# **Bank of England Quarterly Bulletin**



# August 1996

Volume 36 Number 3

# **Bank of England Quarterly Bulletin**

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# **The Quarterly Bulletin and Inflation Report**

*Inflation Report* (published separately)

*The operation of monetary policy* (pages 245–57)

*The international environment* (pages 258–67)

*Financial market developments* (pages 268–80)

Research and analysis

(pages 281-313)

The *Inflation Report* analyses recent economic developments in the United Kingdom and assesses the outlook for inflation over the next two years in relation to the government's inflation target. Section 1 reviews retail prices, Section 2 considers the monetary aggregates, credit, and financial market data, and Sections 3, 4 and 5 investigate demand and output, the labour market and firms' pricing behaviour respectively. Section 6 presents the Bank's medium-term inflation projections and discusses the risks surrounding them.

UK official interest rates were cut once during the quarter, by 25 basis points to  $5^3/4\%$  on 6 June, three months after the previous cut. Future rates implied in the markets also fell during the quarter, most clearly at the short end of the money market, and by diminishing amounts through medium maturities in the gilt market. The spread of UK bond yields over those in other major markets declined, and sterling appreciated, though these movements were largely reversed soon after the quarter's end. Gilt sales of £11.1 billion were made.

This article considers economic developments in the European Union, North America and Japan since the May 1996 *Quarterly Bulletin*. These countries account for about half of world GDP, but three quarters of UK external trade. The main points are:

GDP growth in the first quarter was quite strong at first sight; in the major six international economies, output was 1% more than in the last quarter of 1995. But much of that reflected special factors, particularly in Japan, France and Italy, that are likely to have unwound in the second quarter. The strength of the US economy appeared more robust. And domestic demand in Germany was stronger than the markets expected. In Europe, cyclical conditions improved, but structural problems remained.

Consumer price inflation remained subdued. In the United States, however, there were some signs of emerging price pressures earlier in the production chain, and labour market conditions continued to tighten.

At the time of going to press, there were no changes in official interest rates in the G3 countries, following the Bundesbank's <sup>1</sup>/<sub>2</sub> point cut in mid April. Several other European countries, however, including France and the United Kingdom, trimmed interest rates in June. Yield curves steepened at the short end, reflecting market expectations of interest rate rises ahead, notably in the United States but also in Germany and France.

Two special topics are considered: consumer indebtedness in the United States; and the extent to which eastern Germany has converged with western Germany.

Prices in most major financial markets either showed little variation in the quarter, or inched upwards. US equity prices shrugged off speculation that they might fall sharply in the quarter. Over-the-counter (OTC) derivative volumes rose, in contrast to exchange-traded derivative volumes.

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

*The industrial impact of monetary policy* (by Joe Ganley of the Bank's Markets and Trading Systems Division and Chris Salmon of the Bank's Monetary Assessment and Strategy Division). This article investigates the disaggregated effects of monetary policy on the output of 24 sectors of the UK economy. The purpose of the analysis is to identify the speed and magnitude of firms' reactions in these sectors to an unexpected monetary tightening; and to examine whether these responses provide any evidence on the

transmission mechanism of monetary policy. The results indicate that the sensitivity of output to changes in monetary conditions differs markedly across industries.

*Simple monetary policy rules* (by Alison Stuart of the Bank's Monetary Assessment and Strategy Division). This article describes two simple rules, the McCallum rule and the Taylor rule, that could in principle be used to guide monetary policy. It then applies the rules to past UK data. In the United Kingdom, monetary policy decisions are based on a thorough assessment of the prospects for inflation rather than on one simple rule or single indicator. But simple rules can have a useful complementary role alongside all the other information within a pragmatic approach to monetary policy.

#### Probability distributions of future asset prices implied by option prices (by

Bhupinder Bahra of the Bank's Monetary Instruments and Markets Division). The most widely used measure of the market's views about the future value of an asset is the mean or average price expectation—a point estimate. This article shows how this information set can be extended by using option prices to estimate the market's entire probability distribution of a future asset price. It also illustrates the potential value of this type of information to the policy-maker in assessing monetary conditions, monetary credibility, the timing and effectiveness of monetary operations, and in identifying anomalous market prices. Finally, the article looks at the limitations in data availability and details some areas for future research.

*Expected interest rate convergence* (by Neil Cooper and Jim Steeley of the Bank's Monetary Instruments and Markets Division). In the previous edition of the *Quarterly Bulletin*, the authors described the method underpinning the Bank's approach to estimating yield curves for the G7 countries. This article presents an economic application of these curves. It looks at estimated forward rate curves for pairs of countries, in order to assess the interest rate differentials that bond market participants expect to occur at different times in the future. Although the prospect of EMU may account for expected interest rate convergence among some of these countries, there are other factors that could also explain the observed interest rate differentials.

*Payment and settlement strategy*. The Bank of England announced in November last year that it proposed to review, with market participants and other interested parties, the strategic requirements for payment and settlement for UK financial markets. The review was conducted during the first half of this year and this note summarises its findings. It was presented by the Governor to the City Promotion Panel on 3 July.

*Practical issues arising from the single currency*. The Bank intends to publish a broadly quarterly series of papers as part of its efforts to ensure that the practical issues arising from the single currency, whether the United Kingdom is inside or outside the euro area, are fully understood and appropriate action is taken. This paper was originally prepared for the House of Commons' Select Committee on the Treasury, and subsequently made publicly available on 10 May. It reports the outcome of the Bank's discussions with banking and other sectors in the United Kingdom in the period up to May.

*Reports* (pages 314–22)

# The operation of monetary policy

- UK official interest rates were cut once during the April-June quarter, by 25 basis points to 5<sup>3</sup>/<sub>4</sub>% on 6 June, three months after the previous cut.
- Future rates implied in UK markets also fell during the quarter, most clearly at the short end of the money market, and by diminishing amounts through medium maturities in the gilt market.
- The spread of UK bond yields over those in other major markets declined, and sterling appreciated, though these movements were largely reversed soon after the quarter's end.
- Gilt sales of £11.1 billion were made.



### International bond and money markets

The fall in the short sterling curve over the period as a whole was in contrast to the movements of the comparable curves in the major overseas economies. The main features of the second quarter were uncertainty regarding the timing of any interest rate increases in the United States and Japan (where growth in the first quarter turned out to have been higher than had been expected); uncertainty as to whether rates in Germany had reached their low point; and a climate of monetary policy easing in some other European countries. (See 'The international environment' on page 264.)

Financial markets displayed some concern over prospects in the United States, in particular the sustainability of strong economic growth, a tight labour market and low retail price inflation. The possibility that the Federal Reserve might, in these circumstances, tighten monetary conditions was reflected in interest rate expectations (see Chart 1). The rate on the September three-month eurodollar deposit contract increased by about 20 basis points during the quarter to 5.73% on 28 June. The cumulative increase since 1 January 1996 amounted to 75 basis points.

Since early 1996, the markets have often been surprised by the strength of US labour market data, particularly for non-farm payrolls. In the second quarter, publication of the March and May

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

	Interest rat (per cent p	es er annum)				Gilt yields (b) (per cent per annum)				Exchange rates		
	Short sterling           Sterling interbank rates (c)         future (d)         Co.		Convent	ionals		Index-linked						
1996	1 month	3 months	6 months	12 months	3 months	Short	Medium	Long	Long	ERI	£/\$	£/DM
1 April 5 June 6 June 28 June	563/64 61/64 513/16 549/64	63/64 61/32 555/64 549/64	63/32 67/64 561/64 551/64	611/32 623/64 63/16 63/64	6.23 6.16 5.91 5.90	7.63 7.58 7.49 7.36	8.10 8.05 7.98 7.89	8.30 8.28 8.24 8.20	3.79 3.86 3.83 3.86	83.6 86.4 86.1 86.3	1.5255 1.5487 1.5412 1.5537	2.2623 2.3683 2.3580 2.3644

(a) Close of business rates in London.

(a) cross of outmices rates in Donton.
 (b) Gross redemption yield. Representative stocks: short—7% Treasury 2001; medium—71/2% 2006; long—8% Treasury 2015; index-linked—21/2% Index-linked Treasury 2016 (real yield assuming 5% inflation).

(c) Middle-market rates.

(d) Implied future rate: September 1996 contract.



Chart 3 Ten-year bond yields<sup>(a)</sup>



Chart 4

Ten-year bond yield differentials of the United Kingdom over France, Germany and the United States<sup>(a)</sup>



(a) Based on benchmark stocks; gross redemption yields on semi-annual basis.

non-farm payrolls data had a significant impact on yields. During the second quarter, the yield on ten-year Treasuries reached a high of about 7% in mid-June, but then decreased steadily as expectations of an imminent tightening were reduced over the rest of the quarter. Financial market expectations of US growth and corporate earnings could be seen in the decoupling of bond and equity markets. Despite the generalised rise in US interest rates, the major US equity indices rose strongly in the first half of 1996. The Dow-Jones Industrial Average rose by 11% and the Standard & Poor's 500 index by 9%. In Japan, exceptional growth in the first quarter partly reflected public investment. The monetary authorities suggested that the stance of monetary policy was unlikely to be altered until economic growth became selfsustaining. However, financial markets remained sensitive to stronger-than-expected economic data. Japanese bonds ended the quarter largely unchanged, despite falling in April amid concerns of an imminent rise in the Official Discount Rate.

In Germany in the second quarter, the markets came to see a further slowdown in economic activity as less likely, even though the Government's forecast for growth in 1996 was lowered. The Bundesbank reduced its discount and Lombard rates by 50 basis points each on 18 April to 2.50% and 4.50% respectively and kept its reportate at 3.30% throughout the quarter. Thereafter the market tended to the opinion that the Bundesbank might not cut official interest rates again, particularly in view of the strong growth of M3, which had been above target since January 1996. This was reflected in the futures price of three-month euro-Deutsche Mark deposits contracts. By the end of June, the rate implied by the September contract was back up to its January level, while the December and March 1997 contracts indicated slightly higher interest rates. In the second quarter, the September contract yield initially declined but ended the period slightly higher, while the December and March 1997 contract yields remained unchanged. The German fixed-income market outperformed US Treasuries during the second quarter. The yield on ten-year bunds nevertheless increased 11 basis points to 6.39% in the second quarter.

An easier monetary policy in Germany facilitated reductions in official interest rates in a number of European countries. In France, official rates were cut following the continued strength of the French franc, low inflation and weak domestic demand. In Sweden, the strength of the krona and continued progress towards the inflation target were factors in the lowering of official rates. Financial markets rallied in Italy and Spain following the elections. In the former, the spread against bunds narrowed considerably and, with the lira trading back at its late 1995 levels, there was some expectation that the currency might return to the ERM. Official interest rates were also cut in all other EU countries except Italy.

#### **Foreign exchange markets**

During the second quarter, the dollar again appreciated against both the Deutsche Mark and Japanese yen, as expected short-term interest differentials continued to move in favour of the US currency. Over the five months to the end of June, the expected differential between US and German three-month interest rates in September 1996 had widened from 136 basis points in favour of the dollar to 237 basis points and the dollar had risen from DM 1.4875

#### Operation of monetary policy

#### Chart 5 Dollar exchange rates



#### Chart 6 \$/DM rate and expected three-month interest differential<sup>(a)</sup>



#### Chart 7 Sterling effective exchange rate and £/DM exchange rate



to a high of DM 1.5489 on 28 May. Although key official interest rates in the United States (the target federal funds rate) and Germany (the repo rate) remained unchanged, the expected differential continued to widen, mainly due to the release of US economic data, which suggested that the US economy was operating closer to capacity constraints than had earlier been thought. In contrast, although the evolution of the dollar/yen exchange rate was also influenced by expectations about short-term interest rates, market attention generally focused more on the prospects for monetary policy in Japan as opposed to the United States. The yen briefly strengthened in the second half of May, in part due to comments from Japanese officials attributing the 1980s so-called bubble economy to the low level of interest rates. But the yen subsequently weakened again as this upward shift in Japanese interest rate expectations was unwound, when the Bank of Japan's stance remained accommodative and it became clear that no early change in monetary policy was likely.

Over the second quarter, sterling rose from 83.4 to 86.3 on the effective exchange rate index. In contrast to exchange rates among the three largest economies, shifts in relative short-term interest rate expectations over the period as a whole fail to provide a straightforward explanation of sterling's appreciation: interest differentials indeed moved against sterling, which might have triggered a depreciation. Bond market developments may however have been influential. During the second quarter gilts outperformed US Treasuries, in part due to the growing perception that the economic conjuncture in the United Kingdom and United States was much less synchronised. Sterling was aided by this background and by reports suggesting that international fund managers were aiming to increase the proportion of sterling assets in their portfolios. Towards the end of May, sterling breached important technical levels against the dollar, which had presented strong resistance in the past, and this may have triggered a reassessment of whether sterling's link with the dollar would be as close as in the recent past. As sterling began to show signs of breaking out of its familiar trading range against the dollar, it experienced a period of independent strength. On an effective basis it rose by 2% between 24 May and 4 June (rising against all the currencies in the basket over this period). Although sterling weakened slightly following the UK rate cut on 6 June, it recovered its poise towards the end of the quarter, with the technical and portfolio factors noted above remaining supportive.

Within the ERM, currencies continued to trade close to their central rates throughout the second quarter. European bond yield differentials narrowed further (with ten-year French bond yields converging on German yields) which would be consistent with more weight being placed on the probability that EMU would take place. An examination of implied forward interest rates showed that short-term interest rates in France and Germany were expected to converge before January 1999. The market perception that both the Swedish krona and Italian lira might enter the ERM during 1996 helped both currencies to reach their highest levels against the Deutsche Mark since December 1992 and July 1994 respectively. The Finnish markka also performed strongly, for similar reasons, reversing the depreciation which occurred in the first quarter.

As noted above, US employment data continued to have a strong influence on markets in the second quarter. Indeed the key event

#### Chart 8 £/\$ rate and expected three-month interest differential<sup>(a)</sup>



for the dollar was the release of US non-farm payrolls data for March on 5 April, which showed job growth to be twice as high as market expectations. The dollar rallied strongly when markets reopened after the Easter holidays, rising back above DM 1.50. The dollar had approached this important level on several occasions since August 1995, but had failed to strengthen beyond that rate. It subsequently consolidated its gains above DM 1.50, aided by the Bundesbank's rate reduction on 18 April, and the dollar finished April at DM 1.5363. Sterling was generally on the sidelines during April, but the background of a stronger dollar aided the currency and, on an effective basis, it rose from 83.4 on the index to a high of 84.0 on 30 April.

At the beginning of May, the dollar received some support from the release of US Q1 GDP data, which was stronger than forecast, but it did not make significant gains until concerns about incipient inflationary pressures were assuaged by the release of better-than-expected core US producer price inflation data on 10 May. It reached a 1996 high at DM 1.5489 on 28 May; but it weakened subsequently against a range of currencies and ended May at DM 1.5267. Comments from Federal Reserve officials regarding inflationary pressures in the United States and the Bundesbank's announcement of another fixed-rate repo at 3.30% (whereas lower rates had been thought possible) were both factors which caused the dollar to weaken from its 1996 high.

The volatility of the sterling/US dollar exchange rate increased during May and implied volatility on short-dated sterling option contracts also rose (albeit from low levels). It is often difficult to account for short-term exchange rate movements in terms of economic fundamentals and chartist expectations may have influenced the evolution of the sterling/US dollar exchange rate during May. Sterling had traded in a well-defined downtrend against the dollar since early 1995 but chartists might more recently have revised their expectations of the short-term path of the sterling/US dollar exchange rate. The key event from this perspective was the breach of sterling's 100-day moving average against the dollar on 30 May (a level which had presented resistance on several occasions); this may have triggered buy orders, which helped sterling to a 1996 high at \$1.5568 on 3 June. Earlier in the month, sterling had come under speculative selling pressure when it weakened to a two-year low at \$1.4903 on 2 May, but strong buying interest was apparent at these levels and the currency recovered before it reached its main downtrend support line against the dollar: a positive development from a technical perspective.

Another factor which aided sterling towards the end of May was gilts' outperformance of other markets and in particular the success of the long gilt auction on 29 May. The currency rose from 85.1 to a high of 86.6 between 29 May to 4 June over a period when the spread between ten-year gilts and US Treasuries and Bunds narrowed significantly. The currency weakened slightly ahead of the Chancellor/Governor meeting on 6 June. And it fell further following the announcement of the rate reduction, closing at 86.1, a fall of 0.3 points on the day. Sterling subsequently drifted lower to 85.6 on the index by 13 June, with the release of better-than-expected UK PPI and RPI data triggering a further movement of expected short-term interest rate differentials against the currency. But sterling rallied against the dollar towards the end

of the month, as the US currency was undermined by the Bundesbank's decision to leave rates unchanged on 27 June and comments from officials were interpreted as implying that the Deutsche Mark correction was at an end. Sterling continued to trade in a firm manner thereafter and by 2 July it had recovered to a new 1996 high at 86.7 on an effective basis.

#### **Operations in the money markets**

The reduction in official rates on 6 June was unexpected by the markets. Despite sterling's initial weakness in the immediate days following this cut, the reduction was accepted without significant disturbance in the domestic markets, coming as it did against a background of economic data which the markets considered reassuring. The response of the short sterling curve in the course of the following days was to lower implied rates for contracts out to December 1996, by up to  $\frac{5}{16}$ , with some limited market expectations of a further reduction in rates by the autumn. But over the entire short sterling curve there was a significant steepening, as rates implied for 1998 and 1999 were little changed; the spread between the first and last contracts widened by around 45 basis points in the two weeks following the move. Thus, the steepening of the curve suggested that the markets expected the cut to be reversed later. Chart 9 shows the rates implied by short sterling futures contracts. By the end of Q2, compared with the beginning, smaller changes in three-month rates were expected over the next two quarters, but a slightly greater increase in threemonth rates from the second quarter of 1997 onwards.

