yield curves in Germany and France are practically identical is consistent at least with EMU going ahead—at least with a narrow membership. But the steep rise in implied future yields five years ahead suggests that inflation is expected to be higher in the medium term. That could be associated with expectations of softer macroeconomic discipline, perhaps more specifically reflecting market uncertainty about EMU in the light of the ongoing debate about prospective membership and about how far the ECB will in practice be free to pursue its statutory task of maintaining price stability. It may, on the other hand, simply reflect some kind of market imperfection.

The same analysis can be applied to Italy and Spain, for example, to try to assess market expectations about their possible membership of EMU as part of the first wave. It shows that, notwithstanding the recent falls in short-term interest rates in those countries—which can largely be explained by their improved economic performance—five years forward yields remain significantly higher than those in Germany and France, suggesting that early EMU membership is not at all certain in the eyes of the markets.

The conclusions that I draw are essentially threefold and hardly very surprising.

I conclude, first, that markets at present are reasonably persuaded that the world economy as a whole will remain relatively stable, at least by comparison with much of the post-war period. Excluding short-term influences, bond yields in the major countries—apart from the special case of Japan—are converging at a level of around 7%, which suggests that relative macroeconomic monetary and fiscal discipline will be sustained, though it will stop short of effective price stability.

I conclude, second, that the markets see current developments in the United States and the United Kingdom as essentially cyclical; and that they anticipate a pick-up in activity elsewhere somewhat further ahead.

And I conclude, third, that there remains some considerable uncertainty about the prospect for EMU, in particular about its initial membership but also about the extent of the discipline it will involve.

Now, of course, these conclusions are based on the bond markets as they currently are, which is a bit like forecasting the past! What you really need to know is how the markets will evolve in the future. Happily it is not my task to venture down that path. It is during our next session that the market experts will seek to 'forecast the future'. But I do hope they will tell us whether they agree that relative stability will indeed persist in the medium and longer term, how they see the different national situations evolving in the more immediate future, and what prospects they see for EMU. These seem to me to be the key issues for the future and I look forward to listening to what they have to say.

Monetary policy and the exchange rate

Mervyn King, Executive Director and Chief Economist of the Bank, considers⁽¹⁾ the implication of the recent rise in sterling for inflation and interest rates. He argues that any coherent analysis of the implications of a change in the exchange rate must consider why the exchange rate has moved. Different explanations have different implications for inflation and monetary policy. It is for this reason, argues Mervyn King, that there is no mechanical link between the exchange rate and domestic interest rates.

The outlook for output, inflation and therefore monetary policy has been clouded by the sharp and unexpected appreciation of sterling since last August. The effective exchange rate has risen by 17%, although there have been marked differences among the bilateral rates. Against the dollar, sterling has appreciated by only 6%, but against the Deutsche Mark it has risen by no less than 21%. That has occurred against the backdrop of a gradual acceleration of activity in the UK economy to above-trend rates of growth, driven primarily by domestic demand. But equally important in the rise of sterling has been sluggish demand in continental Europe, with their and our economies at different phases of the business cycle.

What are the implications of the rise in sterling for inflation and interest rates? The first thing to say is that no central bank is, or can be, indifferent to the exchange rate, or to the information that it provides. The exchange rate is not just another price, to be seen in the same terms as the price of washing machines or restaurant meals. It is in fact the price of our money—sterling—in terms of other people's money—dollars, Deutsche Marks, or even a weighted basket of other currencies.

It should also be immediately clear that there is no such thing as 'the' exchange rate. There are many exchange rates. There are bilateral exchange rates against each of the other currencies in the world. And there is also the 'effective' exchange rate, which is the value of sterling against a trade-weighted basket of the currencies of our major trading partners. As I noted at the beginning, these exchange rates have changed in rather different ways. That should not be surprising. The exchange rate is a relative price between two currencies. So any developments that affect the value of either currency will affect the exchange rate between them. Changes in monetary policy in Britain will certainly have an effect on the exchange rate between sterling and, say, the Deutsche Mark. But so will changes in German monetary policy. So a change in the sterling-Deutsche Mark exchange rate could reflect actual or expected changes in either British or German monetary policy, or both. That simple observation should make us cautious about drawing strong conclusions about the

implications for domestic monetary policy of a change in the exchange rate.

Nevertheless, people do so and some go so far as to draw the bold conclusion that a 10% appreciation in sterling would, if sustained, lead to a 10% reduction in the UK price level. Of course, there are some circumstances in which that would be true. But, as a general statement, it is false. Since August, sterling has appreciated by more than 20% against the Deutsche Mark. Does this mean that the rise in sterling will lead to a 20% fall in the British price level? Or does it mean that the equivalent fall in the Deutsche Mark against sterling implies a 20% rise in the German price level? Clearly, both cannot be true at the same time. And even if we accepted that the change in the exchange rate would, if sustained, correspond to a 20% change in relative price levels, that tells us rather little about inflation in the two countries. An appreciation does not necessarily imply a fall in inflation in the medium term. Since 1957, the Deutsche Mark has risen by 345% against sterling. But German prices did not fall by 345%; rather they rose by 216% over the period. The Deutsche Mark appreciation reflected higher inflation in Britain—where prices rose by 1,230% rather than price falls in Germany.

That simple example is an illustration of why the first step in any coherent analysis of the implications of a change in the exchange rate for domestic inflation is to pose the question—why has the exchange rate changed? Of course to pose the question is not to answer it, and there is no doubt that it is difficult to understand why sterling has risen so much since August. There is no doubt that sterling's appreciation has started to affect the balance between domestic and external demand in the economy, and so poses a dilemma for monetary policy. But in the absence of some attempt at analysis, no clear conclusions about inflation can be drawn.

It should also be apparent that any attempt to construct a simple 'monetary conditions index' (MCI) by adding together domestic interest rates and the exchange rate is akin to adding together apples and oranges. One refers to only the domestic economy, while the other may refer to either

(1) In a speech to the Governors of the National Institute of Economic and Social Research, 27 February 1997.
the domestic or overseas economy. Moreover, one refers to an exogenous instrument of monetary policy and the other to an endogenous variable, which may be responding to changes in interest rates or to other shocks to either the domestic or overseas economy. That latter distinction is important because it means that interest and exchange rates, rather than act as substitutes for each other, may in many instances move in a complementary manner. For example, an expected tightening of monetary policy will lead not only to higher market interest rates in the short term, but also to an appreciation against the currencies of countries in which there has been no such expected change in policy. And if interest rates do not move in line with market expectations, then the exchange rate is likely to fall back.

But the problems with an MCI go deeper. It is impossible to analyse the rise in the exchange rate without trying to understand those factors that were responsible for the appreciation. Take a simple example. If the price of apples were to rise, what would one conclude about the future demand for and supply of apples? At first sight, the answer might appear simple-the rise in price would lead to a fall in demand and stimulate greater supply. But think about it for a moment. Suppose the rise in the price of apples had arisen because of an increase in demandperhaps the health-conscious had switched from bananas to apples. Then a higher price of apples might actually go hand in hand with higher, not lower, demand. Equally, suppose the supply of apples had fallen because of a disease in the apple orchards of Kent. In that case, the price increase might be accompanied not by a rise but by a fall in the supply of apples. It is clear that the association between quantity and price cannot possibly be analysed without asking the question of what caused the initial price rise.

Exactly the same is true of exchange rates-indeed it is even more complicated because the exchange rate is analogous to the relative price of apples and bananas. So demand and supply conditions in both markets come into play. The impact of a higher sterling exchange rate on the demand for, and supply of, exports depends on precisely what lay behind the initial appreciation. Why does this matter? It matters, first, because the reason for the appreciation may affect expectations about whether or not the higher exchange rate will persist. But it matters too because the appreciation has two effects: a direct effect on domestic prices through a reduction in import prices and an indirect effect via a smaller contribution of net trade to output growth. The first effect is short-lived. The second may persist and influence the degree of inflationary pressure for some time. So exchange rate developments will influence the optimal interest rate setting. But the extent to which they do so will depend on why the exchange rate moved, and cannot be expressed in any mechanical link between interest and exchange rates. Once the shocks to the economy that were responsible for any change in the exchange rate have been identified, then, but only then, is it

possible to draw out the implications of that for output and inflation, and hence for the appropriate level of domestic interest rates.

The measurement of 'monetary conditions' is not at all a straightforward matter. And the more you look at it, the more elusive it becomes. In the last resort, perhaps the best measure is the inflation forecast itself.

That proposition is clearly understood by those central banks, such as the Bank of Canada, that use an MCI. They do not use it to decide how to alter interest rates in the wake of shocks to the economy that have changed the exchange rate. Rather, the MCI is used to assess high-frequency changes in interest rates during periods when there are no significant shocks to the economy, as has been made clear in speeches by Bank of Canada officials (for example, Freedman, 1995). The index is useful in Canada because the authorities operate in money markets to change interest rates much more frequently than the monthly interval at which policy decisions are made in the United Kingdom and elsewhere. And it is clear from the use of the MCI in both Canada and New Zealand that there is no mechanical link from exchange rates to interest rates. That is because economic shocks affect both the actual and the desired values of the MCI. Different shocks will alter the relationship between the two, and so the appropriate policy response depends on the nature of the shock.

If the simple-minded use of an MCI is flawed, then, for exactly the same reasons, so too is the idea that there is a simple rule of thumb which equates a given percentage rise in the exchange rate to a 1% rise in interest rates. It makes little sense to trade off interest rates and the exchange rate according to some pre-determined constant weights. The origin of the so-called 4:1 rule—by which a 4% rise in the exchange rate was thought to be equivalent to a 1% rise in interest rates-was the use of large econometric models in which interest rates and the exchange rate were treated as exogenous and independent policy instruments. With floating exchange rates, interest rates and exchange rates are interdependent. Indeed, it is precisely because the exchange rate is, in the jargon, endogenous, that a Reserve Bank of New Zealand discussion paper argued that 'a standard nominal MCI (ie with nominal interest rates and exchange rates) with prices as a target variable cannot be calculated'.(1)

A simple calculation should illustrate why the 4:1 rule appears rather odd in present circumstances. If the 4:1 rule were correct, then the appreciation of sterling since the beginning of August was equivalent to an increase in interest rates of no less than $4^{1}/_{2}$ percentage points. I know of no one who was, or has been, arguing that interest rates needed to rise by this amount to hit the inflation target. It follows, therefore, that any followers of the rule should now be arguing for a substantial reduction in interest rates, of the order of 3% or more. Whatever disagreements exist on the

⁽¹⁾ Nadal-De Simone et al (1996).

appropriate level of interest rates, they do not encompass that extreme view. So, in practice, no commentator appears to base their advice on such a rule.

At the risk of stirring up boredom, I have laboured the point that there is no simple mechanical link between the exchange rate and domestic interest rates. That, of course, begs the question of why sterling has in fact appreciated so sharply since August. The February edition of the Bank of England's *Inflation Report* identified a range of possible explanations, each of which has different implications for inflation two years or so ahead, and hence for the appropriate level of interest rates. Those explanations are set out on pages 46–50 of the February *Report* and there is no need to repeat the analysis here.