There were several technical modifications to the Bank's operational techniques during the quarter, which were intended to assist the Bank in meeting its objective of delivering a broadly stable pattern of short-term interest rates around the prevailing level of base rates.

On 25 April the money-market shortage was forecast to be £2,100 million and the Bank took the opportunity presented by the largest liquidity shortage for two years to re-introduce bill repurchase agreements to the daily operational menu. There had been no necessity to offer bill repos for over a year, as shortages had on the whole been satisfactorily dealt with through the purchase of bills on an outright basis only. But the size of that day's shortage-resulting in part from settlement of the previous day's gilt auction-and a view that it would assist the Bank's objective for short-term interest rates if bill repos were to become once again a normal feature of the daily operations, made it opportune to reintroduce this technique. The threshold at which bill repos were included on the operational menu was progressively reduced from the initial £2,100 million to £950 million towards the end of the quarter, as use of the technique again became familiar in the market.

A further modification was introduced on 18 June when it was announced that, in future, invitations to repo bills in the money-market operations would incorporate the option to repo holdings of HM Government's floating-rate gilts (FRG). This innovation was made in response to suggestions from market participants, on the basis that the trading characteristics of FRGs, where the coupon is based on the price of three-month



Chart 9



Per cent

- 8.5

# Table B Influences on the cash position of the money market

£ billions; *not seasonally adjusted* Increase in bankers' balances (+)

contracts

	1995/96 Apr.–Mar.	<u>1996/9</u> Apr.	7 May	June
CGBR (+)	35.5	0.6	4.0	4.1
Net official sales of gilts (-) (a)	-26.6	-4.0	-1.7	-3.6
National savings (-)	-5.1	-0.7	-0.6	0.5
Currency circulation (-)	-1.7	1.2	-1.7	-0.1
Other	-1.7	1.1	0.9	-0.4
Total	0.4	-1.8	0.9	0.5
Increase (+) in the stock of assistance	2.3	1.7	0.9	-0.3
bills in market (b)	-2.7	0.2	-1.8	_
Increase in bankers'				
balances at the Bank	0.1	0.1		-0.4

 (a) Excluding repurchase transactions within the Bank.
 (b) Excluding repurchase transactions within the Bank (market holdings include Treasury bills sold to the Bank in repurchase transactions). money-market rates, are similar to the assets that the Bank had hitherto been prepared to accept in its operations. With the 1999 FRG, the pool of assets available for use in the Bank's operations was increased by about 20%, from about £30 billion (of which Treasury bills were about one third and eligible bank bills about two thirds) to nearly £36 billion. And it was further increased after the auction of £3,000 million FRG 2001 on 27 June. Experience so far suggests that this has been a valued technical change and has allowed a wider range of market participants access, through the discount market, to the Bank's daily operations in the money market.

The twice-monthly gilt repo facility remained an important element of the Bank's operations, with nearly 70 institutions signed up for participation and an average amount outstanding in the facility of around £3,000 million during the quarter. This facility is intended to complement the Bank's daily operations in the money market and, as appropriate, to provide a core amount of liquidity at the authorities' desired level of interest rates. While the Bank welcomes regular participation in this facility, it also favours a degree of stability in participation from one rollover to the next, since it is not helpful to the purpose the facility serves if there are large reductions in participation by individual institutions over a short period; institutions have generally felt able to participate on this basis. Applications were only scaled back once during the quarter, on 8 May, when around 64% of the amount applied for was allotted, taking the amount outstanding from £2.3 billion to £3.2 billion. One technical change to the conduct of this facility was announced on 19 June with the introduction of phased provision and return of funds over the three days following application, in order to smooth the supply of funds to and from the money markets.

During the period, the Bank was also able to moderate its scaling back of assistance during the course of each day and to reduce the market's recourse to late lending operations by the Bank. This was done in response to periodic tightness in short-term interest rates, but was also made possible by the technical adjustment to the Bank's bill dealing rates in the previous quarter (aligning the Bank's intervention rate more closely with the aim for interbank rates), which allowed for more effective management of market interest rates. In addition, the Bank reduced the size of the weekly Treasury bill tender to £600 million by the end of the period in the light of forward projections for the outstanding stock of assistance over the period immediately ahead.

### **Gilt financing**

### Financing requirement and gilt sales

The gilt sales target at the beginning of the financial year was  $\pounds 32.6$  billion. This was revised up during the course of the quarter to  $\pounds 34.9$  billion as a result of the carry-forward of  $\pounds 2.2$  billion of cumulative underfunding from the previous year. On 9 July, the Government published its revised forecast for the central government borrowing requirement which increased the gilt sales target for the year by a further  $\pounds 4$  billion to  $\pounds 38.9$  billion. At the same time, the Bank of England announced that no change to the auction programme or other aspects of the remit<sup>(1)</sup> to the Bank had

(1) Reproduced in the May 1996 Quarterly Bulletin on pages 136-37.

# Table C1996/97 financing requirement

± .	b 1	1.4	<b>^</b> +	20
				15
$\sim$			U1	×.,

	Original remit	Post Summer Forecast
CGBR forecast	24.1	28.1
official reserves Gilt redemptions	11.5	11.5
1995–96	_	2.2
Financing requirement	35.6	41.8
Assumed contribution from national savings Expected contribution from	3.0	3.0
certificates of tax deposit	—	-0.1
Gilt sales required	32.6	38.9

#### **Table D Issues of gilt-edged stock**

	Amount issued (nominal)	Date	Average price	Average yield	Cover (a) at auctions	Tail (b) at auctions (basis points on yield)	Date exhausted (c) (taps)
Auctions							
71/2% 2006	3,000	24.4.96 (d)	95.29 (e)	8.08	2.65	2	
8% 2021	3,000	29.5.96 (d)	96.16 (e)	8.35	2.04	2	
FR 2001	3,000	26.6.96 (d)	99.71 (e)	libid minus 6 basis points (f)	4.51	1	
Index-linked taps							
21/2% 2001	150	1.4.96	177.47	3.62 (g)			16.4.96
21/2% 2013	200	1.4.96	138.47	3.76 (g)			2.4.96
21/2% 2011	200	18.4.96	169.81	3.71 (g)			22.4.96
21/2% 2024	250	18.4.96	118.44	3.74 (g)			26.4.96
2% 2006	150	10.5.96	181.78	3.73 (g)			15.5.96
2% 2016	100	10.5.96	147.22	3.83 (g)			15.5.96
21/2% 2003	150	17.6.96	173.88	3.78 (g)			18.6.96
21/2% 2001	150	17.6.96	167.72	3.89 (g)			17.6.96
21/2% 2009	200	21.6.96	163.97	3.80 (g)			1.7.96
21/2% 2024	200	21.6.96	117.56	3.84 (g)			2.7.96
Conventional tap							
6% 1999	250	10.5.96	96.53	7.22 (h)			10.5.96

Total of bids divided by the amount on offer.

(a) (b) 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 (difference in discount to Libid for the Floating Rate stock). Taps are exhausted when the issue is no longer operating as a tap. The auction is held on the day before the stock is issued. Gross redemption yield, based on the weighted average of successful competitive bids. Yield relative to Libid, based on the weighted average of successful competitive bids. Weighted average real rate of return, based on the actual price at which issues were made, assuming 5% inflation. Gross redemption yield, based on the price at which the issue was made.

(c) (d) (e) (f)

#### been made.

Gilt sales to end June amounted to £11.1 billion, over 30% of the sales target for the year as a whole, as it stood at the beginning of the quarter. £8.9 billion of this represented sales of conventional gilts, nearly all of which (£8.7 billion) was raised through the three conventional auctions held during the quarter. This is consistent with the authorities' intention, as stated in the remit published at the end of March, that auctions constitute the primary means of conventional gilt sales. Each auction was for the maximum £3 billion of stock indicated by the remit's range for single stock conventional auctions.

#### **Auctions**

The results of the auctions in the first quarter of the financial year are summarised in Table D. The maturity bands for the auctions were published on 3 April, and generally caused little surprise; the decision to issue 10 and 25-year gilts built up existing benchmarks and took account of market participants' preferences for longer-dated stock following the fourth quarter of the financial year 1995/96, when two short-dated issues were auctioned. Having created a new 25-year issue in February, it was desirable to increase supply in order to enhance its liquidity. The scarcity premium was evident in the relationship between it and the next longest strippable benchmark, 8% Treasury Stock 2015: following February's auction, the ultra-long issue traded around 7 basis points below the shorter gilt in yield terms, so that there was an inversion of the yield curve at the ultra-long end. By May's auction this inversion had disappeared. The 10 and 25-year issues will be strippable when the planned stripping facility is introduced in the early part of next year, and the auctions took the total value of strippable issues to £41 billion.

The remit published in March had indicated that the authorities might issue floating-rate gilts (FRGs) during the financial year. The first quarter maturity schedule included a short stock for June, which was subsequently specified as Floating Rate Treasury Stock 2001, creating a new five-year instrument to complement the existing 1999 FRG, which had seen consistently good demand since its creation. Demand was enhanced by the Bank's announcement

that floating-rate gilts would be eligible for use in repos in the Bank's daily money-market operations. In the event, the auction elicited bids from a wide range of wholesale investors<sup>(1)</sup> and was heavily covered.

Floating-rate issuance in June was expected, following the April maturity-band information, which depressed the price of the existing FRG by 4 points. The average price realised in the auction produced a yield margin below Libid of 6 basis points, slightly higher than in auctions of the 1999 FRG (10 basis points below Libid in March 1994 and 7 basis points below Libid in June 1994); these auctions were for smaller amounts. The cover of 4.5 produced in the June auction was, however, the highest ever for a gilt auction.

This continued the pattern of high levels of cover seen in the first two auctions of the current financial year and the final auctions of 1995/96. April's ten-year  $7^{1/2}$ % 2006 auction was covered 2.65 times compared with 1.12 times in the previous December auction of the issue, and 0.99 times in September 1995's auction. May's auction of 8% 2021 was also covered more than twice. These cover statistics compare with an average cover in the last financial year of 1.75 times. The increase may reflect greater appetite for risk from the market-makers having recovered from a series of disappointing auctions in 1995. But there is also an element of 'bidding back' by the market, hoping to pick up cheap stock in the event that general demand at auction is poor. This strategy may be reflected in the relatively high volumes of bids coming via the GEMMs, but made on behalf of clients. Such 'retail' bids amounted to an average of 130% of the stock on offer in the three auctions during the quarter, compared with a 30% average over the course of the previous financial year.<sup>(2)</sup> Even excluding the auction of the FRG, which in the past has also produced high levels of retail bids, the level of retail bidding in the first two auctions amounted to 80% of the stock on offer.

Transmission of bids from end-investors has been helped by the increase in the number of telephone bids each GEMM can make in the period immediately before the auction close, together with an extension of the period for unlimited bids (from 9.45 am to 9.50 am). These small changes were introduced at the beginning of the financial year. Levels of cover have also been helped at the margin by the expanded non-competitive bidding facility for GEMMs, which was introduced this financial year—GEMMs may now bid for up to 0.5% of the stock on offer at the average accepted price. This facility has been extensively used. Finally, the gilt repo market may have facilitated (and reduced the costs of) GEMMs and end-investors taking short positions and financing holdings, and so encouraged greater participation. The pattern of repo activity for the auction stock parents has varied. But in the case of a stock identifiable as likely to be auctioned by the quarterly maturity announcements-for example the 8% 2021 in May-there has been a substantial increase in the 'specials' premium in the period before the week of when-issued trading. This is evidence of how market participants position themselves in the auction stock.

Yield tails were below average: 2 basis points for the two

<sup>(1)</sup> The terms of the auction were tailored to the wholesale market: a minimum bid size of £250,000 and no non-competitive facility for the general market, only for the gilt-edged market-makers. As with the 1999 FRG, the stock pays interest gross. It may only be held in CGO. Figures only include retail bids in amounts of over £10 million. Smaller bids are not reported to the Bank of England.

<sup>(2)</sup> 

conventional auctions in the last quarter, 1 basis point in the FRG auction. This compares with an average of 3.3 basis points in the last financial year, suggesting that while low bids have become more common, leading to better cover, the dispersion of successful bids has narrowed.

#### Index-linked gilts

Sales of index-linked gilts (IGs) during the quarter raised £2.2 billion in cash terms—over 40% of the pre Summer Economic Forecast requirement.

The sector was buoyed at the outset of the financial year by the remit announcement, on 27 March, that no index-linked auctions were planned for 1996–97. Some market participants had feared that the possible additional weight of supply resulting from auctions, together with a fixed timetable, would adversely affect IG prices: the news that there would be no such auctions in this financial year boosted prices in the sector by nearly a point, outperforming conventional gilts by 4 basis points on the day.

The strength of demand for index-linked gilts during the quarter may also have been linked with their relationship with equities. Equity yields have historically been higher than yields on index-linked gilts, with the better credit and lower variance of returns from indexed gilts apparently outweighing the possibility of real dividend growth on equities. However, with stock markets continuing to rally during the quarter, dividend yields on shares fell steadily. The yield spread narrowed from around 30 basis points at the start of 1996, to around zero at the start of the quarter and subsequently became negative, with IGs yielding around 10 basis points more than equities by the middle of May. While the spread returned to zero by the end of June, for most of the quarter switches out of equities and into index-linked gilts may have been regarded as relatively attractive. In these conditions ten individual tap stocks were issued over the quarter, spread across the yield curve. The size of taps was slightly higher than typical in the last financial year: taps have been issued up to £200 million in nominal size, compared with around £150 million previously.

Market participants also broadly welcomed the US Treasury's announcement on 16 May that it plans to issue inflation-linked bonds. There was no discernible impact on UK IG prices, but in general it was seen as a positive development, prospectively leading to greater international familiarity with index-linked instruments and possibly facilitating hedging.

#### Conventional tap

Only one conventional stock was tapped during the quarter; details are given in Table D. As explained in previous *Bulletin* issues, the authorities retain tapping as a market-management tool, to be used only in conditions of temporary excess demand in a particular stock or when there is an exceptionally sharp general rise in the market. There was evidence of difficulties in buying and borrowing the stock in question, the 6% 1999, its price had tightened relative to other short stocks, it was special in the repo market, and there was anecdotal evidence of a difficult situation. The tap was exhausted in the initial tender.

#### Sectoral investment activity

The results of the latest (end-December 1995) survey of gilt





# Latest developments in the gilt repo market

In order to monitor market developments over time, and to make aggregate information available to market participants, the Bank collects data quarterly on a voluntary basis from major repo and stock lending market players. Because not all market participants report their activity, the coverage is not comprehensive. Nevertheless, the data collected from a relatively stable reporting population should be representative of developments in the repo market as a whole. Figures collected by the Bank from around 70 participants showed that the size of the combined markets, measured in terms of amounts outstanding, grew slightly from the end of February to exceed £50 billion by the end of May. Of this, around £35 billion was in repo, broadly unchanged from end-February, and around £16 billion in stock lending (see Table 1).

#### Table 1

#### Outstanding amounts<sup>(a)</sup> by practitioner

£ billions

	End-May 199	96		Reference:
	Banks (b)	Securities houses and others (c)	Total	Total at end-Feb. (d)
Repo	21	14	35	36
Stock lent	4	3	7	4
Sell/buy back (e)	1		1	1
Total out	26	17	43	42
Reverse repo	24	10	34	34
Stock borrowed	11	5	16	12
Buy/sell back (e)	1		1	2
Total in	36	15	51	48

(a) Transactions entered into, but for which the second leg has not yet settled. Transactions are reported gross of other, similar transactions with the same cour
(b) Including discount houses, and, in some cases, other parts of the banking group
(c) Including GEMMs and all other reporters.
(d) Totals may not sum due to rounding.
(e) Solldwu and buyets reporters reported to the second sec same counterparty

Sell/buy and buy/sell transactions conducted under an annex to the Gilt Repo Legal Agreement are included under repos and reverse repos. (e)

There was some consolidation after the market's initial growth in January and February. The flatness of the short end of the yield curve and the convergence of views on interest rate prospects around the end of May may have meant that fewer positions would have been taken in repo and other sterling instruments. The outstanding size of the repo market might therefore be expected to show considerable variation over time, depending on market conditions and the spread of interest rate expectations in the market.

The increase in stock lending and borrowing from around £12 billion in February to around £16 billion at the end of May partly reflects an increase in the population of institutions reporting to the Bank. But

it is also consistent with market comment that, for many participants, the development of the repo market has contributed to a revitalisation and expansion of the stock lending market.

Monetary statistics published by the Bank show that at the end of June, gilt repos and reverse repos outstanding on banks' and building societies' combined balance sheets were some £25 billion and  $\pounds$ 32 billion respectively. It is impossible to estimate with certainty the proportion of the rises in M4 and M4 lending that has been caused by the new market, since it is not known to what extent the new business is additional to or substitutes for business that would have taken place in some other form instead (for example unsecured lending). These issues were discussed in the Bank's May 1996 Inflation Report.

Average daily turnover (see below) has increased proportionately much more than the reported increase in outstandings. Over time, new participants are entering the market, so that activity is gradually becoming somewhat more widely spread. And brokers are thought to be seeing a rather higher proportion of repo business than in the market's first months.