What that analysis implies for the Bank's advice on interest rates is explained in the minutes of the monthly monetary meetings, and you will have to wait until 19 March for the next set. My aim tonight has been to explain why, although the exchange rate is an important component of our assessment of the economy and the prospects for inflation, it is not wise to succumb to the superficial attraction of a 4:1, or any other n:1, rule for linking interest rates to changes in the exchange rate. As Keynes and others have warned us, it is better to be roughly right than precisely wrong.

References

Freedman, C (1995), 'The role of monetary conditions and the monetary conditions index in the conduct of policy', *Bank of Canada Review*, Autumn 1995, pages 53–59.

Nadal-De Simone, F, Dennis, R and Redward, P (1996), 'A monetary conditions index for New Zealand', *Reserve Bank of New Zealand Discussion Paper*, G96/2.

European central banking—East and West: where next?

In this lecture, the **Deputy Governor** considers⁽¹⁾ the degree to which contemporary forces—including moves towards monetary union and the globalisation of financial markets—are eroding the distinctions between central banks across Europe. He notes that, while there is nowadays a broad consensus that the raison d'être of central banks everywhere is the pursuit of monetary and financial stability, each central bank remains at present unique—in terms of its constitutional position, the range of its activities, its size, structure and organisation. The **Deputy Governor** compares the Bank of England with the central banks of other leading industrial countries—its role in monetary policy, in the management of government debt, in banking supervision, and in the payment system, and also the extent of its branch network. He goes on to look at the recent evolution of central banks in Central and Eastern Europe. Finally, he considers the nature of a future European Central Bank. The **Deputy Governor** concludes that European central banks are not moving inexorably towards a single format—rather they will continue to evolve in different directions in response to the characteristics of their local habitat. However, as the responsibilities assumed by many have increased, so there is a greater need to display accountability—both to explain the basis of decisions and to account for resources used.

This new series of LSE Bank of England lectures picks up where the last left off. In 1996 the Governor noted that nowadays there is a broad consensus that the *raison d'être* of central banks everywhere is the pursuit of monetary and financial stability. He also observed that once you go beyond that level of generality, each central bank is unique—in terms of its constitutional position, the range of its activities, its size, structure and organisation. Many of these differences are the result of history. The question I plan to address tonight is whether contemporary forces are eroding these distinctions between central banks and pushing them towards some common model.

I shall confine myself largely to what is happening in Europe. The increasing globalisation of financial markets is one pressure for change across the world and in Western Europe, the Maastricht Treaty and the preparations for Economic and Monetary Union are requiring central banks to review their statutes and to align their operating procedures. And I also want to talk about the central banks of Eastern Europe. They are feeling similar pressures several hope that their countries will accede to the European Union within five years or so—but their origins are very different.

In 1989 most of the state banks of Central and Eastern Europe had little understanding of the role of a central bank in a market economy. Since then they have rapidly had to acquire the knowledge and skills needed to tackle acute inflationary pressures while many of their leading banks were effectively bankrupt. At the Bank of England, we have been actively involved in helping them by drawing on our own experience as central bankers, adapting the lessons we have ourselves learned over the years to the unique circumstances of the transition economies.

Much of this effort has been channelled through our Centre for Central Banking Studies which we established in 1990 to provide technical assistance and training to other central banks. We have given advice principally on core functions such as monetary policy and operations, the development of money markets and payment systems, the management of government debt, and banking supervision; but our help has also been sought in some less obvious matters such as the physical security of central bank buildings and their contents. The assistance is provided through our experts visiting other central banks and by their staff coming on study visits to London, as well as through seminars and workshops here and abroad.

In the earlier years most of these events were essentially training courses. But increasingly the participants from many countries are able to contribute more themselves to the discussion so that they are now learning, not only from our experience as central bankers, but also from each other. And in some instances, their experience may hold lessons for us. Since 1990 over 4,000 staff of other central banks-two thirds of them from the transition economies-have participated in these various events. The work of the Centre for Central Banking Studies and the other interbank links we maintain (notably between supervisors) give us, I believe, a privileged perspective on the development of central banking across Europe. The analysis below-particularly the Eastern European sections-is very largely the work of Lionel Price, the Centre's Director, and his staff.

(1) At the London School of Economics and Political Science Annual Lecture on Central Banking on Tuesday, 4 March 1997.

History is important

In a study⁽¹⁾ published by the LSE's Financial Markets Group last year, Rosa Maria Lastra concludes that central banks are not 'natural products' but products of history. She emphasises the special relationships whereby central banks have been consciously awarded privileges by governments, and have been expected to provide certain services and functions in return. This may seem a dubious process, like selling monopolies. But though a product of history and a creature favoured by the state, a central bank may serve useful economic goals in the pursuit of stable money and sound banking. While most of their functions could be fulfilled by a different public or private institution, central banks are today typically seen as convenient instruments for the conduct of both monetary policy and banking supervision.

I agree with Dr Lastra's conclusions. Moreover, central banks' differing historical origins influence not only the tasks they carry out today, but also the way in which they think and operate. The Bank of England was established to lend money to the government; and though the Maastricht Treaty now prohibits any buying of British government debt by the Bank of England in the primary market, the Bank still manages government funding operations in an essentially agency capacity. By contrast, the origin of the Federal Reserve Bank in the United States lay in the provision of a reliable nationwide payment and depository system, and that remains a central activity. While some banking supervision is conducted by the Fed, it is largely the remit of other institutions (the Office of the Comptroller of the Currency, banking regulators in each separate state and the Federal Deposit Insurance Corporation).

The Bundesbank was set up against a background of the need to restore and maintain a stable currency, and this, together with the concomitant political independence, remains at the heart of its role. An early strong belief in the 'real bills' doctrine still influences the Bundesbank's views on appropriate collateral for central bank operations with the market, and justifies its large branch network and staff. The Banque de France has retained more retail banking than most other modern central banks, maintaining branches in every French département. It also makes use of its branches in compiling a *centrale des risques*, a register of commercial bank lending, and in keeping track of the million or so individuals who have drawn bad cheques. The Bank of Japan's background is more of a medley. Its role model when it was established in 1882 was, you may be surprised to hear, the Banque Nationale de Belgique, though some aspects of English banking practice were also adopted. Legislation in 1942 followed the German model, particularly in making the Bank of Japan subservient to the Ministry of Finance; and, after the war, there was some American influence.

In Charts 1 and 2, I have tried to capture some of the distinctions between these leading central banks. (Because

Chart 1 The shape of the Bank of England



Chart 2





I am concentrating on distinctions, I have omitted common tasks-such as the issuance of banknotes and acting as banker for government-which are carried out by virtually all central banks.) Chart 1 shows the United Kingdom's 'scores' in five areas, while Chart 2 adds in, by way of comparison, the other G5 countries. Mapping the distinctions is not an easy task. For instance, though in Germany a government office is responsible for banking supervision, it is central bank staff who undertake much of the day-to-day work of monitoring individual banks. In France, supervision is the responsibility of the Commission Bancaire, but its secretariat is effectively part of the Banque de France, and the Governor chairs it. And in Japan, the central bank closely monitors the large banks, though the responsibility for supervision formally rests with the finance ministry. Furthermore, the extent of a country's total financial regulatory effort encompassed by the term 'banking supervision' varies-most British banks have set up separate subsidiaries for their trading activity, regulated by securities regulators (though the responsibility for consolidated supervision remains with the Bank of England); by contrast, European banks tend to retain trading within the banking entity.

(1) Rosa Maria Lastra (1996), 'Central Banking and Banking Regulation', LSE Financial Markets Group, page 285.

It is also not always apparent whether the central bank is, in practice, free to set interest rates to achieve the monetary policy objectives which derive from its own statutes or from objectives set by government. The Bundesbank clearly has that freedom; and the other EU Member States have been legislating in accordance with the Maastricht Treaty to give their central banks independence in the field of monetary policy. In Britain, even though there have been very welcome improvements in the transparency of monetary policy formulation since 1992, decisions on interest rates remain clearly with the Chancellor of the Exchequer though now within a clear inflation target framework. In Japan the position is under review. The ultimate authority on interest rates has rested legally with the Minister of Finance, though according to Goodhart, Capie and Schnadt 'it is widely understood that it would be extraordinary if the government resorted to these provisions, and they have never been enacted'.⁽¹⁾ The same authors conclude that the Bank of Japan 'has thus enjoyed independence in practice'. What is harder to judge is the extent to which the Bank of Japan's decisions may have been influenced at times by recognition of the latent ministerial powers.

Notwithstanding those nuances, what can be seen from Chart 2 is that the Bank of England is quite distinctive among the five leading industrial countries. We have:

- the least independence in setting interest rates;
- the most comprehensive responsibility for banking supervision (though some other banks have broader financial regulatory responsibilities);
- the greatest role in managing government debt—we provide substantial policy input as well as actually handling auctions as issuing agent for the Treasury;
- the smallest branch network—we have consciously reduced the scope of our private banking activities in recent years (focusing on areas of comparative advantage as a public sector institution) and are now also leaving note distribution to be handled largely by the private banks; and
- a comparatively limited but increasing role in the operation of payment and settlement systems— typically, the Bank of England participates in payments systems which are run by the private sector, and has only involved itself in the establishment and operation of settlement systems when the private sector has not itself succeeded in doing so. Recently, however, the introduction of CREST and RTGS, and the European work on TARGET, have expanded our work considerably.

These maps cannot easily convey a sense of the dynamics of change in central banking. Central banks are evolving creatures, which respond to political and economic forces around them. One unusually powerful force, which will change their environment fundamentally, is EMU. But before considering its impact, I would like to consider the state of play in the rest of (non-EU) Europe, where exciting transformations of a different kind have occurred in the last decade.

Turning socialist state banks into central banks

The central banks of the formerly planned economies of Central and Eastern Europe have generally developed important responsibilities in each of my five areas (Chart 3). The old state banks have been transformed to fill the vacuum left by the dissolution of the mechanisms and institutions of a planned economy. Most had extensive branch networks and already operated rudimentary payment systems-though transfers often relied on correspondent banking relationships and slow and unreliable postal systems. But under the old regime there was little if any requirement for the other functions-setting interest rates, managing government debt, and supervising banks. Instead, the main roles of the state banks had been the provision of banknotes and making the financial transfers between state enterprises inherent in the central economic plans. The perceived importance of cash and the bookkeeping culture still influence, to varying degrees, their successor institutions. But these banks have been hit by a series of powerful shocks.





(a) The lines for Poland and Slovakia, and for the Czech Republic and Slovenia, coincide.

Monetary policy

The first is the shift from centralised control of the economy to a market-based system. Instead of directing money to meet enterprises' deficits—a job which required a large branch network and hordes of bureaucrats—the aim is to influence the behaviour of the economy by using indirect instruments of monetary policy to guide interest rates and the exchange rate, and to conduct the prudential supervision of the new commercial banks. But many of the bureaucrats

⁽¹⁾ Charles Goodhart, Forrest Capie and Norbert Schnadt (1994), 'The development of central banking' in *The future of central banking, the tercentenary symposium of the Bank of England*, Cambridge, page 169.

find it difficult to work out which bits of information they need and how often, and prefer instead to demand a substantial volume of data without prioritisation. Some of the staff of Eastern European central banks, used to passing on raw data which can be checked against enterprises' targets, find it difficult to analyse information with the aim of learning something about the behaviour of markets, consumers or firms. The simple questions, 'Why are we doing this?', 'What does this mean?' can be too hard to ask. New goals, however well-enshrined in the constitution and law, do not change culture overnight.