Table 2 shows the residual maturity breakdown of outstanding transactions, as reported to the Bank; it

#### Table 2 Outstanding amounts at end-May by residual maturity

£ billions	On call and next day	2–8 days	9 days 1 month	1–3 months	3–6 months	Over 6 months	Total (a)
Repo Stock lent Sell/buy back <b>Total out</b> (a)	$\frac{\overset{7}{_{6}}}{\overset{1}{_{13}}}$	$\frac{12}{-}$	8 1 9	5  5	2  2	 	35 7 1 <b>43</b>
Reverse repo Stock borrowed Buy/sell back <b>Total in</b> (a)	$\frac{13}{20}$	$\frac{10}{1}$ 11	7 1 <b>8</b>	8 1 9	2 <b>2</b>	1 1 1	34 16 1 <b>51</b>

(a) Totals may not sum due to rounding

shows positions as booked at the reporting date, but understates the proportion of short-term transactions compared with the turnover data, which give an indication of daily repo activity. The data on turnover collected by the Bank are less reliable than the comparable figures for

outstandings, partly because a number of participants are not yet able to report turnover figures.

Average reported daily turnover from March to May 1996 was at least £14 billion per day, which is somewhat below market perceptions, perhaps partly reflecting difficulties in capturing turnover data. Over 70% of turnover in all repo and reverse repo transactions reported during the period was either overnight or on call and a further 20% was up to one week's maturity.

Both member-to-member deliveries of individual stocks and deliveries by value<sup>(1)</sup> (DBVs) are used to settle repo trades across the Central Gilts Office (CGO) settlement system. Turnover on the CGO to the end of June continued to show an increase over a year earlier in the number of member-to-member deliveries but a slight decline in the number of DBVs. The overall decline in DBVs is believed to be mainly attributable to two factors: reduced matched principal intermediation in the stock lending market—in which DBVs are the usual means of passing collateral—and the reported trend toward larger trades.

Market reports suggest that both larger trade sizes and enhanced liquidity in the cash gilt market may become a permanent benefit of the gilt repo market. For example, market participants report greater ease in effecting trades above £100 million. Further, the average daily turnover in cash gilt trades, excluding gilt repos, reported to the London Stock Exchange was £7.6 billion in the first half of 1996, an increase of 16% over the same period a year earlier, although it is hard to know to what extent this increased cash gilt market activity may be linked to repo activity.

General collateral (GC—the repo of a gilt or a parcel of gilts having no 'special' or premium value) has traded consistently below interbank rates at three months, as shown in the chart, although overnight rates do not show a consistent pattern and occasionally trade above GC rates. In the specials market, stocks 'trading special' (at a premium, ie having repo rates below the GC rate) have included 7<sup>1</sup>/<sub>4</sub>% Treasury 1998, 6% Treasury 1999, 8% Treasury 2000, 8% Treasury 2003, and 8% Treasury 2021. Special rates have not so far tended to move as low as those found in some repo markets overseas, with the exception of a few very small, illiquid stocks. In May, the Bank became aware of reports of possible attempts to corner a small stock near maturity, 15% Exchequer 1997, causing the stock to trade at up to 500 basis points through (ie below) the GC rate, and inducing failures to deliver. Given the circumstances, the Bank indicated that it was monitoring the situation and was in contact with market participants to ensure that any difficulties were resolved in an orderly manner. The situation was normalised by the end of May. On a separate occasion, different market conditions called for a different response from the Bank, when £50 million of 8% Treasury 2002–06 was created by tap on 11 July, following widespread difficulty in obtaining this small stock which is widely held by non-lenders. The full amount of the tap was sold immediately.

The successful interaction of the stock lending and repo markets, in which stocks have generally been supplied smoothly to the market when the returns



increase, may help explain why large specials discounts to the GC rate have tended to be short-lived. Some market participants expect that this will change over time, and perceive a trend in the increased specials activity in May-July 1996, compared with earlier months. The Bank of England reserves the right for market management purposes to reopen or repo a stock if it is being squeezed by market participants, but does not discourage activity in special stocks or the development of a specials market.

<sup>(1)</sup> A DBV is an overnight bulk delivery through the CGO of one or more stocks to a given value, rather than a delivery of a specified amount of a named security. Equivalent securities are returned automatically the following business day, provided that both parties to the delivery are then able to transfer stock through the CGO system.

# Table EOfficial transactions in gilt-edged stocks

£ billions: not seasonally adjusted

	1995/96	1996/97		
	AprMar.	Apr.	May	June
Gross official sales (a) Redemptions and net official purchases of stock	30.7	4.0	3.5	3.6
within a year of maturity	-4.1	—	-1.8	_
Net official sales (b) of which net purchases by:	26.6	4.0	1.7	3.6
Banks (b)	5.4	-0.6	-0.7	1.6
Building societies (b)	1.0	0.1	0.1	0.2
M4 private sector (b)	14.2	3.0	2.3	1.0
Overseas sector	5.8	1.4	_	0.8

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

### Chart 11 Inflation expectations at 3, 5 and 15 years<sup>(a)</sup>



holdings in the Central Gilts Office (together with the remaining holdings registered directly) were published in the Bank of England's 'Gilts and the Gilt Market Review 1995–6'.<sup>(1)</sup> The largest changes in percentage shares of holdings were shown by pension funds (an increase from 17.3% to 20.8%), and the overseas sector (a fall from 18.3% to 14.4%), although the latter is not shown in ONS data for the same period. The increased holdings of pension fund investors are consistent with the ONS figures for calendar 1995 which showed a continuing significant shift into gilts by this sector.

The latest ONS statistics, covering the first quarter of calendar 1996, show that institutional net investment in gilts remained buoyant; at £5.3 billion it was roughly at the same level as in the fourth quarter of 1995. Decreases in the amount of net investment by pension funds and long-term insurers were offset by increases by other types of institutional investor—other insurers and unit trusts. The pension funds and long-term insurers nevertheless continued to be the heaviest net investors in gilts.

For the most recent quarter (April-June 1996), statistics compiled by the Bank of England on the basis of reporting by banks and building societies indicate that the M4 private sector-in which institutions predominate-increased still further its level of net investment in gilts. But, as investment by this sector is calculated as a residual, we do not yet have a breakdown of the investors principally responsible for this. During the quarter as a whole, net investment by banks and building societies was fairly modest relative to the levels seen in the two immediately preceding quarters. However, there was an uneven monthly pattern, with net disinvestment in April and May being offset by large-scale investment in June. The June investment is likely to reflect the appeal to the monetary sector of the June auction stock-a floating-rate gilt. Finally, the overseas sector made significant net purchases in the latest quarter, continuing the recovery in investment levels from overseas seen in the first quarter of 1996. Purchases were concentrated particularly in April, perhaps reflecting the attractions of the gilt market spread over other European markets during that month.

#### Inflation expectations

UK bond yields were little affected by the unexpected cut in UK rates. Indeed they were very stable throughout the quarter, with a slight fall in nominal yields, most clearly perceptible at the shorter maturities.

At the end of June, inflation expectations, as derived, stood at 3.96%, 4.45% and 4.89% at 3, 5 and 15 years respectively. While they declined 37 basis points, 30 basis points and 13 basis points respectively from the levels at the end of the previous quarter, inflation expectations remained in well established ranges for most of the quarter.

#### Technical developments

On 14 June, the Bank of England issued an Operational Notice, 'Official Operations in the Gilt-Edged Market'. The new Operational Notice brought together the large number of changes

Published on 16 July and available from Michelle Morris, Gilt-Edged & Money Markets Division, Bank of England, Threadneedle Street, London, EC2R 8AH.

that have been made in recent years to the mechanics of the operations which the Bank undertakes in the gilt-edged market in its role as debt manager to the government. In addition to covering changes that had already been announced and described in other publications, it set out the operational framework for the Bank's transactions in the secondary market. These are separate from auctions and taps and are undertaken only on a very small scale. In order to ensure that any such transactions are effected in a way that promotes the liquidity and efficiency of the market, from 1 July the Bank is publishing on its screens a list of all the conventional stocks for which it is available to be bid in an outright sale or switch of stock (the 'Shop Window').

In May, the Bank published a Gilts Strips Update, setting out further decisions on the planned gilt strips facility and seeking views on some technical issues. Both the Operational Notice and the Gilts Strips Update are available from Lucy Clary, Gilt-Edged & Money Markets Division, Bank of England, Threadneedle Street, London, EC2R 8AH, telephone 0171-601 3677.

During the quarter, the Bank published further details of the upgrade to the Central Gilts Office (CGO). New features will facilitate stripping and reconstitution of gilts, allow repos to be processed more efficiently, effect automatic reporting to the SFA and Stock Exchange, offer more flexible membership and account management arrangements and allow better control by settlement banks of any residual risk in the settlement process.

# The international environment

This article considers economic developments in the European Union, North America and Japan since the May 1996 Quarterly Bulletin. These countries account for about half of world GDP, but three quarters of UK external trade.

- GDP growth in the first quarter was quite strong at first sight; in the major six (M6) international economies, output was 1% more than in the last quarter of 1995. But much of that reflected special factors, particularly in Japan, France and Italy, that are likely to have unwound in the second quarter. The strength of the US economy appeared more robust. And domestic demand in Germany was stronger than the markets expected. In Europe, cyclical conditions improved, but structural problems remained.
- Consumer price inflation remained subdued. In the United States, however, there were some signs of emerging price pressures earlier in the production chain, and labour market conditions continued to tighten.
- At the time of going to press, there were no changes in official interest rates in the G3 countries, following the Bundesbank's <sup>1</sup>/<sub>2</sub> point cut in mid April. Several other European countries, however, including France and the United Kingdom, trimmed interest rates in June. Yield curves steepened at the short end, reflecting market expectations of interest rate rises ahead, notably in the United States but also in Germany and France.

Two special topics are considered: consumer indebtedness in the United States; and the extent to which eastern Germany has converged with western Germany.

#### Table A GDP growth

Percentage change over previous quarter

	United States	Canada	Japan	Germany	France	Italy	Major six (a)
1995 O1	0.1	0.4	0.1	0.2	0.7	1.4	0.3
Ò2	0.1	-0.3	0.6	0.9	0.1		0.3
Ò3	0.9	0.3	0.6	_	0.1	1.8	0.7
Q4	0.1	0.2	1.2	-0.2	-0.4	-1.1	0.2
1996 Q1	0.6	0.3	3.0	-0.4	1.2	0.5	1.0
(a) UK trad	e-weighted	average.					

#### GDP growth in the M6 countries in the first quarter of 1996 was not as strong as the reported data suggest

The exception to this was in the United States (see Table A), where growth was slightly above trend, despite the adverse effects of bad weather, government shutdowns and strikes. This was well above most market expectations. Data available so far for the second quarter suggest that above-trend growth continued and is likely to turn out even higher than the first quarter. Industrial production grew strongly in April, May and June, led by the automobile sector. The National Association of Purchasing Managers' index in June rose to its highest level since February 1995, indicating a growing manufacturing sector. Consumer spending also remained strong; although consumer credit growth has been slowing, the level of consumer debt is still rising, and may hold back consumer growth at some point. (See the box on page 259 for a fuller discussion of consumer indebtedness in the United States.) Growth of retail sales slowed a little in the second quarter, particularly for big ticket items. Employment growth was particularly strong, rising at about double the normal rate in the first five months of the year.

Prospects for the second half are less certain, but with signs that the recent inventory correction has been completed, and demand strengthening in major overseas markets, notably Japan, Mexico and Canada, activity should hold up well, even if policy is tightened.

## **Consumer indebtedness in the United States**

High consumer indebtedness is a possible downside risk to consumption growth. Chart A illustrates the evolution of instalment and revolving (credit-card) debt. After a period of rapid expansion in the mid-1980s, consumer credit declined as the economy went into recession during the early 1990s before picking up again in the present cycle.

Chart A



The growth in credit-card debt has been particularly noteworthy. Stimulated by increased competition in the credit-card industry, credit-card debt has risen rapidly since 1993. Easier availability of credit has contributed to the long-term decline in US personal savings. Although delinquency rates have increased in the present cycle, it appears that this is because consumers of poor credit standing have obtained greater access to credit. There is no evidence to suggest that rising default rates are the first sign of a decline in aggregate consumption.

The pattern of consumer credit appears to contradict consumption-smoothing theories of consumer behaviour which suggest that debt-income ratios should increase during recessions as consumers borrow to cover expenses while income is temporarily low. When consumers experience income uncertainty they face a trade-off between *impatience*, in the sense that they could borrow against future income to finance current consumption, and *prudence*, in the sense that they have a precautionary savings motive. Faced with this tension, changes in the probability of adverse developments such as unemployment have a significant influence on saving and consumption.

Chart B shows that there was a marked reduction in consumer confidence (a proxy for employment expectations) between 1990 and 1992. During this period consumption fell and the saving rate rose significantly. Net wealth therefore began to rise, in time inducing a recovery in consumption and a steady decline in savings. Since 1994 there has been a pick-up in the saving ratio, which may have reflected the rebuilding of wealth following the fall in bond prices in 1994. If consumers have target buffer-stocks of wealth, then these may have been raised in the light of the perceived increase in job insecurity that accompanied the 'jobless recovery', generating an unwillingness to spend. The more recent phenomena of rising stock prices and lower interest rates in 1995 have helped repair consumer balance sheets, allowing targeted wealth levels to be attained more rapidly. The slowdown in the accumulation of savings since 1995 appears to support this. The reduction in precautionary savings as wealth increases can therefore be expected to generate extra growth in consumption.

#### Chart B Insecurity, savings and consumption



Recent academic work (for example, Cabellero 1991, Carroll 1992) suggests that precautionary motives and employment expectations are quantitatively important determinants of consumer behaviour.<sup>(1)</sup> In their models, risk aversion and earnings uncertainty have direct effects on individual consumption in the United States. Over time, as precautionary savings add to wealth, consumption becomes less depressed. Increases in the degree of relative risk aversion and earnings uncertainty also raise the target level of liquid assets for the typical consumer.

It thus appears that if consumer indebtedness is an issue, the appropriate focus is not the level of indebtedness, but rather, the behaviour of savings and consumption in the presence of increased risk aversion and job uncertainty. The behaviour of consumption in the present cycle is consistent with the predictions of buffer-stock explanations of consumption behaviour. If consumers do behave in this fashion then the consequences, for aggregate consumption, of a downturn in income are ambiguous and dependent on the proximity of consumers to their target levels of wealth. Consumers at, or near, their targets will be less inclined to engage in precautionary savings. In this regard, beliefs about income risk are important—anecdotal tales of job insecurity may be sufficient to have a significant impact on desired target levels of wealth.

(1) Cabellero, R (1991), 'Earnings Uncertainty & Aggregate Wealth Accumulation', American Economic Review, 81, pages 859–71. Carroll, C (1992), 'The Buffer Stock Theory of Saving—Some Macroeconomic Evidence', Brookings Papers on Economic Activity

# Table BContribution to growth in GDP in 1996 Q1

	United States	Germany	Japan	France
Stocks	-0.3	0.6	0.1	-0.9
Investment	0.4	-1.1	0.6	_
Net trade	-0.2	-0.4	-0.3	0.4
Government	0.1	0.2	1.1	0.3
Consumption	0.6	0.3	1.5	1.4
Total (a)	0.6	-0.4	3.0	1.2
Total (a)	0.6	-0.4	3.0	1.2

(a) Totals may not sum due to rounding

#### Chart 1 French household activity



#### Chart 2 Investment in plant and machinery in Germany



The most striking increase in reported GDP in the first quarter was in Japan where the economy grew by a remarkable 3% on the quarter. The figure is, however, distorted by statistical and temporary factors. GDP data in Japan are not adjusted for the leap year, which is estimated by the Economic Planning Agency to have added 0.8% to consumer spending, and 0.5% to GDP growth in the quarter. Moreover, a considerable part of the remaining growth reflected the effect of last autumn's fiscal package. Table B shows that public investment and government consumption accounted for over 1% of the 3% quarterly growth. The direct effects of the fiscal package may have ended, as budgets were used up by the end of the fiscal year. Equally, the growth in residential investment may not be sustained. It tends to be highly interest rate sensitive and there seems to have been a surge in residential investment with investors feeling that the interest rate cycle had bottomed out.

Nonetheless, while the first quarter Japanese GDP figure is probably exceptional—and is likely to be followed by negative reported GDP growth in the second quarter—the chances of a broadly based recovery seem to have improved. Even allowing for special factors, growth in the first quarter was strong. A particularly encouraging sign of recovery was the large increase in consumer spending in the first quarter, even after allowing for the leap year effect. The May Tankan survey also substantiated the impression of a continuing improvement in the economy, but underlined the fragility of the recovery. Small and medium-sized enterprises (SMEs) in particular still faced difficulties, and there were concerns that stocks were still too high, implying a constraint on production at least in the second quarter. The survey reported modest investment intentions for large companies, but SMEs planned to *reduce* investment by 11% in the fiscal year 1996/97.

As Table B shows, GDP grew by 1.2% in France, but fell by 0.4% in Germany. Special factors account for much of the measured increase in French GDP. As in Japan, GDP data are not adjusted for the leap year, which added as much as 0.5% to the quarter-on-quarter growth, and at least part of the remaining 0.7% growth reflects a rebound from the strike-related weakness of the fourth quarter of 1995. Moreover, the exceptionally strong increase in consumer spending was partly explained by special government incentives on car purchases, while consumption of energy was boosted by the cold weather. It is likely therefore that recorded GDP growth in the second quarter will be flat or negative. Since the first quarter, consumer confidence has slipped back, and household consumption fell in April and May (see Chart 1). Unemployment went back up to 12.4% in May, on the Internatioanl Labour Organisation (ILO) measure. Real disposable income is likely to be flat in 1996. Against this background the near-term outlook is for subdued growth in demand and output.