The second culture shock has been the move from a monobank to a two-tier banking system. The old system had two separate monetary circuits-one for cash (used mainly by individuals) and the other in transfers between bank accounts (used by enterprises). One of the early tasks of Western advisers was to try to convince the would-be central bankers in the East that monetary policy was not just a matter of regulating the supply of banknotes. And many of the same people found it difficult to accept that the provision of credit by a central bank-whether to government or to enterprises-is likely to have inflationary consequences. When the basic problem is a shortage of national savings (often because the state is pre-empting private savings through its budget deficit and off-budgetary spending), the central bank cannot magically create extra real resources by relaxing monetary policy. Were it so, we central bankers would be even more popular people than we are now.

The response of the Eastern European and CIS central banks to their new goals has been tempered by a number of factors:

- how long the old culture had prevailed;
- how democratic the new regime is (independent central banks do not get on well with autocracies);
- the size of the country;
- the availability of foreign currency to the government, whether from export revenues (oil or gas) or loans from international financial institutions; and
- in the case of the ten applicants from the region to join the EU, how quickly they believe they need to move into line.

The differences between these central banks are perhaps most marked in relation to monetary policy and financial relations with the government. The westernmost of the transition countries have typically liberalised the most, adopting policies and structures which are already very close to those of their EU neighbours; while, further east, reform and market-based operations are still viewed with some scepticism (everyone, of course, pays lip service to the benefits of, and need for, market reform and structural adjustment, but many do not in their hearts believe it will work for them), and the markets that have been introduced are subjected to discretionary administrative controls particularly in crises.

Partly because of the influence of the IMF and other Western advisers as well as, in the case of EU applicants, the need to harmonise with EU law and practice, the legislation governing the new central banks usually follows a common model, giving them autonomy to pursue an objective of monetary stability. What is interesting is that the aspects of monetary control whose merits we debate in the West-the degree of independence of the central bank, inflation targets versus monetary targets, fixed or floating exchange rates-have in terms of results been of secondary importance to the understanding and acceptance of the case for reform on the part of the public, parliament and government. There is little benefit to a central bank being independent of government if the parliament is able to force it to grant subsidised credits to favoured sectors. And independence counts for little if the government persists in running a deficit while non-monetary means to finance it have yet to be developed.

If we look at five of the central European countries where reform is most advanced-the Czech and Slovak Republics, Slovenia, Hungary and Poland-the first two have succeeded in bringing annual inflation down to single figures, while inflation in Hungary and Poland is just below 20%. All except Hungary monitor an intermediate monetary target, but these targets have proved unreliable friends in the transitional economies generally. It has been far from easy to predict the velocity of money when the economic and financial structure is in turmoil. The more important success factor appears to be exchange rate policy. The Czechs and Slovaks have been able to hold their exchange rates fixed against a Deutsche Mark/US dollar basket. This has not been sufficient to deliver the inflation rates of 1%-3% seen in Germany and the United States, as the transition economies are experiencing faster rates of productivity growth in tradables; they need to permit their currencies to appreciate if they are to lower their inflation rates further. But their fixed exchange rates have cemented and enhanced the credibility of the sound monetary and budgetary policies being followed.

Yet fixing the exchange rate is not the only route to lowering inflation. Slovenia has succeeded with a managed float, though a key factor has been its willingness to keep the real exchange rate relatively high. In contrast, Hungary and Poland have tried to prevent the inevitable real appreciation of their currencies by continually depreciating their nominal exchange rates to reflect their higher rates of inflation. Polish policy became less accommodating last year, and Hungary may be set to follow.

Of course, an exchange rate peg is far more credible if a country has sizable foreign exchange reserves. The Baltic states were fortunate in this respect as they regained access to the gold held by their central banks in London and Paris before the War; and Estonia and Lithuania have gone as far as fixing their exchange rates rigidly in a currency board system which removes discretion from monetary policy. (Note that these countries are also experiencing real appreciation: annual inflation is nearly 15% despite their fixed exchange rates.) The IMF is now encouraging Bulgaria to follow suit and adopt a currency board as their central bank has not been able to impose sufficiently tight monetary policy in the face of lack of progress on other aspects of reform. But the currency board can only succeed as part of a comprehensive package of fiscal and structural measures. The strict monetary policy rules of a currency board can work well if fiscal policy is highly responsible or will become so as a result of the currency board; if not, it may put severe strains on the banking system, as has been the case in the Baltic states.

Banking supervision

This potential conflict between monetary policy and maintaining the stability of the banking system is not one which has greatly troubled most Western industrial countries in recent years. But in some transition economies, such conflicts have been real. In most, the problem has not been so much to *maintain* the stability of the banking system as to create a robust banking system from a number of often insolvent state-owned banks spun off from the old monobank, together with newly created commercial banks whose behaviour has frequently been far from prudent.

In contrast to the diverse arrangements in the West, banking supervision in transition economies is nearly always the responsibility of the central bank (although in some cases the Ministry of Finance is also involved in the licensing of banks). An exception is Hungary, where supervisory responsibilities have in large measure been transferred to the State Banking Supervision Office: the central bank is nominally responsible only for monitoring banks' liquidity and foreign exchange positions, although in practice its role extends rather more widely.

In most of the countries—especially in those with hopes of acceding soon to the EU—banking legislation approximating to Western standards is (or is about to be) in place. But in practice, banking supervision has proved a difficult topic to master. Whereas monetary policy requires a highly trained but small cadre of economists in the head office of the central bank, large numbers of supervisors are needed, often spread across the country, to deal with a multitude of new banks with poor quality accounts. And the skills of assessing risk and the quality of management have not always come easily to staff from a bookkeeping background whose instincts are to tick boxes rather than make judgments. Staff who have acquired the skills needed are frequently enticed away to work for commercial banks at higher salaries.

Managing government debt

Another field in which Central and Eastern European central banks are generally more heavily involved than their Western counterparts is in the management of government debt. (Hungary, where there is a separate debt office under the Ministry of Finance, broadly on the Irish model, is again an exception.) Under the old regimes governments relied on their state banks for finance, but the new statutes of the central banks—usually following an IMF model—limit the provision of finance to government. Ceilings are mostly around 5% of government revenues, though in Estonia and Lithuania they are zero. With monetary financing restricted, new methods of financing governments have had to be developed and nearly all the central banks have taken a leading part in this process.

Even where the government's own financing needs have been small, as in the Czech Republic, central banks have been keen to establish markets in short-term paper in which they can conduct monetary operations. Several of them have issued their own bills for this purpose, particularly where in the early years the finance ministry was reluctant to issue government paper. Whether the market being developed is in government, central bank or private paper, the central banks have had to strike a difficult balance in deciding how frequently to intervene in the markets. In the absence of intervention, a market can remain illiquid and unused. But if the central bank intervenes too much and holds prices too steady, then private market-makers will not develop. This dilemma is not unique to transition countries. Similar dilemmas arise elsewhere, and some Western central banks still sometimes play a role, if only a marginal one, in balancing supply and demand in the domestic securities and foreign exchange markets.

Payment and settlement systems

One area of activity in which the new central banks do mirror the diversity of their Western counterparts is in responsibility for payment and settlement systems. Of the nine central banks in Central and Eastern Europe, five operate the main clearing system themselves. In the other four countries the position is roughly as it is here, with the central bank participating in, and providing final settlement for, a privately owned clearing system. In Russia the central bank has been slow to develop its own payment system, and commercial banks have been putting parallel mechanisms in place. In the West, technological developments and a desire to reduce systemic risks have been drawing central banks like ourselves into greater involvement in payment and settlement services, especially in the provision of real-time gross settlement. No doubt the central banks in the transition economies will feel the same pressures before long.

Branch networks

On the last of my five metrics of central bank functions the size of the branch network (which I use as a convenient proxy for the extent of their involvement in straight banking activities and in note distribution)—the transition central banks occupy an intermediate position. The extensive branch networks of the monobanks went largely to the savings banks, and in some cases they have been turned into commercial banks. The result has been surprisingly consistent across Central and Eastern Europe, with one branch remaining for every 1/2-1 million people (except for the Bank of Estonia which has no branches, a scrupulous qualification). Some of the new central banks are even now questioning, as we have done, whether they need branches—as distinct from regional agencies—at all. Following the setting up of a State Treasury, the Hungarian central bank has closed more than half its branches.

Obviously the political structure and geography of the country is material. In the United States and Germany, the maintenance of a branch network reflects the federal structure of the state. In Russia, a federal state with a very large geographical area, the central bank has 60 territorial branches and 19 regional banks—apparently rather modest numbers for a country with some 150 million people spread across ten time zones. But in addition the CBR in 1994 ran 1,356 cash and settlement centres, 13 banking schools, and 30 'other organisations'. To run this empire the bank employed over 52,000 staff, having created over 7,000 additional posts in the previous two years to conduct its various new functions.

Central bank staffing and costs

All this shows that, even though all European central banks face similar pressures, the solutions remain quite diverse. This is reflected in relative costs. Comparable data are hard to come by, but the Bank of Russia appears to have more staff per head of population than any other. The People's Bank of China is larger, employing some 150,000 people (but only 1,000 in head office where policy is centralised), but considering the PBoC's continuing role as banker to the state-owned enterprises, that looks small in relation to a population of 1.2 billion. Other very large central banks are the Reserve Bank of India with 32,000 staff and the US Federal Reserve System with 25,000.

One would expect the number of staff employed by a central bank to depend not just on the population of the country (and in this there should be some economies of scale) but also on the range of tasks it has and how efficiently it conducts them. At the Bank of England we take a lot of interest in comparative efficiency: we are determined to be a value-for-money central bank, and benchmark ourselves against others wherever possible. Some of the data we use are confidential: central banks are more candid with each other in private than they are in public. But there are a few published measures. A study in 1995 by Fry, Goodhart and Almeida(1) of a sample of 30 central banks, largely from developing countries, tested twelve variables as possible explanations of non-supervisory staff numbers. Most significant was a country's population, with an elasticity of one half, confirming substantial economies of scale across the sample countries.

There were positive relationships with real *per capita* income (central banking appears to be a luxury good!), the number of branches, and the use of exchange controls (both of which would increase staff needs). Perhaps surprisingly the more independent central banks seemed to employ fewer staff. Among the variables which showed no relationship was the inflation rate (though there could be a simultaneity problem here).