In Germany, by contrast, the underlying picture for the economy in the first quarter was probably stronger than the GDP data—which are adjusted for the leap year—suggested. An exceptionally harsh winter hit the construction sector badly with a fall in output of nearly 8% on the previous quarter. But, significantly, the 1.3% increase in domestic demand excluding construction investment was stronger than the markets expected. Private consumption increased, perhaps because the effects of the income tax cuts introduced in January offset those of the sharp rise in unemployment in the first quarter. But investment in machinery

#### Chart 3 European real exchange rates







### Chart 5 European consumer price inflation



and equipment, which normally features prominently in German economy upturns, was mediocre (see Chart 2). Export growth was also weak, reflecting competitive pressures and weak external demand for Germany's traditional exports.

The data available so far for the second quarter suggest a rebound in activity—particularly in the construction sector. But there were some signs that, in addition to the bounce back, a cyclical recovery was underway. Industrial production rose in both April and May, and manufacturing and export orders improved. Retail sales were less buoyant than production, but nonetheless rose for three consecutive months before falling in May. Retailers' confidence also picked up in the quarter. The labour market remained weak; headline (unadjusted) unemployment fell slightly to 9.9% in June, but the improvement was entirely due to seasonal factors, according to the official statistics office. The seasonally adjusted rate of unemployment was unchanged at 10.31%.

Looking at the components of demand, consumption may be constrained by high unemployment, but the fiscal stance in 1996 is expansionary. Exports were weak in the first quarter, but both foreign and domestic orders rose in the second. As Chart 3 shows, the real exchange rate depreciated by 1.8% in the second quarter, but remained high in historic terms. The prospects for exports will be an influence on investment spending which has so far made no contribution to growth since the trough of the last recession.

Among the other European economies, first quarter GDP growth was weak in Italy and Spain. In Italy, the expected bounce back from the fourth quarter fall in GDP was weaker than expected. Reported activity grew by only 0.5%, despite a beneficial leap year effect, in part because the appreciation of the lira and weak external demand hit exports. In Spain, industrial production was weak, despite a weather-related boost to energy output. The slowdown in these economies has been less pronounced, however, than in Germany and France (see Chart 4). Performance was mixed in the Benelux countries, which together account for about 13% of UK exports of goods (a similar proportion to Germany, our largest export market). In the Netherlands, a less cyclical economy than the others, and a larger market for UK exports than either Italy or Spain, GDP grew by 1.1% quarter on quarter; the gradual slowdown in economic growth seen in 1995 did not persist into 1996. In Belgium, by contrast, GDP growth in the first quarter was only 0.2%. All European economies continued to be outstripped by the Irish economy, where real GDP grew by  $7^{1}/_{2}$ % last year.

# Inflation

# Average consumer price inflation in the major economies has remained at around $2\%-2^{1}/4\%$ for more than two years

Inflation differences between areas persist, but are less stark than five or ten years ago. In the European Union as a whole, average inflation was about 2<sup>3</sup>/<sub>4</sub>% a year in April, down from 3.1% in December 1995, reflecting sharp falls in inflation in Italy, Spain and Portugal in the first four months of 1996 (see Chart 5). Further falls in EU inflation are possible in the near term as the effects of lower commodity prices and lower producer input price inflation feed through. In Germany, whole economy unit labour costs should

## Eastern Germany six years on

Since German reunification, the output of the eastern Länder has increased rapidly—by 7.5% per year on average since 1991 (see Chart A). However, last year, growth in the eastern Länder slowed sharply, raising questions about the conditions necessary for continued convergence of eastern and western German *per capita* 

# Chart A



output. In this box, reasons for the current slowdown are examined and the implications for the German reunification process are considered. It suggests that living standards in eastern Germany will be dependent on transfers from the west until eastern Germany is capable of self sustained growth. This requires investment sufficient to create jobs and support the living standards currently enjoyed by eastern and western Germans. The eastern Länder remain a long way from this point, as costs in the region, along with less buoyant economic conditions in western Germany, have deterred direct investment, despite generous subsidy provisions.

#### Investment

At the end of 1994, fixed capital formation as a share of total output was running three times faster in the eastern Länder than in western Germany. Since then, investment growth has declined in both regions of Germany following the sharp fall in business profitability and confidence (Chart B). As a high level of investment in the eastern Länder is likely to be a pre-requisite of the convergence process, a recovery of business confidence and investment is particularly important if eastern German living standards are to continue rising.<sup>(1)</sup>

#### Construction

In the new Länder, construction investment has been a mainstay of economic growth since reunification,

#### Chart B

Eastern German business confidence



supported by western German public transfers and by subsidies (see Table 1). Total real construction investment increased almost two and a half times between 1991 and 1995, while employment in the construction industry rose from about 630,000 in 1990 to more than 1,000,000 five years later. By creating many new jobs, the construction sector acted as an important counterweight to job losses in other sectors, particularly manufacturing industry. From the second quarter of last year, construction orders decreased, housing construction fell, and confidence in the construction sector weakened sharply. This is in part due to the cyclical slowdown in western Germany, in part due to tight public sector budget constraints, but is also a consequence of the dynamic growth of previous five years, which saw around 30% of commercial buildings renewed and costs rising very quickly—by 1995, the basic pay of eastern German construction workers had risen to 92% of the western German level. Given these developments, demand for construction is unlikely to be as dynamic as in previous years.(2)

Table 1 also illustrates the similarity between the production structures of west Germany in 1965 and east Germany in 1989, and illustrates changes in production structures since these dates.

# Table 1Structure of output in the eastern and westernGerman economies

Percentage of output	FRG 1965	GDR 1989	West 1994	East 1994
Agriculture	10.1	9.5	1.2	3.0
Production	61.3	60.4	38.6	40.7
Construction	17.1	16.9	10.6	26.1
Manufacturing	44.2	43.5	28.0	14.6
Trade/transport	11.8	12.7	14.3	14.2
Services	8.4	7.1	32.6	23.6
Government and other	8.4	10.3	13.3	18.8

(1) See IFO Institute Schnelldienst (5/1995), 'Investment in the New Bundesländer, and 17–18/1995—Investment: High dynamism

underpins adjustment process'. (2) See 'The trend and current state of the German construction industry', *Deutsche Bundesbank*, June 1996 Monthly report.

#### Private consumption and the welfare state

By 1994, private consumption *per capita* in eastern Germany had risen to 67.2% of the western German level (compared with 49.9% in 1991). However, GDP per capita only increased from 31.3% to 48.7% of western German levels during this period. Private consumption growth has been buoyant largely because of official transfers. Table 2 shows how these transfers have

### Table 2

#### **Public sector payments to eastern Germany**

				-	
	1991	1992	1993	1994	1995
Payments to eastern Gern	many				
Federal budget Transfers from western Länder Governments at	75 nd	88	114	128	151
authorities	5	5	10	14	14
German unity fund	31	24	15	5	_
EC budget	4	5	5	6	7
Federal labour office	24	25	15	14	14
Statutory pensions	—	5	9	14	14
Gross payments, total	139	152	168	181	200
Revenues in EG					
Tax revenue	31	35	37	40	43
Administrative revenue	2	2	2	2	2
Revenue, total	33	37	39	42	45
Net payments, total as percentage of GDP	106 3.7	115 3.7	129 4.1	139 4.2	155 4.5
Source: Deutsche Bundesbar	nk.				

developed over the last five years. Payments to the east have continued to increase, primarily due to the link between benefits and average earnings: as average earnings rise in the east to western levels, unemployment benefits also increase pro rata. In addition, eastern pension rates are steadily converging on those in the west. Indeed, average pensioner incomes in the east now exceed those in the west due to longer periods of insurance, a higher participation rate of women in the labour force and vested rights provisions. Although the uptake of investment subsidies has also been substantial, about 60% of financial transfers to the east have financed consumption rather than investment and have therefore had a relatively minor direct effect on the adjustment process.

#### Labour market

Tight regulation of the German labour market has, in large part, determined the effect of the recent economic

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(3) See De Nederlandishe Bank reprint 409, 'Can Eastern Germany Catch-up? A brief look at Neo-Classical and Modern Growth and Trade Theories', S. Brakman and H Garretsen.

downturn on the level of unemployment. Since the beginning of 1995, the unemployment rate has increased from 13.7% to 15.5% in eastern Germany, and from 8.2% to 9.0% in the west. Although job protection, social welfare, and product market regulation are broadly the same in both German regions, and wage and non-wage labour costs are somewhat lower in the eastern Länder, unit labour costs are considerably higher than in western Germany because high wage settlements have not been matched by productivity improvements (see Table 3). As a result, the incentives for eastern German firms to create

## Table 3 Unit wage costs in eastern and western Germany

Eastern as a percent of western	age 1991	1992	1993	1994	1995
GDP	7.8	8.3	9.0	9.5	9.9
Wage rates	51.3	60.6	69.3	70.4	73.1
Productivity	33.2	38.0	43.1	43.4	44.0
Unit wage costs	154.5	159.6	160.8	162.3	164.7
Source: Deutsche Bun	desbank				

jobs in anything but very high value-added, capital intensive, activities are much reduced.<sup>(3)</sup> The recent fall in investment growth has been accompanied by reduced productivity growth in the eastern Länder (Chart C), putting further upward pressure on unit labour costs and unemployment.



#### Chart 6 US price inflation



Chart 7 US interest rates and inflation



#### Table C Three-month interest rates<sup>(a)</sup> expected in September 1996

Percent

	1995	1996	
	29 December	29 March	28 June
US dollar	5.01	5.04	5.73
Deutsche Mark	3.45	3.33	3.42
Yen	0.15	0.44	0.74
Sterling	6.05	6.27	5.75

(a) Expected rates as implied by futures contracts.

rise by less than 1% in 1996; wage settlements in the first half averaged under 2%—well under last year's 3.5%.

Eleven of the 15 EU countries recorded inflation rates between 1% and 3% in April 1996, the latest month for which national data are available, with only Greece, Italy and Spain above 3% and Finland below 1%.

In the United States, by contrast, there is growing evidence that inflation has ticked up somewhat in recent months. Consumer prices in May were 3% up on a year earlier, compared with 2.7% in February. On the three-month annualised measure, moreover, consumer price inflation was 4.5% in May. The three-month annualised increases in producer prices and average earnings in the United States in May were also higher than the six-month annualised and twelve-month changes. Against that, productivity gains and reductions in the costs of health care plans meant that unit labour cost increases remained moderate.

There is a marked divergence between inflation rates at different stages of the supply chain. Chart 6 shows that annual inflation in crude goods was above 12% in May. But this has not, so far, translated into higher inflation in final goods prices. Indeed, the rate of increase in prices of finished producer goods remains below consumer price inflation, suggesting little upward pressure on consumer prices.

Perhaps the more serious upside risk to inflation comes from the possibility that growth will continue above trend during 1996, resulting in wage pressures as the labour market tightens. By mid-1996, employment had been growing at a rate of about 2% for a year or so; and unemployment fell to 5.3% in June, its lowest for six years. An increase in hours worked was further evidence of a tightening labour market. This potential inflation risk may be one reason for the recent rise in bond yields (see Chart 7).

In Japan, the combination of robust growth in the first quarter and a lower exchange rate than in 1995 seems to have reduced the likelihood of continued price deflation. In April, the core measure of consumer prices, which excludes food, was 0.2% higher than a year earlier, though this measure probably overestimates prices.

#### Interest rates remained on hold in the G3 countries

With activity if anything strengthening and the inflation outlook reasonably benign, official interest rates in the G3 countries at the time of going to press had not been changed since publication of the May *Quarterly Bulletin*. The round of easing in Europe continued over the period under review, however, with France, Denmark, the United Kingdom, Spain and Sweden all trimming interest rates over the period. The Bank of Italy cut its discount rate from 9.0% to 8.25% in July, amid indications that core inflation was below 4%.

For the G3 economies, market expectations at the end of June were that the next movement in interest rates would be upwards (see Table C). Implied forward short-term interest rates for the United States increased sharply in June, although interest rate expectations have been creeping up gradually throughout 1996. In Germany, the level of interest rates expected in September 1996 fell during the first quarter, only to rise again in the second. In Japan, the

#### Chart 8 Ten-year government bond yields







Chart 10 Average money growth in the M6



December 1996 and March 1997 interest rate futures contracts at end June suggested market expectations of a tightening of monetary policy at end-1996/early 1997.

Long-bond yields in the United States and Japan have risen since the start of the year (see Chart 8); bond yields in France and Germany have also increased slightly since May but in these two countries there was a more pronounced rise in interest rates at the short end of the yield curve. Ten-year bond yields in Italy, by contrast, fell by more than 125 basis points from the beginning of the year, reflecting falling inflation and confidence in the new government. Yields on UK bonds also fell relative to yields in the G3.

Part of the explanation for the changes in bond yields may be changes in uncertainty. As Chart 9 shows, in Italy, implied bond market volatility fell sharply in the second quarter, suggesting that uncertainty had decreased; this may have been a factor in yields falling.

In France and Germany, long and medium-term bond yields converged in May, following a progressive narrowing of the differential during the year. The spread over German bonds of most other EU countries also fell noticeably in the first half of 1996, possibly reflecting growing confidence in financial markets that EMU will proceed on track. But the pattern of implied ten-year forward nominal short-term interest rates is rather different: on this comparison the UK/German differential was only about 40 basis points at end-June compared with around 150 basis points on the bond yield comparison. The narrower differential reflects the fact that bond yields are heavily influenced by interest rates in the near future, which are likely to be higher in the United Kingdom than in Germany for cyclical reasons. Differentials in implied ten-year forward nominal short-term interest rates between Italy, France and Germany are also low. By contrast, there is no evidence of expected future interest rate convergence between Germany and either the United States or Japan.

## Money in the M6 economies

#### Broad money

Average broad money growth in the M6 economies accelerated in the first five months of the year, which may presage stronger GDP growth. The increase over a year earlier was 4.8% in May, compared with 4.3% in December 1995, thus continuing the sharp upward trend that began in April 1995 (see Chart 10). A considerable part of the increase in broad money since the start of 1995 has been driven by credit expansion, with consumer credit being particularly strong in the United States. As noted in previous *Quarterly Bulletins*, broad money velocity has fallen in most G7 countries over the past two years.

In the United States, both M2 and M3 growth remained strong, with the former increasing by 5.3% a year in May—above its monitoring range of 1%–5%. German M3 was also well above its target range in the first five months of the year after a year of slow growth

(see Chart 11), but the Bundesbank attributed much of this to flows into 'special savings' products such as new savings schemes with

Chart 11 German M3 growth



escalating rates of interest, which are included in the definition of M3. Monetary capital formation, which is outside M3, has been fairly volatile over the period, languishing in the first quarter, but picking up after the cut in official rates in April. Consequently M3 growth slowed in May.

In Japan, the annual growth rate of broad money (M2 plus CDs) picked up slightly in May, but at 3.3% remained moderate. The rise in May possibly reflected the effect of slightly higher interest rates on CDs. Broad money growth in Italy also picked up in May, to 3.8%; as in Japan a slight increase in deposit rates may have been the underlying reason. In France the annual rate of growth of M3 fell sharply from 5.1% in Q4 1995 to only 1.8% in May.

#### Narrow money

Narrow money growth in the G7 countries has also been accelerating since its trough in April 1995. Within the M6, Japan continued to have the highest annual rate of growth of narrow money at 15.4% in May, but growth rates in Germany and Canada also accelerated in the first five months of the year.

Following a similar pattern to 1995 Q4, currency in circulation continued to slow down in Canada and the United States. The increased use by US banks of sweep accounts to reduce their reserve requirements may explain the negative growth rate of M1. Without these sweep accounts, M1 would have increased by 1% in 1995.

In Germany, currency in circulation accelerated to an annual growth rate of 6.1% in May, while M1 grew at an annual rate of 10.4%. The strength of narrow money may signal a recovery in activity later this year, and is also consistent with Bundesbank forecasts of a continued increase in Deutsche Mark circulation in eastern Europe.

In Japan, M1 continued to accelerate quickly to an annual rate of 15.4% in May, compared with 12.9% in 1995 Q4. The strength of M1 reflects Japanese monetary policy; since September last year the Bank of Japan has held the official discount rate at 0.5% in order to prevent a deflationary spiral and to stimulate economic recovery led by private demand.

In Italy, narrow money contracted and continued the slowdown recorded since early 1994. An increasing interest differential between Treasury bills and current account deposits, and subdued activity were two factors behind the recent slowdown.

#### **Fiscal policy**

The weakness in activity in Europe at the start of the year led to a deterioration of the fiscal positions in France and Germany, relative to budget plans. In May, the German Council of Experts forecast that tax revenues in 1996 would be DM 21.7 billion less than originally assumed in the 1996 Tax Law and Budget. About half of the shortfall was attributed to weaker output, and half to higher than expected uptake of tax reliefs in eastern Germany. In response, the Finance Ministry announced savings which should be sufficient to cover the projected DM 11.8 billion shortfall in the Federal government sector this year.

There is more uncertainty about whether the Länder government

and social security deficits can be held to target this year and next. The 1997 proposed budget package envisages some DM 70 billion of expenditure cuts; DM 25 billion in each of the Federal government and Länder sectors, and DM 20 billion on the social security fund. These proposals have yet to be agreed, and it has not yet been determined where savings outside the Federal government sector will be made. The Bundesbank monthly report for June said that 'the overall public sector deficit might expand this year to approximately 4% of GDP. The deficit ratio would therefore overshoot the ceiling laid down in the Maastricht Treaty even more than it did last year, and the maximum debt level (60% of GDP) is likely to be exceeded slightly'.

In France, figures published for the first quarter of 1996 showed a sharp deterioration in the government deficit, as expenditure rose while revenues fell. The 1997 draft state budget, announced in May, proposed holding government expenditure in 1997 to 1996 levels in cash terms, implying a cut of 2% in real terms. This is considerably tougher than the 1996 budget, which envisaged a freeze in real terms between 1996 and 1999. The 1997 draft budget also assumes that the social security deficit returns to balance in 1997.