Chart 4 shows the numbers of staff employed two or three years ago by the central banks of various industrial countries and some of the transition economies. There is

Chart 4 Staff of 27 central banks *versus* population



clearly the expected positive relationship with population, but the ratio varies hugely: a central bank on the highest of the three parallel lines has ten times the staff per million population as one on the lowest line. The extent of this dispersion is more apparent in Chart 5 which shows the number of staff per million population for the large



Numbers of central bank staff per million population



countries. With only around 3,500 people—down by more than 50% over the last 20 years and still falling—the Bank

(1) Maxwell Fry, Charles Goodhart and Alvero Almeida (1996), 'Central Banking in developing countries', Routledge, pages 97-99.

of England itself is one of the most modestly staffed in relation to its population. In contrast to the significant results found by Fry et al from their sample of developing countries, regression analysis on the industrial country data shows only weak evidence of small economies of scale. Nor did other variables tested on industrial countries yield any significant results. As for the transition economies, their staff numbers generally conform to those in industrial countries with similar populations. The exception is the Bank of Russia, whose staff looks abnormally large. Some of these central banks are still growing as they seek to carry out their new functions; but one or two, like the National Bank of Hungary, are already reviewing what they are doing and how they do it, and are slimming down. By the end of this year, they expect to have 40% fewer staff than two years ago.

These variations in staff numbers naturally have an impact on the running costs of central banks, but relative salary levels and non-staff costs are obviously also important. Chart 6 is based on data for 1992, taken from central banks' Annual Reports. The vertical axis shows the gross





operating costs of each central bank as a percentage of GDP. The horizontal axis shows population. For a swathe of countries across the bottom of the chart-from New Zealand at 0.06% through Sweden, Denmark, Switzerland, the Netherlands and Australia (0.04%-0.05%) to Britain (0.037%) and Canada and the United States at 0.03% there may be some scale effect, but several European countries do not fit this model at all. The central banks of Italy and France-countries with the same population as the United Kingdom—then cost 5 and 3.5 times more than us, and the picture has changed little since. Some of the differences may be down to national culture, but another factor may be that the funds at the disposal of the different central banks vary widely. In particular, I suspect that some of our relative cheapness may be attributable to the Bank Charter Act of 1844, since which time the seignorage on our banknote issue has been passed directly and immediately to the government. This is not generally the

case abroad, at least in European countries—West or East where profits, a fraction of seignorage, are passed only periodically to government. (The United Kingdom is also unusual in that foreign exchange reserves, and any profits earned on them, belong to the government rather than to the central bank, although the Bank of England does of course have responsibility for managing the reserves.)

European integration

Looking at the European continent as a whole, it is interesting that, whereas the common history of Central and Eastern European countries over the last half century has produced broadly similar central banks in the different countries—at least in those which are contemplating accession to the European Union—the central banks of the existing Member States are a disparate bunch. What remains to be seen is how far the advent of Economic and Monetary Union may induce more homogeneity and, indeed, reduce costs. It ought to be the case, after all, that one monetary policy is cheaper to administer than 15, or 25.

The European Central Bank will appear a much more concentrated creature than the central banks we have been looking at. It will be responsible for the issuance of euro banknotes but beyond this, in terms of the diagram I have been using, the ECB will be almost uni-dimensional (Chart 7). According to the Maastricht Treaty, its independence in setting interest rates will be unparalleled. But it will not supervise banks (not even as an agent) and it will not manage government debt. It is agreed that those functions will remain firmly with the national central banks (or other relevant agencies). In payment systems the ECB will be responsible for only the tip of the iceberg, that is TARGET, the system linking the various national payment systems of EU Member States. This narrow focus is no accident: the ECB's task is to maintain monetary stability, and its design reflects that. The European System of Central Banks, collectively, will do much more than that, of course.



Discussions between EU central banks on how monetary policy will operate within the EMU are well advanced, and the European Monetary Institute published a report in January setting out what is agreed and what remains to be decided. In principle, the creation of the ECB in 1998 (in advance of Stage 3) or thereafter need not affect the other activities of EU central banks, whether they are in or out of the euro area, provided they do not conflict with the ECB's achievement of monetary stability. But it seems very likely that some of the activities of the national central banks, and especially those who are members of the euro area, will change character as EMU develops (if it does). That is partly because questions will undoubtedly be asked about costs. One American commentator has recently pointed out that the total cost of the US Federal Reserve system today is well under a third of the total costs of EU central banks. On that issue, as I have demonstrated, I believe that we at the Bank of England have a good story to tell. But the introduction of the euro would also have major implications for payments systems and financial markets generally, which are bound to push national central banks closer together. At the same time, functions further from the core of central banking, and especially those which could be performed as well or better by the private sector, are likely to move out of the central banks.

As for monetary policy, if you will permit me one last quotation, Alex Cukierman said in his extensive study of central banking, 'A governor who is backed by an absolutely and relatively strong research department carries more weight *vis-à-vis* the Treasury and other branches of government'.⁽¹⁾ The same will be true within the European System of Central Banks, so I envisage national central banks keeping their capacity to analyse the state of their domestic economy. However, it ought to be possible, over time, for Member States to capture some economies of scale, and to develop centres of excellence in central banks around the Union, with expertise in particular areas of work. It is unlikely to make sense to have 15 (and certainly not 25) teams of economists analysing the causes of changes in the velocity of euro M4.

But I do not wish to give the impression that EMU, even if it comes about on something roughly approaching the current timetable, will be the 'end of history' as far as European central banking is concerned. I suspect that central banks in Europe will continue to display great diversity, and will continue to evolve in different directions, and at different speeds, in response to the characteristics of their local habitat. What is important is that they should be responsive, learning and self-critical organisations, ready to react quickly to changing circumstances. They must also, in my view, display their accountability, perhaps more so than in the past. With the greater responsibilities which European central banks, East and West, have assumed in recent years, comes a greater need to explain the basis on which decisions are made, and to account for the resources deployed in making those decisions. That accountability runs partly to the Treasury, who exercise financial discipline over us, partly to Parliament—whose growing interest in our affairs we welcome-and partly to the broader community. I see this series of lectures fitting within that context, and have been pleased this evening to have had the opportunity to set out some more recent reflections, from within the Bank, on the way we exercise our functions on the people's behalf.