In June, a month after its formation, the new government in Italy announced a mini budget to bring 1996 public finances back on track, as the growth forecast of 3.0% for 1996, on which the original budget was made, had come to look too optimistic. (By mid-year, most forecasters were predicting growth of around 1.2% for 1996.) The mini budget contained measures to achieve savings of 16 trillion lire (0.8% of GDP). The reduction in long-term Italian interest rates noted earlier will also have a beneficial effect on public finances.

# **Financial market developments**

- Prices in most major financial markets either showed little variation in the quarter, or inched upwards.
- US equity prices shrugged off speculation that they might fall sharply in the quarter.
- Over-the-counter (OTC) derivative volumes rose, in contrast to exchange-traded derivative volumes.

### Background

Overall market conditions in the second quarter can be described as 'trading in a range'-in other words, there was no major turbulence or radical change in market expectations, and price movements were relatively limited. The foreign exchange markets were more settled than usual, although the Deutsche Mark weakened against the dollar. Price movements in bond markets were also relatively restrained, although market participants became concerned that the prospect of stronger growth in both the United States and Japan later in the year might lead to rises in official interest rates. There were also concerns about overvaluation of US equities but the widely anticipated falls did not occur until July. The S&P index rose by 4% over the quarter. In Japan, the Nikkei 225 rose by a similar amount but, in contrast, the FT-SE 100 lost early gains and ended flat over the period.

In the derivatives markets, the OTC segment seems to have grown far more rapidly than the exchange-traded derivatives markets through 1995 and in the first half of 1996. This may reflect changes in the underlying structure of participation in derivatives markets with firms active in OTC portfolios and so having less recourse to exchangetraded products.

The stability of the bond markets (see Chart 1) was, in part, a reflection of the stable macroeconomic environment: short-term official interest rates in two of the three major regions remained the same. The Federal Reserve did not change short rates during the quarter, but with the publication of data indicating stronger growth in the US economy, prices in the US Treasury market drifted lower. The economic data, particularly the increase in non-farm payrolls reported on 7 June, led market participants to expect a rise in short-term interest rates of 50 basis points (as priced into the implied forward curve) by the autumn. The 30-year long bond traded as high as 7.193% in mid-June, but ended the quarter at 6.872%. In Japan too, rates remained unchanged; but bond prices were sensitive to market interpretations of official signals about when the next interest rate rise might be. By contrast, in Germany the

#### Chart 1 Ten-year government bond yields



Bundesbank cut the discount and Lombard rates by 50 basis points on 18 April, which was followed by similar cuts in other countries including Belgium and Canada. Deutsche Mark weakness dampened investor sentiment toward the government debt of countries with currencies closely associated with the Deutsche Mark, but the high-yield group of European currencies benefited, with the Italian BTP/German bund spread on a downward trend over the period. The long end of the Italian curve has been the best performing bond sector in the world since the beginning of the year<sup>(1)</sup> as investors also reacted positively to the election of the new government. In the United Kingdom, the authorities surprised the markets with a cut of 25 basis points in official rates on 6 June.

Emerging markets continued to be buoyant. The Salomon Brothers' Brady Bond index, which fell to 191 in March 1995 in the wake of the Mexico crisis, continued its steady rise and reached 312 in June, although there were some concerns in the market about credit risk after a state-owned Bulgarian bank defaulted.

Turnover was subdued in most of the bond markets, in part because of caution following losses sustained as a result of the bond market reversal in the first quarter. But the last

<sup>(1)</sup> Bloomberg EFFAS Italian 10+ years Total Return Index.

year has, overall, still been a good one for fixed-income investors (see Chart 2).

#### Chart 2





Market participants report that far fewer investors are putting on 'direction trades'—or positioning themselves for movements in interest rates generally—than in the past. Instead, many are becoming more focused in their risk taking. They eliminate much of the potential effect of rate changes on their portfolios by hedging, and concentrate instead on spread relationships or yield curve slopes, risks which they feel that they understand better.

Investors appeared increasingly to favour US dollar exposure in cash or bills over the quarter. Survey data<sup>(1)</sup> suggested that European investors increased the proportion of short-dated US debt in their portfolios during the period. The weakness of the Deutsche Mark may have been one reason, but professional investors may also have been reducing their US equity holdings, and substituting bonds and cash. Surveys of UK institutional investors and US mutual fund data suggest that institutional investors reduced their holdings of US equity—although retail inflows into equity mutual funds remained high. As the US equity market was seen as being fully valued, this may indicate that investors were positioning themselves for market falls.

#### **Bonds**

#### International issues

The second quarter saw strong gross issuance, whose patterns resembled the strong bull markets of last year—the higher-yielding issuers, particularly those from European and emerging markets, were well received by the markets. US and (particularly) Japanese official interest rates remain extremely low, so 'search for yield' remains a motivating factor for investors. The premium that must be paid by lower quality borrowers does not seem to move in line with the level of interest rates, so when rates are low the rates paid by such borrowers are more attractive to investors. There has been a sharp drop in the average maturity of international bond issues from the first to the second quarter

# Table A Total financing activity:(a) international markets by sector

\$ billions; by announcement date

	1994	1995 1996					
	Year	Year	Q2	Q3	Q4	Q1	Q2
International bond i	ssues						
Straights	320.2	378.4	91.9	100.2	97.7	146.7	124.6
Equity-related	35.4	24.1	7.6	7.7	5.8	12.2	15.1
of which: Warrants	117	67	0.7	15	22	11	3.6
Convertibles	22.7	17.4	6.0	6.1	2.6	4.1 9.1	11.6
Conventibles	23.7	17.4	0.9	0.1	2.0	0.1	11.0
Floating-rate notes	126.4	100.1	23.5	30.4	25.2	38.1	43.9
Total	482.0	502.6	123.0	138.3	128.7	196.9	183.6
Credit facilities (announcements)							
Euronote facilities of which:	196.8	293.3	70.3	68.8	64.6	101.5	94.0
CP (b)	36.4	50.3	8.9	6.4	18.6	23.3	30.6
MTNs	160.4	243.0	61.4	62.4	46.0	78.2	63.4
Syndicated credits	548.3	787.2	202.3	131.9	182.7	180.6	216.8
Total	745.1	1,080.5	272.6	200.7	247.3	282.1	280.2
Memo: amounts out All international	tstanding	g					
Bonds (c)	2.020.8	2.224.9	2.225.3	2.199.7	2.224.9	2.230.4	2.251.0
Euronotes (b)	378.7	595.2	517.1	555.8	595.2	647.5	710.9
of which, EMTNs	259.4	461.0	397.5	426.4	461.0	504.6	555.0
Sources: IFR, Euroclear,	BIS.						

(a) Maturities of one year and over. The table includes euro and foreign issues and publicised placements. Issues which repackage existing bond issues are not included. Figures may not add to totals because of rounding. Bond total includes issues from MTN programmes.

(b) Euroclear figures.
 (c) BIS-adjusted figures, including currency adjustment. Includes issues of fixed-rate bonds and floating-rate notes.

for most categories of borrower, from 6.6 to 5.9 years (the average for the past ten quarters is 6.1 years). This may be a reflection of increased uncertainty about the future course of interest rates, as the prices of shorter maturity bonds are less sensitive to rate changes than those of longer-maturity bonds.

Second quarter gross bond issuance was \$183.6 billion (see Table A), only slightly less than the very high first quarter figure of \$196.9 billion. Both of the first two quarters have a positive seasonal factor and on a seasonally adjusted basis they are even closer together at \$178.5 billion for the first quarter, and \$172.9 billion for the second. Part of the reason for this is that redemptions were unusually high during the first half of 1996 (see Chart 3), so refinancing accounts for some of the strength of issuance.

### Chart 3 Redemptions of international bonds



# Seasonality in international bond and syndicated credit markets

It is widely recognised that prices and quantities in financial markets may be subject to seasonal fluctuations.<sup>(1)</sup> Although these effects vary in magnitude they are often a substantial proportion of the unadjusted flows in primary debt and credit markets each quarter. Clearly, in interpreting changes in bond issuance or bank credits, it will be important to adjust for these factors in order to get a better view of the underlying changes in market activity from quarter to quarter.

Preliminary research at the Bank has used standard econometric techniques to decompose time series on primary bond and credit issuance into trend, cycle, seasonal and erratic ('noise') components.<sup>(2)</sup> Chart A shows the absolute value of the estimated seasonal factors for international bond issuance based



quarterly seasonal component



on a sample of quarterly data beginning in 1976. There have been some quite striking changes over time. Early in the sample—the mid to late 1970s -the seasonals were more evenly distributed between the first and second halves of the year-the former containing a seasonal boost to issuance and the latter a reduction. Over time, however, the effect seems to have become more concentrated in the first and final quarters of the year with much less seasonal effect in the second or third quarters. For example in the first quarter of 1995 an estimated 12% of the flow of international bond issues was seasonal while in the final quarter seasonal effects depressed issuance by around  $8^{1/2}$ %. So in broad terms the seasonal boost to issuance at the start of the year is roughly offset in the final quarter.

It is interesting to contrast these results with those for international syndicated credits, based on a sample of quarterly data beginning in 1976. Relatively speaking, the seasonal effects in credits have been much more stable and are substantially smaller in absolute terms over time. Although the unadjusted quarterly flows in credits are around half those in bonds, the average size of the quarterly seasonal component in syndicated credits is only \$582 million, several times smaller than the comparable figure of \$4,341 million in international bond issuance. The largest single effect in syndicated credits is a seasonal downturn in the third quarter which broadly offsets the combined upward effect in the first half (see Chart B).



- 4 1976 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95

In both credit and bond markets the simplest intuitive explanation for these effects is a link to corporate (and possibly fiscal) accounting years. The start of the year usually appears to see a burst of activity with a decline towards the end of the year. Of course these results do not indicate which way causation goes. The beginning of the accounting year may see issuers' demand for finance rise with the supply of funds from investors adjusting passively to this. Equally, investors' willingness to supply finds may be actively managed through the year; in the second half of the year, for example, issuers might choose to delay an issue in the expectation that investor demand will rise in the first quarter. An interesting further source of seasonality may be financial intermediaries' willingness to take on business at different points of the year.

See for example Fama, E (1991), 'Efficient capital markets: II', *Journal of Finance*, 46, pages 1,575–617.
 The results were estimated using a Kalman filter in the econometric package STAMP.

This quarter has seen a sharp rise (see Chart 4) in the proportion of international bond issues paying a floating-rate coupon (FRNs). Some borrowers wish to issue floating-rate debt because they need to finance floating-rate assets, and conversely some issuers like to buy FRNs because they have floating-rate liabilities. However, the size of these groups is unlikely to be much affected in the short term by market conditions. The current, rather unsettled markets are attractive for investors and issuers who take the view that the current yield curve and/or swap rates do not fully reflect their view of future interest rates. Such people can either issue or invest in FRNs if they take the view that future interest rate changes are not fully reflected in the price, or they can use the swap markets to acquire or dispose of floating-rate liabilities. As with all markets, the level of activity depends to some extent on different participants taking different views.

#### Chart 4





#### Asset-backed securities

There has been a record volume of international asset-backed security<sup>(1)</sup> (ABS) issues over the past year, which is a continuation of a longer-term trend. Gross issuance this quarter was \$26.2 billion, compared with \$32.6 billion in the whole of 1995.

It was not until the last quarter of 1994 that the number of issues in this market exceeded 15. This quarter, there were 43. There has been a superficial shift in the composition of issuers from financial institutions to corporates, but this does not reflect a change in the nature of the borrowing activity as industrial and commercial companies often issue through wholly-owned financing vehicles (which are nominally financial companies). In either case the real borrower is the originator of the underlying assets. It remains the case that international ABS is predominantly US borrower, US dollar-denominated paper. Market growth has been motivated by a growth in the corresponding domestic market in the United States and by an acceptance of the instrument by international investors (domestic ABS in Japan have only been authorised this year).

(1) Asset-backed securities do not include mortgage-backed securities here.

#### Currency of issuance

Among the G3 currencies, which always account for the majority of eurobond issues, the dollar appreciated against the Deutsche Mark, and traded in a range against the yen. The dollar's share of gross international issuance rose to 47% this quarter, up from 37% in the same quarter last year (see Table B). The yen's share fell over the same period, from 23% to 14%. Deutsche Mark-denominated bonds'

#### Table B

# Currency composition of international bond issues

Per cent							
	1994	1995				1996	
Currency denomination	Year	Year	<u>Q2</u>	<u>Q3</u>	<u>Q4</u>	Q1	Q2
US dollar	38.4	39.2	36.7	40.8	42.2	38.8	47.4
Yen	17.2	18.4	22.8	19.1	17.2	11.9	14.1
Deutsche Mark	10.9	13.9	16.4	11.7	15.0	16.0	9.2
Sterling	6.5	4.3	4.0	3.5	4.3	7.5	5.9
French franc	5.4	2.7	2.9	1.7	2.3	5.8	6.4
Swiss franc	4.5	6.1	5.8	6.8	5.3	4.5	3.3
Italian lira	3.6	2.4	1.6	1.5	1.7	2.8	4.4
Ecu	1.6	1.8	0.2	2.7	0.2	0.8	0.2
Other	11.9	11.2	9.6	12.2	11.8	11.9	9.1
Total (US\$ billions)	482.0	502.6	123.0	138.3	128.7	196.9	183.6
Source: IFR Omnibase.							

share of issuance, which has fluctuated somewhat during the past year, fell sharply this quarter to 9%, from 16% last quarter. The French franc share continued to recover from its low of 1.7% in the third quarter of last year, when it reached 6.4% this quarter.

#### Sterling issues

Sterling's strength (even after the 25 basis point cut in UK official rates on 6 June) and attractive yield spreads over European bonds, notably against German short dates, led to increasing demand for sterling assets over the quarter. This encouraged further substantial issuance of sterling bonds, many of which were targeted at continental retail investors. Total fixed-rate issuance in the quarter was £4,833 million, of which £2,575 million was short-dated, £1,478 million was medium-dated, and £780 million was longer-dated, including two perpetual issues of £100 million each. Almost all of the fixed-rate issuance, totalling  $\pounds4,753$  million, was in Eurosterling form, with just one domestic debenture issue for £80 million.

There was a broad range of fixed-rate issuers, almost half of which were overseas. UK corporations raised £1,328 million in short and medium maturities, while issues of longer-term bonds were favoured by UK financial institutions, including 10 and 25-year issues for the Halifax and a 20-year issue for Commercial Union. Halifax's £300 million 25-year subordinated debt (ranking as Tier 2 capital) was particularly well received—the issue was oversubscribed and the spread over gilts narrowed sharply in secondary market trading—reflecting built-up demand from institutions for strongly rated issuers after a lull in supply of longer-dated paper. Overseas issuance was predominantly in short-dated paper for European banks but other issuers included overseas sovereigns, corporates and other public sector bodies. Brazil's £100 million three-year bond was the first Latin American credit since Pemex in 1993.

With the uncertainty over the direction of UK and overseas interest rates continuing, floating-rate note issuance was also substantial in the second quarter at £2,359 million. FRN issuance is normally dominated by bank and building society names but, with spreads tightening on such paper, a wide range of issuers, both UK and overseas, was warmly welcomed by FRN buyers eager to pick up Libor-plus yields. Four of these issues were structured, giving the issuer a call or step-up option after a certain period, so as to allow a play on the steepness of the UK yield curve. FRN issues in the quarter also included £309 million of asset-backed securities, variously secured on mortgages, car and consumer loans. As with international issues (see above), sterling asset-backed securities have been growing owing to the tightening of credit spreads and increasing investor participation.

Despite the abundant supply of sterling issues, demand for sterling paper saw secondary market spreads over gilts narrow over the quarter, as narrower spreads in short-dated issues fed through to longer-dated paper. Indeed, certain sovereign issues have traded through gilts. Demand related to corporate bond PEPs continued through April but subsequently slowed. However, the market was also supported by bond buy-backs by SBC Warburg (of its 9% perpetual) and New Zealand (of its 2008 and 2014 bulldog issues).

Total outstanding sterling commercial paper fell to  $\pounds 6.7$  billion by the end of the quarter,  $\pounds 555$  million lower than the revised end-March level of  $\pounds 7.3$  billion. Outstanding sterling medium-term notes rose by  $\pounds 765$  million to stand at  $\pounds 17.9$  billion at end June.

### ECU issues

In the United Kingdom, regular monthly tenders of ECU 1 billion of Ecu Treasury bills continued during the second quarter of 1996, 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 strongly oversubscribed, with issues being covered by an average of 2.1 times the amount on offer, compared with an average of 2.4 times during 1995. Bids were accepted at average yields between 4 and 11 basis points below the Ecu Libid rate of the appropriate maturity. There are currently ECU 3.5 billion of Treasury bills outstanding which have been sold to the public. Secondary market turnover in the second quarter averaged ECU 2.1 billion per month, up from ECU 1.9 billion of average monthly turnover in the first quarter, but slightly lower than the ECU 2.2 billion average level in 1995.

On 16 April, the Bank of England reopened the Ecu Treasury note maturing in 1999 with a further tender for

(1) The instruments issued in the domestic market were Billets de Trésorerie.

ECU 500 million, raising the amount outstanding with the public of this note to ECU 1.0 billion. There was strong cover at the auction of 3.4 times the amount on offer and accepted bids were in a range of 5.29%–5.33%. The total of notes outstanding with the public under the UK note programme thus rose from ECU 5.0 billion to ECU 5.5 billion.

#### Samurai market

Although it is still small in absolute terms compared with the whole market for international bonds, gross issuance in the Samurai market has been very strong, reaching US \$9.5 billion this quarter. Chart 5 shows that this is double the level for the same quarter last year, and 2.5 times greater than the second quarter of 1994.

#### Chart 5 Gross Samurai issuance



The Samurai market has been a microcosm of the international capital markets more generally over the last couple of years. The search for yield has been particularly strong from Japanese retail investors because absolute government bond yields have been lower there than in the other major economies. There has been strong demand for high yielding assets such as emerging market bonds (though surprisingly, emerging markets share of Samurai issuance has remained stable since the second quarter of 1994, at around 45%).

### Note markets

EMTN markets continued to be active, with issuance of \$63.4 billion. Commercial paper (CP) announcements have surged over the past three quarters, reaching \$30.6 billion. This quarter saw some large CP issues from Cades, the French body set up to refinance social security debt. It issued CP in the French domestic market,<sup>(1)</sup> euromarkets, the US market and set up a global commercial paper programme—all of which totalled FFr101 billion.

#### Borrowers

While government bonds dominate domestic markets, banks and (non-financial) corporates are the biggest classes of

borrower in the international and eurobond markets. Banks are the biggest borrowers in the eurobond market—their share of gross eurobond issuance has risen this quarter to 41%, up from 33% a year ago—but corporates predominate in the foreign bond markets. Adding together eurobonds, global bonds and foreign bonds, banks accounted for 39% and corporates for 35% of issuance this quarter. German banks, which have been by the far the largest bank issuers for some time, made up 37% of gross eurobond bank issuance.

### Emerging markets

Emerging market issuance was strong this quarter, as it has been since the middle of 1995. The resurgence of emerging market issuance so soon after the December 1994 Mexican Peso crisis surprised some. However, two factors explain the resurgence. First, with nominal yields so low in the major markets, the higher yields offered by emerging markets were attractive to investors, despite the higher risks that they entail. This effect will weaken if, as macroeconomic data suggest is likely, interest rates in the G3 rise. Second, there has been an increasing differentiation between emerging markets, with perhaps more attention paid to economic fundamentals. As with the euromarkets in general, an additional reason for high gross bond issuance in this sector in the first quarter is the high redemption levels of this year, when \$12.4 billion of Latin American eurobonds alone will mature. The picture has not been uniformly rosy for emerging market issuers. The Mexican Brady bond swap was highly successful, but South African Rand-denominated assets did not perform as well as some others.

Central and eastern European countries continue to develop their access to the markets. The region issues far less debt than Latin America, and the series is volatile, varying (quarterly) between zero and 17% of emerging market issuance over the last three years. However, these countries are increasingly accessing international capital, for example Romania issued its first eurobond during the quarter. A number of corporates from the region are planning substantial equity issues in the second half of the year, and with the launch this year of several new equity funds dedicated to the region there is likely to be substantial demand for such issues. The performance of this region's debt has not been uniformly good though, reflecting the wider emerging market situation: for instance, an 80% state-owned Bulgarian bank defaulted on a Samurai issue. It may be some time before we can see how this will affect investor attitudes to other emerging market assets.

A number of structural and regulatory developments have accompanied the market development of central and eastern European assets. IBCA and S&P promoted Poland to investment grade this quarter. This follows recent upgrades for the Czech Republic and Slovenia. Also, the Czech authorities passed laws reforming the regulatory structure of their markets, with stricter rules on disclosure and greater protection for minority shareholders. International capital is needed in this region to supplement domestic capital in order to finance high growth, and so there is a strong incentive to liberalise capital markets along G7 models (the Czech Republic, Poland and Hungary all joined the OECD this quarter). Indeed, some countries have been so enthusiastic about setting up safe capital markets that they may have overregulated. The Warsaw stock exchange is one institution that is simplifying regulations, such as those governing disclosure.

# Benchmarking in the global bond markets

Investors usually price bonds in reference to a baseline, or 'benchmark', because a relative price rather than an absolute one gives them the additional information they need, given their existing knowledge of what underlies the benchmark price. This is normally a bond issued by a high-quality borrower (ie with little or no credit risk), although an index of such bonds can serve the same purpose. One of the most commonly used is the US Treasury bond. So if a ten-year corporate Yankee yields 9% and a ten-year US Treasury bond yields 7%, the Yankee's yield is '200 basis points over Treasuries'. In this example, 200 basis points is a good proxy for the default risk of the corporate. 1996 has seen a number of new assets which will serve as benchmarks and facilitate the pricing of issues in their sector.

- The French Trésor has launched a constant maturity price index which will help all issuers price and issue mid-curve debt. The TEC10 index (Taux de L'Echeance Constante Dix Ans) gives the yield on a theoretical ten-year French Treasury Bond ('OAT'). There is a US equivalent—the Constant Maturity Treasury. The issuance of a floater paying the TEC10 earlier this quarter will reinforce the index as a benchmark.
- The US authorities plan to issue inflation index-linked bonds before the end of the year. These should provide a global benchmark for real interest rates.
- One effect of the German authorities' decision to increase issuance of short-term debt will be to deepen that part of the yield curve, making it a better reference rate (though there is currently a large amount of government debt outstanding with a short residual maturity).
- In August 1995, the Asian Development Bank issued a seven-year Taiwanese dollar bond, and were quite explicit in their motivation: 'There is no doubt we would like to develop a yield curve in the Taiwan dollar market'. This is an increasingly common strategy for emerging market authorities who want to facilitate borrowing in new markets or at longer maturities.

# **Developments in international banking in 1995**

This box summarises developments in international banking in 1995: the first section looks at global trends, as revealed by quarterly statistics published by the Bank for International Settlements (BIS); the second section focuses on developments in the UK market, using the Bank's own data.

#### Banking business within the BIS reporting area<sup>(1)</sup>

International lending by banks in the BIS reporting area grew at a faster rate in 1995 than in the previous two years. It rose by \$652 billion<sup>(2)</sup> (8%), to an outstanding stock of \$9,224 billion<sup>(3)</sup> (see Chart A). Almost half of the increase in business occurred during the first quarter and was related to the turbulent condition in foreign exchange markets. Lending between banks accounted for \$6,347 billion (69%), an increase of \$405 billion (7%) compared with 1994. In contrast to the previous year's fall, lending to non-bank end-users increased by \$247 billion (10%).



#### BIS area banks' business with non-BIS reporting countries

Lending to countries outside the BIS reporting area rose for the fifth consecutive year, and at a stronger rate than in previous years (see Table 1). The developing economies of the Asian region were again the main recipients of the new lending. An increase of \$84 billion to that region was dominated by increased lending to Thailand and South Korea of \$36 billion and \$22 billion respectively. There were also large increases in lending

#### Table 1

#### Lending to, and deposits from, countries outside the **BIS reporting area**

\$ billions							
Exchange rate adjusted flows							
	1991	1992	1993	1994	1995	end-1995	
Total lending	7	66	11	37	108	994	
of which:							
Developed countries	—	7	5	-1	24	189	
Eastern Europe	-1	4	-4	-13	3	87	
Latin America	-1	15	3	2	7	237	
Middle East	-8	16	-5	3	-7	75	
Africa	-4	-1	-2	-2	-3	38	
Asia	21	26	15	48	84	368	
<b>Total deposits</b>	-12	13	-18	75	92	896	
Developed countries	-3	11	10	22	23	177	
Eastern Europe	1	10	3	2	9	47	
Latin America	-2	-2	-7	21	35	194	
Middle East	-12	-7	-20	3	9	204	
Africa		3	_	3	-1	42	
Asia	4	-1	-4	23	18	232	
Source: BIS.							
Totals may not sum due to re	undings						

to China (\$10 billion) and Indonesia (\$9 billion). Lending to non-BIS area developed countries also rose significantly (by \$24 billion), with Portugal and Greece being the main recipients of this new lending (\$8 billion and \$5 billion respectively).

Deposits from countries outside the BIS reporting area also continued to increase strongly during 1995, by \$92 billion. The increased deposits were mainly from Latin America (\$35 billion), non-BIS area developed countries (\$23 billion) and Asia (\$18 billion). Within these regions notable increases were reported from Brazil (\$22 billion), Portugal (\$7 billion), Argentina (\$5 billion), Mexico (\$4 billion) and Thailand (\$4 billion).

#### Analysis by nationality of bank

Although Japanese-owned banks remained the largest lenders of funds within the BIS reporting area, with 24% of international bank assets (see Chart B), their market share fell (from 27% in 1994). German-owned banks, the second largest group in terms of international business, increased their share to 17% from 15% in 1994. British-owned banks' share of business remained at 5%.

### Analysis by centre and currency

The United Kingdom retained its position as the leading centre for international bank lending (comprising foreign currency business within the United Kingdom as well as cross-border claims) during 1995. Outstanding

The BIS reporting area comprises: Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom and the United States within the industrial area; and the Bahamas, Bahrain, Cayman Islands, Hong Kong, Singapore and Netherlands Antilles as offshore centres. Changes are adjusted so as to remove the effects of exchange rate movements on amounts outstanding. So changes are not simply the difference between the stock data figures for two periods. Stock data are translated to dollars at end-year exchange rates; appreciation of a currency against the US dollar will therefore increase the value of forein currency assets when converted into dollars. (1)

<sup>(2)</sup> 

<sup>(3)</sup> the value of foreign currency assets when converted into dollars



cross-border loans by banks located within the BIS industrial area amounted to \$6,156 billion at the end of 1995; as Chart C illustrates 22% of this was lent by banks in the United Kingdom (\$1,350 billion, up by 13% compared with 1994).

#### Chart C

**Chart B** 

# Cross-border lending transacted by banks within the BIS industrial area<sup>(a)</sup>



The amount of foreign currency lending in the United Kingdom also increased, by \$30 billion to \$353 billion. Within the BIS industrial area, cross-border lending in Japanese yen increased strongly for the second consecutive year (by \$158 billion or 21%). Cross-border lending in French francs and Deutsche Marks rose by \$46 billion (19%) and \$22 billion (3%) respectively, in each case following falls in the previous year. Lending in ECU continued to fall (by \$14 billion or 9%).

# Analysis of international business by banks in the United Kingdom

Cross-border lending by banks located in the United Kingdom rose for the fourth consecutive year but at a slower rate than in 1994 (see Table 2). German-owned banks remained the most active (their business increased by \$40 billion). American and French-owned banks'

#### Table 2

#### External lending of banks in the United Kingdom \$ billions

	Exchange rate adjusted flows					
	1991	1992	1993	1994	1995	end-1995
By country						
BIS reporting area	-44	78	36	89	74	1,143
Outside reporting area:						
Developed countries	-1	3	1		11	45
Eastern Europe	-3	-2	-1	-2	2	10
Latin America	2	-1	3	-1	-4	24
Middle East	-2	3	1	1	1	14
Africa	-1	_	-1	-1	—	4
Asia	1	3	2	3	4	26
Other	3	-3	15	13	-9	84
Total	-45	81	56	102	79	1,350
of which:						
By currency						
US dollar	-52	38	-10	67	7	572
Deutsche Mark	-5	32	18	11	19	228
Sterling	-10	25	15	1	7	112
Yen	-30	-31	-12	8	30	106
ECU	1	4	3	-9	-2	38
By nationality of bank	(a)					
Japanese	-57	-44	1	11	-29	243
British	-3	24	44	-2	4	217
German	5	33	23	46	40	271
American	2	4	7	27	16	148
Italian	2	4	-9	-1	-1	72
French	2	13	-1		13	60

Totals may not sum due to roundings.

(a) Nationality flows only relate to monthly reporting banks, whereas other figures include quarterly reporting banks and some other financial institutions.

business also increased while Japanese-owned banks' business fell for the first time in three years. British-owned banks' business increased slightly following the previous year's fall. Transactions in yen rose strongly (by \$30 billion or 28%). Lending in Deutsche Marks also rose (by \$19 billion or 8%). As in recent years most of the new funds were lent to countries in the BIS reporting area (up \$74 billion), and to Germany in particular (up \$31 billion) in 1995. Lending was comparatively strong to non-BIS area developed countries (up \$11 billion), most notably to New Zealand (\$2 billion), while lending to Asian countries continued to increase (up \$4 billion). Banks in the United Kingdom continued to increase the amount of business they undertook with countries in the European Union in 1995. Lending to EU countries rose by \$43 billion (9%), almost the same amount as in the previous year, and again mainly attributable to Germany, while deposits from EU countries rose by \$13 billion (3%), only half the rate of the increase in 1994.
#### International syndicated credits

Syndicated credit announcements have risen and spreads are reported to have stopped falling. Announcements this quarter totalled \$216 billion, up 20% on last quarter, but only 7% higher than for the same quarter last year. Syndicated credit announcements have also risen relative to bond issuance: loan announcements were 92% of bond issuance last quarter, but 118% this quarter. This has occurred despite issuers and investors substituting floating-rate bonds for syndicated credits (these loans are almost always priced on a floating-rate basis).

Of the syndicated credits announced this quarter, 64% were denominated in dollars, down from 84% in the second quarter of last year. Sterling and the French franc have gained ground, together making up 24% of this quarter's announcements, up from 6% in the same quarter last year. The change in currency composition was mirrored in changes in the nationality of borrowers. Over the past ten quarters, US borrowers have made up 55% of all borrowers, but only 40% this quarter. British and French borrowers have averaged 13% of borrowers over the same period, but almost doubled their representation to 24% this quarter. French borrowing was boosted by Cades' FFr40,000 million (US \$7.8 billion) loan.

Chart 6 shows size-weighted spreads on syndicated loans to US borrowers. The picture is far from clear, but there is little evidence for a continuation of a downward trend. The general low level of spreads is indicative of the degree of competition in this market, and also of the fact that, for many banks, this business is to some extent a loss-leader which they attempt to use to gain more profitable business in other areas.



## **Equity markets**

#### Prices

Despite widespread speculation that US equity markets were due for a correction, prices continued to rise during the second quarter. The Standard and Poor's 500 index rose by 3.9% (see Chart 7); technology stocks were particularly



strong, as indicated by a rise of 7.6% in the NASDAQ composite index. Strong earnings reports, particularly from NASDAQ companies, underpinned prices. By the end of the second quarter, the S&P index had risen by nearly 9% after a rise of over 34% in 1995 but equity prices became increasingly vulnerable to increases in bond yields over the second quarter. Latin American equities, helped by the growing US market but further boosted by their own improving economic prospects, rose strongly over the quarter, the Brazilian equity market climbing by 22% and the Argentinian market by 19%.

The Japanese equity market continued its upward momentum during the second quarter, to achieve levels last reached four years ago. The Nikkei index rose by 5.3% over the quarter. There was little evidence of sustained selling pressure despite continued concern over the state of the Japanese financial sector, and buying was fuelled later in the quarter by a strengthening in the dollar against the yen, with support from foreign investors evident. Taiwanese equity prices climbed nearly 30% during the quarter, with strong foreign demand a major contributing factor, and Indian equity prices rose by 13%; other Asian markets, however, were relatively subdued.

The UK equity market continued to be influenced by political uncertainties, the FT-SE 100 index rising only 0.3% between the end of March and the end of June. Takeover speculation, very much a feature of recent months, waned slightly in the spring; though utility stocks were in focus. Early in the quarter, as the New York equity market

## The alternative investment market

In the twelve months since the alternative investment market (AIM) went live, on 19 June 1995, the number of companies traded has increased from 10 to 166 (see Chart A).



After just six months AIM had reached a critical mass of 121 companies; however, at least two thirds of these were previously traded on Rule 4.2—the Stock Exchange occasional deal facility—and were, therefore, non capital raising introductions. While only one in ten of the companies joining AIM in its first six months raised capital on admission, two thirds did so in the second six months (see Chart B). While the transfers from Rule 4.2 may have disguised the true level of activity on the market, it did give the market a valuable momentum which appears to have continued.

Not surprisingly, turnover on AIM has increased month on month as the number of companies trading has grown (see Chart C). However, turnover velocity (turnover as a percentage of market capitalisation) has increased over the last twelve months, indicating an increasingly liquid market. If turnover in May is annualised, annual velocity on AIM is 62%, which compares favourably with the USM where annual velocity in 1982 was 56% (turnover velocity peaked in 1987 at 80%). The increasing liquidity on the market has attracted more firms to make markets in AIM stocks.

### **Chart B Admissions to AIM** Non capital raising Capital raising Companies \_ 50 - 45 - 40 - 35 - 30 - 25 - 20 - 15 -105 0 July Aug. Se 1995 Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June 96

The increasing number of firms willing to make markets in AIM stocks is encouraging for this market. From only three registered market-makers at its inception, there were eight by the end of May. 63% of AIM companies now have at least two market-makers quoting prices for their stocks.



The increased capital-raising activity and liquidity levels on the market indicate the increasing maturity of AIM which has consolidated its strong start. While it is still too early to say with confidence that AIM could overcome a downturn in the market or economy, as it becomes more established it is in an increasingly strong position to overcome any such disturbances. weakened, there was reported to be some switching of funds out of the United States and into the United Kingdom, helping to drive the FT-SE to a record high of 3857.1 on 19 April. But the cut in UK base rates on 6 June was not widely expected and equity prices responded in a muted manner, with traders worried that the move had been politically, rather than economically, motivated. Prices drifted lower toward the end of the quarter.

All of the other European equity markets, less restrained by political uncertainties and assuming a better chance of interest rate reductions, were stronger than the UK market. The Italian equity market showed particular strength, the Comit index rising by 13.2% over the quarter as a new government, in which the financial markets had confidence, was appointed. The German equity market rose 3% in low turnover, helped by a 50 basis point reduction in the discount and Lombard rates on 18 April, and with exporters boosted by a weakening in the Deutsche Mark against the dollar. The stronger dollar helped the French equity market too, the CAC 40 index rising by 3.9% over the quarter. The Netherlands market reached a series of record highs, rising by 5.4%. Scandinavian markets continued to show strong rises, underpinned by foreign investor interest.