Bank of England publications

Working Papers

The *Working Paper* series are available free of charge. A complete list of the *Working Papers* is available from the address below. The latest *Working Papers* to be published by the Bank are:

<u>No</u>	Title	Author
49	Independence and accountability	Clive B Briault Andrew G Haldane Mervyn A King
50	Unemployment persistence: does the size of the shock matter?	Marco Bianchi Gylfi Zoega
51	UK asset price volatility over the last 50 years	Nicola Anderson Francis Breedon
52	Feasible mechanisms for achieving monetary stability: a comparison of inflation targeting and the ERM	Matthew B Canzoneri Charles Nolan Anthony Yates
53	What determines the short-run output-inflation trade-off?	Anthony Yates Bryan Chapple
54	Monetary policy uncertainty and central bank accountability	Charles Nolan Eric Schaling
55	The information content of the short end of the term structure of interest rates	Marco Rossi
56	Inflation forecast targeting: implementing and monitoring inflation targets	Lars E O Svensson
57	Why do the LIFFE and DTB bund futures contracts trade at different prices?	Francis Breedon
58	The determinants of UK business cycles	Allison Holland Andrew Scott
59	Which inter-dealer market prevails? An analysis of inter-dealer trading in opaque markets	Victoria Saporta
60	Testing the predictive power of dividend yields: non-parametric evidence from the G5	Francis Breedon Marco Bianchi Darren Sharma

Statistical Abstract

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

Monetary and Financial Statistics

A new monthly publication, *Bank of England: Monetary and Financial Statistics* was launched in January 1997. This comprehensive publication (priced at £60.00 per annum in the United Kingdom) contains detailed data complementing the Bank's statistical releases, tables previously published in the monthly *Monetary Statistics* booklet and the statistical annex of the *Quarterly Bulletin* and some new tables (on gilt repo and stock lending). If you would like more information please contact Daxa Khilosia, Monetary and Financial Statistics Division HO-5, telephone 0171–601 5353.

Targeting Inflation book

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

Index-linked debt book

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

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

Quarterly Bulletin and Inflation Report subscription details

Copies of the Quarterly Bulletin and Inflation Report are available from the Bank as a combined package; the Inflation Report is also available separately. The prices are set out below:

Destination		1997				1996			
	Quarterly Inflation K	Quarterly Bulletin and Inflation Report package		ı Report	Quarterly Bulletin and Inflation Report package		Inflation Report only (1)		
	Annual	Single	Annual	Single	Annual	Single	Annual	Single	
United Kingdom	£40.00		£12.00	£3.00	£30.00	f8 00	f12.00	f3 00	
	240.00	210.00	212.00	25.00	250.00	20.00	212.00	25.00	
Academics, UK only Students, UK only	£27.00 £14.00	£6.75 £3.50	£8.00 £4.50	£2.00 £1.50	£10.00	£3.00	£4.50	£1.50	
European countries including the Republic o Ireland, by letter service	f £48.00	£12.00	£14.00	£3.50	£48.00	£12.00	£14.00	£3.50	
Countries outside Europe: Surface mail	£48.00	£12.00	£14.00	£3.50	£48.00	£12.00	£14.00	£3.50	
Air mail: Zone 1 (3)	£64.00	£16.00	£21.00	£5.25	£64.00	£16.00	£21.00	£5.25	
Zone 2 (4)	£66.00	£16.50	£22.00	£5.50	£66.00	£16.50	£22.00	£5.50	

 There is a 25% discount if five copies or more of the same issue are purchased.
Subscribers who wish to collect their copy(ies) of the *Bulletin* and/or *Inflation Report* may make arrangements to do so by writing to the address given below. Copies will be available to personal callers at the Bank from 11.30 am on the day of issue and from 8.30 am on the following day. (3) All countries other than those in Zone 2.

(4) Australasia, Japan, China, The Philippines and Korea

Readers who wish to become regular subscribers, or who wish to purchase single copies, should send to the Bank, at the address given below, the appropriate remittance, payable to the Bank of England, together with full address details, including the name, or position, of recipients in companies or institutions. Existing subscribers will be invited to renew their subscriptions automatically. Copies of the above publications can also be obtained over the counter at the Bank's front entrance or at the Bank Museum in Bartholomew Lane; copies of the most recent *Inflation Report* are on sale at selected bookshops.

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

Students and secondary schools in the United Kingdom are also entitled to a concessionary rate. Requests for concessionary copies should be accompanied by an explanatory letter; students should provide details of their course and the institution at which they are studying.

The Quarterly Bulletin is also available on microfilm: enquiries from customers in Japan and North and South America should be addressed to University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, United States of America; customers from all other countries should apply to White Swan House, Godstone, Surrey, RH9 8LW, telephone 01444 445000.

An index of the *Quarterly Bulletin* is also available to customers at no charge, from Publications Group at the address given below. It is produced on an annual basis and lists alphabetically those terms used in the *Quarterly Bulletin* and articles written by named authors.

Bound volumes of the Quarterly Bulletin for the period 1960 to 1985 (in reprint form for the period 1960 to 1980) can be obtained from Schmidt Periodicals GmbH, Dettendorf, D-83075 Bad Feilnbach 2, Germany, at a price of DM 180.00 per volume or DM 4,100.00 per set.

See back page for details of other Bank of England publications.

Issued by the Publications Group, Inflation Report Division, Threadneedle Street, Bank of England, London, EC2R 8AH; telephone 0171–601 4030; fax 0171–601 5196; email mapublications@bankofengland.co.uk. The Bank's Internet pages are at http://www.bankofengland.co.uk. General enquiries about the Bank of England should be made to 0171-601 4444.