#### Turnover

Equity market turnover, which has seen large increases in recent quarters, continued to rise worldwide in the first quarter of this year (see Chart 8). US turnover increased very sharply, with the value of equities transacted on NASDAQ nearly double that of the first quarter of 1995 and New York Stock Exchange turnover up by two thirds. Turnover of domestic equities on the London Stock Exchange in the first quarter was 20% higher than for the first quarter of 1995. Turnover of equities in Tokyo increased by 35%. Continental European equity markets continued to increase their volumes substantially, with Swiss

#### Chart 8

## Turnover of domestic and foreign equities on major stock exchanges<sup>(a)</sup>



<sup>(</sup>a) Turnover in the first quarter of year indicated

turnover particularly striking, more than doubling between 1995 Q1 and 1996 Q1. But this does not appear to have been at the expense of London where foreign equity turnover rose by 40%.

Turnover of equities on Tradepoint totalled £64 million in the second quarter, compared to £86 million in the first. This represents only 0.1% of UK customer equity business.

### **Equity issuance**

#### International

International equity issues increased in the second quarter of 1996, in contrast to the low level of issuance activity in 1995 and a relatively quiet beginning to the year; although at \$11.9 billion in the first quarter of 1996, international equity issuance was more than double issuance in the corresponding quarter last year. High levels of institutional investor liquidity explain, in part, the oversubscribing of recent issues; and the full calendar in the first half of the year may be an attempt to tap that liquidity before it is absorbed by the Deutsche Telekom issue, scheduled for November this year. Almost all European governments are seeking to privatise state assets this year—including those that were withdrawn last year.

Latin American issuers appear to be taking advantage of the renewed investor confidence in emerging markets. However, there remains some evidence of caution on the part of issuers—offers have, for example, been quite heavily discounted—and investors, where interest appears to be coming from specialised Latin American funds.

### United Kingdom

In the second quarter of the year,  $\pounds 2.2$  billion was raised in further equity issues by UK companies, of which  $\pounds 1.6$  billion was raised in rights issues.

Eighty companies joined the Official List this quarter, of which 67 raised capital totalling £4.3 billion. Commentators have suggested that issuers are trying to bring their companies to the market before speculation about the election unsettles the stock market.

Thirty-nine companies joined AIM this quarter raising a total of  $\pounds 181$  million.

### Other developments

On 29 May, the London Stock Exchange issued a further consultation document, 'New electronic trading services —proposal for the introduction of a public limit order book', setting out its plans for an electronic order book for FT-SE 100 stocks. The Exchange proposes the introduction of Registered Principal Traders which would, like the current market-makers, take on obligations designed to ensure liquidity in the market; and that these traders should be exempt from stamp duty on all their transactions in UK equities. The Treasury issued a press notice on 23 May in which the Chancellor indicated his support for the principle of such an exemption but asked the SIB to advise him on what obligations would be appropriate.

## **Derivatives markets**

Turnover on the major derivatives exchanges in the second quarter of 1996 was generally lower than in the first quarter (see Chart 9). Rather than representing a downturn, however, this should be seen more as a reflection of the high level of exchange-traded activity in the first quarter of the



<sup>(</sup>a) Turnover in the major futures contracts listed on the CME, CBOT, LIFFE, DTB, MATIF and TIFFE.

year, which was associated with the short-term turbulence in the bond markets. Volumes on several exchanges in the second quarter showed some growth over the equivalent period in 1995.

Total volumes on the London International Financial Futures and Options Exchange (LIFFE) fell by 23% from the first quarter to the second, with declines evident in most contracts (see Chart 10). This was particularly apparent in the case of LIFFE's Bund contract, which saw a 31% fall, although it remained Europe's most actively traded bond

## Chart 10



contract. Volumes in the short-sterling and long-gilt futures contracts both declined by over 25%. However, open interest on LIFFE fell by only 2%, and increased on both the long-gilt and short-sterling contracts.

Turnover on the Deutsche Terminborse (DTB) fell by 29% from the first quarter to the second, whilst volumes on the Marché à Terme International de France (MATIF) fell by 25%. The DTB remains Europe's second largest derivatives exchange. Increasing numbers of firms have now installed remote DTB terminals.

In the United States, volumes on the Chicago Mercantile Exchange (CME) fell by 9%, while those on the Chicago Board of Trade (CBOT) fell by only 2%. The CBOT's small overall decline was in part attributable to the strong performance of its agricultural contracts during a period of irregular weather conditions, in particular during April.

In East Asia, turnover on TIFFE increased by a moderate 8%, although it was still over 20% lower than a year earlier.

The London Metal Exchange's (LME) copper market experienced great volatility in the latter part of the quarter, which was associated with the departure of Sumitomo Corporation's chief copper trader, Yasuo Hamanaka, and the announcement on 13 June of losses of \$1.8 billion—which Sumitomo attributed to unauthorised trading by Hamanaka. The sizable cash price premium over the three-month price (backwardation) led to suggestions that Hamanaka may have been attempting to manipulate the market. The three-month price of copper fell by 25%, between early May and early June. At the LME's request, the SIB has instituted a review of its markets and their regulation; investigations into Sumitomo's losses are also in train.

A number of Japanese exchanges, notably TIFFE, have now added their names to the Memorandum of Understanding, designed to promote improved information sharing, which 49 other exchanges and regulators had signed at the international regulators' conference at Boca Raton, Florida, in March.

As a move towards a full merger, shareholders of the London Commodity Exchange (LCE) voted unanimously to amend the exchange's constitution to allow LIFFE to purchase all LCE's shares; LIFFE also changed its Articles of Association at its AGM to allow the merger to proceed and a prospectus has now been issued.

The London Clearing House has also unveiled its restructuring plan in which ownership will transfer from six UK clearing banks to the clearing house's clearing members and the four exchanges for which it clears. The proposals will increase backing for the clearing house. Share capital will be increased from £15 million to £50 million; the £150 million back-up provided by the shareholder banks will be replaced by a £150 million Member Default Fund and an insurance tranche for £100 million, which is in place for three years initially. It is hoped that the new arrangements will be in place by October.

## **OTC derivatives markets**

Indications are that volumes in the OTC markets in the first half of 1996 were high when compared with 1995. This reportedly reflects a growth in activity by end-users—whose confidence in their understanding of these markets is gradually being restored—and favourable market conditions. There is said to have been a change in end-users' use of derivatives, from liability management to asset management. One factor behind this could be the low and stable interest rate and inflation environment.

The latest International Swaps and Derivatives Association (ISDA) survey suggested that the OTC derivatives market grew substantially in 1995. Notional amounts outstanding in interest rate swaps, interest rate options and currency swaps stood at \$17.7 trillion at end 1995, up 56.7% on the end 1994 figure. Turnover in these instruments also increased, totalling \$11.2 trillion in 1995, up 37.3% on the 1994 figure.<sup>(1)</sup> As a comparison to the growth in the OTC markets suggested by the ISDA survey, open interest in thirteen major futures contracts grew by 4.4% year on year to \$4.7 trillion at end 1995.

Most volume is still in plain vanilla products. The more complex 'structured products', which bore the brunt of end-user concerns about these markets, are increasingly tailored to the economic needs of the end-users rather than being standardised, and the core firms have increasingly sought to offer end-users advice and assistance in managing the financial risks inherent in their balance sheets rather than merely selling 'off the peg' solutions. Newer products —such as credit derivatives and insurance derivatives—are still uncommon.

Indications are that bid/offer spreads in the OTC derivatives markets remain very tight on plain vanilla products and are tightening on structured products. Despite the tightness of spreads—which partly reflects the entry to the market of several new firms—profitability is reportedly higher, reflecting the higher volumes. However, market entry and tighter spreads has reportedly meant that brokers are being increasingly squeezed out of the market. Attention continues to be given to bilateral credit exposures with the consequence that firms are increasingly using collateral in derivatives transactions.

As mentioned above, OTC volumes have reportedly been high throughout the first half of 1996 but exchange-traded volumes have decreased in the second quarter. There are several possible hypotheses concerning these developments: end-users may be switching to using OTC derivatives because they increasingly want tailored rather than standard products to match exactly assets and liabilities; the type of OTC products which have seen substantial growth (such as those enabling agents to take views on EMU) may be better hedged in the cash market rather than in the exchange traded derivatives market; and market participants may be increasingly comfortable with the level of risk in the OTC market because of, for example, the increased use of collateral and therefore are switching away from exchange-traded derivatives to take advantage of the flexibility offered by the OTC market where spreads are lower than they were previously. However, it is too early to say whether any longer-term change in trends may be emerging in terms of the relative size of OTC and exchange-traded business.

<sup>(1)</sup> These data are not directly comparable with the results of the 1995 central bank survey of OTC derivatives markets which covered a wider range of instruments and market participants and included arms-length internal transactions. See 'The over-the-counter derivatives markets in the United Kingdom', Bank of England Quarterly Bulletin, February 1996.

## Simple monetary policy rules

## By Alison Stuart of the Bank's Monetary Assessment and Strategy Division.

This article describes two simple rules, the McCallum rule and the Taylor rule, that could in principle be used to guide monetary policy. It then applies the rules to past UK data. In the United Kingdom, monetary policy decisions are based on a thorough assessment of the prospects for inflation rather than on one simple rule or single indicator. But simple rules can have a useful complementary role alongside all the other information within a pragmatic approach to monetary policy.

## **Policy rules**

There has been a long academic debate about whether monetary policy is better conducted by following predetermined rules or by the exercise of discretion. As a matter of principle, an optimal monetary policy rule depends critically on the relationship between the policy instruments and economic outcomes and on the relationships among the economic variables. In practice, these relationships have not been very clearly understood and it has not been possible to identify rules which are so robust as to eliminate the need for some discretion in monetary policy. Nevertheless, analysis of what a rule-based monetary policy would entail can provide useful guidance in the exercise of discretion. This article discusses recent thinking about monetary policy rules.

Monetary policy rules have a long history, dating back to the Gold Standard. Many academics have proposed operational rules for monetary policy, of various degrees of complexity. One well-known example of a particularly simple rule is Friedman's (1959) k% rule—a proposal to keep money growth to a fixed percentage each period; see also Simons (1936). Since then there has been considerable interest in evaluating a variety of policy rules.<sup>(1)</sup>

In practice, the rules which have been followed by the United Kingdom in the past have often had some flexibility built into them. And the distinction between rules and discretion has been a matter of degree rather than polar opposites. For example, the Gold Standard allowed some flexibility: a country could leave the Gold Standard for a period and return later having pursued corrective policies in the meantime. The Bretton Woods system included an adjustable peg provision to allow for step changes in the parities of currencies. Monetary targets generally have not operated in a rigidly inflexible fashion. And, within the exchange rate mechanism (ERM), sterling could fluctuate by 6% either side of its central parity (though other currencies operated within a narrower band). Sometimes the flexibility contained in the regime was not usedperhaps to avoid damaging the perceived credibility of the regime. However, flexibility has been useful because of uncertainty about whether the rule or regime was the right one to follow under all conditions.

Recently, there has been a revival of interest in the United States in the possible use of simple monetary policy rules as a guide to discretion.<sup>(2)</sup> A number of authors—including McCallum (1988) and Taylor (1993)-have suggested simple rules which adjust the policy instrument in response to observed deviations of policy objectives from target or trend. For example, the Taylor rule proposes that the level of interest rates should depend on the rate of inflation relative to its target and the level of output relative to trend. These are generally termed feedback rules, as the policy instrument feeds back in response to economic outturns. Taylor's article compares the interest rate path indicated by his rule with the actual path of US interest rates over the period 1987-92 and finds them to have a close correspondence.

The operation of monetary policy in the United Kingdom currently has some of the characteristics of a rule, albeit one which is quite complex and requires the use of judgment. The authorities form a forward-looking assessment of inflation, and then act through monetary policy to offset any deviation between this projection and the stated inflation target. This has something in common with a feedback rule-although the feedback is from a projection rather than an outturn. One of the benefits of such an approach is that policy can take account of a wide range of indicators-real and monetary, quantitative and qualitative. And such an approach has the attractive feature that monetary policy feeds back from all those variables which affect the path of the final objective.

Even under this approach to monetary policy, simple policy rules can still have a role to play. Simple rules based on data outturns can offer a straightforward summary of the main macroeconomic influences on policy-and one which can be monitored in a timely and objective fashion. They

See, for example, Levine and Currie (1985) and Bryant, Hooper and Mann (1993). Alan Blinder's remarks to the Senior Executives Conference of the Mortgage Bankers Association, New York, 10 January 1996; Janet Yellen's remarks to National Association of Business Economists, Washington DC, 13 March 1996.

provide information which complements-but does not substitute for-the information from the wide range of other variables which enter the authorities' forward-looking inflation assessment. With this in mind, this article considers the rules proposed by McCallum and Taylor to assess their usefulness in this role.

## The McCallum and Taylor policy rules

The McCallum and Taylor rules for the setting of the monetary policy instrument have a number of technical differences, but are fundamentally similar. The policy instrument in the McCallum rule is base money, whereas in the Taylor rule it is short-term interest rates. Although the policy instrument in the United Kingdom is short-term interest rates, both rules can provide useful information-for example, the McCallum rule could be interpreted as a dynamic monitoring range for base money. Both rules allow for feedback. The McCallum rule feeds back from deviations in *nominal income* from an assumed target path and the Taylor rule feeds back from deviations in *inflation* from target and *output* from trend. The feedback rule suggests that monetary policy should be tighter than 'a neutral stance' when output is above trend and inflation is above target, and easier than 'neutral' in contrary circumstances. In that way monetary policy 'leans against the wind'.

The inclusion of feedback also illustrates that the appropriate monetary stance is by no means static. For example, if the rate of inflation changes then, according to the rules, the appropriate level of policy instrument will also change: otherwise, for example, leaving nominal interest rates unchanged in an environment of rising inflation would constitute a loosening of monetary policy.

#### The McCallum rule

The McCallum rule derives the nominal growth of base money (M0 for the United Kingdom) which is consistent with delivering a nominal GDP target. The feedback rule is specified in terms of deviations of nominal income growth from target.

$$m = k^* - v_{t-1} + \lambda (x^* - x)_{t-1}$$

where  $x_t^* = x_{t-1} + k^*$  is the nominal income growth target.<sup>(1)</sup>

In this formulation *m* is the quarterly growth of the monetary base; x is the log of money GDP and a \* denotes a target value. The rule has three terms. First, the constant term  $k^*$  fixes the path for steady-state nominal income growth—it is akin to the k% in Friedman's rule. Second,  $v_{t-1}$  is an adjustment for changes in the velocity trend of the monetary base. The velocity trend is measured by a

16-quarter moving average so that only long-lasting changes rather than cyclical factors are captured.

Third, the feedback term  $(\lambda(x^*-x)_{t-1})$  allows for monetary policy to be tightened or loosened from a 'neutral stance' according to the deviation of nominal income from the assumed target. The larger the value set for  $\lambda$ , the greater the speed with which deviations between actual and target nominal income are offset by policy actions. The feedback term is defined here in terms of nominal income growth (rather than levels) and so it gives equal weight to changes in the output gap and deviations of inflation from target. This makes the feedback term similar, but not identical, to that in the Taylor rule. In the Taylor rule, the feedback term is set up as the *level* of the output gap and the deviation of inflation from target; and different weights can be applied to the output and inflation terms.

#### The Taylor rule

The Taylor rule indicates a nominal interest rate (i) which reflects movements of a real interest rate (r) away from equilibrium according to a reaction function which gives weight to deviations of output from trend and of inflation from target. The Taylor rule is consistent with an inflation target: it is designed in such a way as to dampen deviations of output from trend in achieving the inflation target. Taylor's original specification used current levels of inflation and the output gap, but, in practice, outcomes for the current inflation rate and output gap are known only with a lag. In the specification below, the inflation and output data are included after a lag of one quarter.

$$i = p_{t-1} + w1((Y-Y^*)/Y^*)_{t-1} + w2(p-p^*)_{t-1} + r^*$$

Where *p* is the annual inflation rate (using RPIX rather than the GDP deflator which is used in the McCallum rule),  $p^*$  is the inflation target,  $r^*$  is the equilibrium real interest rate and  $(Y-Y^*)/Y^*$  is the output gap. w1 and w2 are the weights given to deviations of output and inflation from their respective trend and target.

### Assessing the performance of the rules

Assessing the rules depends on the purpose for which they are to be used. Previous studies have investigated how well monetary policy based on the rules would have performed if the rules had been operational over history, using counterfactual simulations.<sup>(2)</sup> However, our interest here is not in re-running history but in assessing whether the rules would have provided useful information about the policy stance in particular episodes. This is done by looking at whether past policy errors can be identified by observing the divergence of actual policy from the paths implied by the rules based on historical data (rather than simulations). This

<sup>(1)</sup> In his work McCallum used a number of different formulations for the nominal income target including a levels target, a mixed levels and growth

In his work McCallum used a number of different formulations for the nominal income target including a levels target, a mixed levels and growth target, and a growth target. A levels target ensures that any lapse from the target in previous quarters is fully recovered. However, such a rule was not used here because it is difficult to apply it to UK historical data. The cumulative divergence of the price level from a target path, induced by high inflation in the 1970s and late 1980s, means that it is unrealistic to assume that this overshoot might be clawed back. The results are then dependent on the underlying models which are used for the purposes of the comparison. Therefore, studies have looked at rules in relation to a wide set of different macroeconomic models. McCallum (1988, 1990a, 1993) found that the McCallum rule would have performed favourably in stabilising prices and GDP in the United States and Japan. A recent *Bank of England Working Paper*, 'Base money rules in the United Kingdom', by Haldane, McCallum and Salmon (1996) assessed the McCallum rule for the United Kingdom against a number of other models and concluded that the rule appeared to perform well across a range of macro-models.

is an imprecise exercise because policy objectives and regimes will have varied over the period.<sup>(1)</sup> This means it is more useful to look at the broad trends of the rules compared to the trend in actual policy rather than to compare point estimates. Notwithstanding these problems, how do the rules track UK policy and can they identify policy errors?

### The rules based on historical data

The charts show what the McCallum and Taylor rules would have signalled for monetary policy applied to UK data since 1985, based on the following assumptions:

- The inflation target is taken to be 2.5% and trend output growth is calculated as the average rate of output growth from peak to peak over the latest three cycles, which is around 2.2%.
- The weights (λ, w1 and w2) given to the feedback terms are all assumed to be 0.5. These were the weights used by Taylor in his illustration of the Taylor rule for the United States and they fitted well when applied to historical data, while applications of the McCallum rule have generally used a value of around 0.5 in simulations.
- In the Taylor rule, the equilibrium real interest rate (*r*\*) is calculated as a two-year moving average of the yield on ten-year index-linked bonds; this was generally close to 3<sup>1</sup>/<sub>2</sub>% over the sample period. This is assumed to proxy a long-run average of short-term real interest rates.

Chart 1 shows a wide excess of actual M0 growth over the McCallum rule between 1985 and the end of 1989. This widened from the beginning of 1987. The annual growth rate of M0 picked up from a trough at the beginning of 1986



and rose to a peak of 8% in 1988 Q3. But the McCallum rule suggested that M0 should have been falling at that time.<sup>(2)</sup> And the rule indicated a tightening about a year earlier than the first upward movement in UK interest rates in the middle of 1988.

The Taylor rule, shown in Chart 2, like the McCallum rule, indicated an earlier tightening of policy than actually occurred in the mid to late 1980s. While actual nominal interest rates continued to decline until the middle of 1988, the Taylor rule suggested a trough in interest rates in 1986 Q3.





The McCallum and Taylor rules gave varying messages about monetary policy during the United Kingdom's membership of the ERM and immediately afterwards. Actual M0 growth was fairly close to that implied by the McCallum rule during 1990–92, though the rule suggested that M0 should be accelerating. By the middle of 1992, M0 implied by the McCallum rule was growing faster than actual M0. This perhaps suggests that actual policy had become a little tighter. Thereafter, actual M0 growth picked up once more but McCallum rule growth remained steady, suggesting that policy had eased. The Taylor rule tracked actual interest rates fairly closely throughout the United Kingdom's membership of the ERM and continued to do so during 1992 and 1993.<sup>(3)</sup>

Currently, both the McCallum and Taylor rules are fairly close to actual policy. According to the McCallum rule, policy (measured by monetary base growth) has been on the easy side over the past few years, but has been closer to the position implied by the rule since the middle of 1995 (the acceleration of actual M0 in 1996 Q2 may be temporary and related to the Euro '96 football tournament). The pick-up in

(1) One further potential criticism of the Taylor rule is that it may be purely descriptive and describe the Fisher equation, where nominal interest rates equal real rates plus expected inflation. If that were the case, the Taylor rule would track nominal interest rates irrespective of whether policy was on or off track.

(2) The negative rates of growth of M0 implied by the rule probably indicate that the authorities' objectives were in practice different during the late 1980s from the assumptions made above. If the level of the output gap had also been included in the rule, this may have increased the McCallum rule growth.

rule growth.
 (3) The introduction of the Community Charge in 1990 and the changes to VAT which came into effect in April 1991 had an impact on RPIX, which caused part of the movement in the Taylor rule over that period. Therefore, the chart shows the Taylor rule based on RPIY—which excludes indirect taxes—as well as RPIX. The peak in the rule was lower using RPIY.

M0 growth implied by the McCallum rule partly reflects the slowdown in M0 velocity which began in the early 1990s and which is captured in the rule by the velocity adjustment  $(v_{t-1})$ . The shift in velocity may be explained by a slowdown in the pace of financial innovation and the move to a low inflation environment which may have increased the demand for cash.<sup>(1)</sup> According to the Taylor rule, policy (as measured by interest rates) has been on the tight side over the past couple of years, but again is now closer to the rule.

The retrospective evidence suggests that the McCallum and Taylor rules might have provided useful information about the policy stance. However, the signals provided by the rules would have been less clear if they had been monitored at the time, because the output data included in the feedback terms are subject to substantial revision after first publication. In this context it is interesting to consider the period 1986-88 because the output data for these years have been substantially revised and the rules indicated policy

## Chart 3





## Chart 4





(1)

This was discussed in detail in the article by Janssen, N (1996), 'Can we explain the shift in M0 velocity? Some time series and cross-section evidence', *Bank of England Quarterly Bulletin*, February, pages 39–50. The problems involved in measuring the output gap were discussed in the *Inflation Report*, August 1994, pages 25–27. The issue was also covered by the Treasury's Panel of Independent Forecasters: 'How fast can the economy grow? A special report on the output gap', June 1996. In this report, the forecasters' measurement of the short-term output gap ranged from -1/4% to 3% and measurement of the long-term output gap ranged from 0%-7%

actions different from those actually taken. Charts 3 and 4 show the policy which the rules indicated using the first published estimate of GDP for each quarter and the final (revised) GDP data.

Both rules still indicate a policy tightening earlier than 1988. However, in early 1988 the Taylor rule, based on the first estimate of GDP, indicated a level of interest rates very close to the actual level. Thereafter, the Taylor rule indicated interest rates lower than actual interest rates-the latter rose more quickly than those indicated by the rule. However, the same rule based on the (revised) data available today indicates a level of interest rates around 100 basis points higher than the first estimate during 1988.

These historical comparisons illustrate both the uses and limitations of the two rules. The rules are sensitive to the assumptions on which they are based-though this is true of any model of the economy. And, as a robustness check, it is informative to examine the assumptions underlying the rules.

## Assumptions underlying the rules

## The output gap

Both rules require knowledge of the size of the output gap. The output gap concept is theoretically appealing, but in practice is hard to measure.<sup>(2)</sup> First, there is considerable uncertainty about the potential or trend growth rate of output. Second, even if the potential growth rate was known, actual output statistics are subject to substantial revision.

The trend output growth used in Charts 1-4 was based on an atheoretical calculation which results in trend growth of around 2.2%. One alternative-which is also an atheoretic approach-is to calculate the trend growth of output as a centred moving average of output growth over 16 quarters. Other more sophisticated and structural methods of measuring potential output growth could be used-for example, using measures of capacity utilisation or using an explicit production function. However, the two simple, atheoretical measures are sufficient to illustrate the sensitivity of the rules to the measurement of the output gap.

The two measures result in very different values for the output gap and consequently for the M0 growth and nominal interest rates implied by the policy rules under consideration (see Charts 5 and 6). For example, a difference of  $\frac{1}{2}$ % in the annual trend rate of growth cumulates to a difference in the output gap of  $2^{1/2}$ % over five years—which translates into large differences in the policy indications of the rules (exactly how large depends on the weights attached to the feedback rule).

### Chart 5 Illustrative McCallum rule for M0 using different output gaps





## Chart 6 Illustrative Taylor rule for nominal interest rates using different output gaps



#### The equilibrium real interest rate

Another difficulty, which applies solely to the Taylor rule, is determining the appropriate level for the equilibrium short-term real interest rate. Theory suggests that the equilibrium real interest rate should be similar to the long-term trend growth rate. Taylor uses 2% in his work for the United States, which is close to trend growth. However, direct calculations of the real interest rate for the United Kingdom observed from the yield on ten-year index-linked bonds (which might be expected to represent a proxy for a long-run average of short-term real rates) have averaged around 31/2% since 1982—higher than most estimates of long-term trend growth. In addition, over the past 15 years ex post calculations of the long-term real interest rate in G10 countries, which might be expected to be a little higher than

real short rates, have averaged close to 4%.<sup>(1)</sup> Changes in the equilibrium real interest rate have a one-for-one impact on the level of the nominal interest rate generated by the Taylor rule. Thus, different assumptions about the appropriate equilibrium real interest rate result in very different indications about the stance of monetary policy.

## Specification of the feedback rules

The feedback rules incorporate a target for inflation, as well as an assumption about the trend growth of output. The charts are based on the current inflation target of 2.5% or less. But it is clear that over the past 30 years UK policy has not always been aimed at this objective. This means that historically the rules may be off-track simply because the policy objective was different.

The weights ( $\lambda$  in the McCallum rule, w1 and w2 in the Taylor rule) in the feedback rules are a simplified representation of the way in which monetary policy reacts to economic developments. They can be thought of as a description of a three-way trade-off among the speed and cost of offsetting deviations of inflation from target and output from trend, and inducing volatility in the monetary policy instrument. It is not clear what the ideal weights should be. In a model consisting of a reduced-form system of equations including a short-run Phillips curve trade-off, a Taylor rule which achieved an inflation target might well have higher weights on the feedback rule than Taylor applied.(2)

For illustrative purposes, a small range of arbitrarily chosen values for the feedback weights  $\lambda$  in the McCallum rule, and w1 and w2 in the Taylor rule, are used to show the sensitivity of the rules to different weights (Charts 7 and 8).

## Chart 7 Illustrative McCallum rule<sup>(a)</sup> for M0 using different weights for $\lambda$



 $\overline{(1)}$ The article 'Saving, inve g, investment and real interest rates', by Jenkinson, N (1996), in the Bank of England Quarterly Bulletin, February, pages 51-62 ngs of the G10 Deputies Report and some Bank research on real interest rates in more detail.

iscusses the findi (2)However, in simulations some studies have found that a weight of one or more in the McCallum rule causes deviations of nominal GDP from the

reference path to oscillate explosively. See 'Base money rules in the United Kingdom', Haldane, McCallum and Salmon (1996).

## Chart 8





In the Taylor rule, the weights of deviations of inflation from target and output from trend are also constrained to sum to one—though this restriction is not necessary and could easily be lifted. In the McCallum rule, changing the weight on the feedback term  $\lambda$  from 0.25 to 0.75, reduced M0 growth implied by the rule by 1.1 percentage points on average over the period 1985–95. In the Taylor rule, changing the weight w1 from 0.75 to 0.25 and w2 from 0.25 to 0.75 raised the level of interest rates implied by the rule by around 130 basis points on average.

## Limitations of the rules in a forward-looking framework

Monetary policy has to be forward looking since policy actions affect inflation only with a lag. Therefore, the authorities form a forward-looking assessment of inflation over the next two years and set monetary policy accordingly. However, the McCallum and Taylor rules incorporate only a subset of the information available about the current and likely future path of inflation and output.

Thus, one of the limitations of the rules as guides to policy is that they ignore useful information about the prospects for inflation and activity from other forward-looking indicators. The other limitations of simple rules are comparable to the limitations of other approaches to monetary policy formulation—for example, the susceptibility to data revisions, and the problems of measuring the output gap and equilibrium real interest rate. The simple rules do not eliminate the need for some discretion in monetary policy —or the formulation of a more complex approach based on a thorough assessment of the prospects for inflation, as in the United Kingdom. However, the simple rules provide information which can usefully be taken into account alongside all other relevant information in the formulation of monetary policy.

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## The industrial impact of monetary policy

By Joe Ganley of the Bank's Markets and Trading Systems Division and Chris Salmon of the Bank's Monetary Assessment and Strategy Division.

This article investigates the disaggregated effects of monetary policy on the output of 24 sectors of the UK economy. The purpose of the analysis is to identify the speed and magnitude of firms' reactions in these sectors to an unexpected monetary tightening; and to examine whether these responses provide any evidence on the transmission mechanism of monetary policy. The results indicate that the sensitivity of output to changes in monetary conditions differs markedly across industries.

The monetary authorities need to understand how the effects of a change in official interest rates are passed through the economy. Which sectors respond first to a policy change and are these effects more pronounced in some sectors than in others? A comparison of the impact of monetary policy across different sectors may therefore provide valuable information for the monetary authorities on how monetary policy shocks are propagated through the economy. This article analyses the response of output in 24 sectors of the economy to a monetary tightening.

## Sectoral basis of the analysis

The industry breakdown used in this article is summarised in the Annex. At the broadest level, the output measure of the economy, GDP (O), can be sub-divided into four parts, namely the production industries, agriculture, construction and services. Within these four sectors, services can be split into three further components: distribution, transport and communications and 'other services'.<sup>(1)</sup> Other services



The industry definitions are clarified in terms of the Standard (a) Industrial Classification (1992) in the Annex.

contribute over 40% of GDP (see Chart 1); and the service sector as a whole over 60%. The available data do not permit any further disaggregation of services for the analysis we wish to undertake.<sup>(2)</sup> The production industries can also be broken into three large sub-groups: mining and quarrying, the utilities and manufacturing. Manufacturing can be further disaggregated into what is known as the 'sub-section' level in the Standard Industrial Classification (1992), enabling us to sub-divide manufacturing into 14 component industries. The share in manufacturing output of each of these industries is shown in Chart 2.





In addition to these basic industry output data, we also use concentration ratio and average firm output data as proxies for the size of manufacturing firms to help us to analyse the possible role of credit market imperfections in the transmission mechanism of monetary policy.<sup>(3)</sup> As Chart 3 indicates, there is substantial variation in manufacturing concentration ratios.<sup>(4)</sup> In vehicle manufacture, for example, the five largest firms produce around three quarters of the

The latter aggregates financial and business services (FIN) with public sector activities (GOV). Some greater disaggregation of services output is available in the national accounts, but not on a quarterly basis. We also examined measures of the availability of industries' internal funds but were unable to find a statistically robust proxy, and so do not report the results here. This proxy is discussed more fully in a forthcoming *Bank of England Working Paper*. The data are sourced from the Annual Census of Production (various issues) and hence more timely data than 1991 are not currently available. Because collection of these statistics is time intensive we have compiled them for 1975, 1980, 1985, 1990 and 1991. These indicate that the data do not reveal any along transfer time and go in cubecaugate applicits on profers to their more tables. (4) do not reveal any clear trends over time and so in subsequent analysis we refer to their mean values

Chart 1

## Chart 3 Manufacturing industry concentration ratios



Chart 4 Average output per firm in manufacturing industry<sup>(a)</sup>



(a) Chart excludes PET where the average firm's output is ten times greater than the average for manufacturing industry as a whole.

industry's net output. This figure falls to under 20% in a number of industries, including the wood, rubber and paper manufacturing industries. There is similar, but rather more marked, variation in the average output per firm across manufacturing industries (see Chart 4). Excluding petrol refining—which is heavily influenced by multinational firms—output of the average firm was largest in chemicals (at £4.9 million in 1991), some 25 times greater than in the average firm in 'other manufacturing'. The output of the average firm in manufacturing as a whole (again, excluding

## Table A A sectoral breakdown of GDP



petrol refining) was £1.4 million in 1991. Ideally, we would have liked to carry out this firm 'characteristics' analysis for all 24 of the sectors for which we have output data. But sufficiently detailed figures are available only for the manufacturing sector of the economy (see Table A).

## The effects of monetary policy on industry output

This section gives an overview of our results on the responsiveness of industry output to an unexpected monetary tightening. Our focus is principally on the size and timing of the impact of a monetary shock on industry output. These are key characteristics of the transmission mechanism and may provide the authorities with valuable information when monitoring the effects of monetary policy. The *size* of response in each industry indicates how the impact of policy changes is distributed across the economy; while the *timing* of these responses suggests how long the 'real' effects of monetary policy may persist. We try to explain the responses that we observe in terms of the business cycle. In addition, the interplay of these business-cycle factors with the firm-size characteristics of individual industries may provide some evidence on the relative importance of the different channels of the transmission mechanism of monetary policy.

The problem of identifying the effects of a monetary tightening on output has usually been approached in a Vector Autoregression (VAR) framework.<sup>(1)</sup> Because the relationships which are defined in these are highly simplified, VAR techniques do not differentiate accurately between theoretical explanations of observed behaviour. But they are an efficient means of drawing out 'stylised facts' regarding the monetary transmission process. The technique involves estimating a set of four equations, for monetary policy (measured by official interest rates), aggregate real GDP, the aggregate GDP deflator and industry output. We use quarterly data from 1970 to 1994. The VAR allows us to extract the responses in output to an unanticipated increase, or 'shock', in official interest rates. As in similar studies, real GDP and the GDP deflator are included in the VAR to control for the indirect effects of policy changes on industry output. These arise through the effect of monetary shocks on the wider economy.<sup>(2)</sup>

## (i) Size and timing of responses in the major sectors

Our key results are summarised in Table B, which shows the maximum reduction in output in each sector and how many quarters after the shock this occurs. We interpret this as a measure of the short-run real effects of monetary policy. The results show the response of industry output to an

As in, for example, Christiano, Eichenbaum and Evans (1994). We discuss the estimation procedure in more detail in a forthcoming *Bank of England Working Paper*. It has become a standard approach to identifying the impact of monetary policy shocks. See, for example, Bernanke and Blinder (1992), Christiano, Eichenbaum and Evans (1994) ns (1994) Bernanke and Gertler (1995) and Dale and Haldane (1995). Some criticisms of this type of approach can be found in Rudebusch (1996).

<sup>(1)</sup> (2)

## Table BSize and timing of sector output responses

Industry	Maximum ou Per cent	utput reduction Quarter	Industry	Maximum outp Per cent	ut reduction Quarter
Memo:			Manufactu	ring industries:	
GDP (O)	-1.3	14	RUB OMN ELC	-3.6 -3.2 -3.0	10 9 11
Main components of GDP:			PPP	-2.5	11
CON	-2.1	10	LEA	-2.4	5
PRD	-1.5	8	WOD	-2.3	7
SER	-1.0	11	PET	-2.2	8
AGR	-0.1	30	MIN	-2.1	9
			CHE	-1.9	11
Other sector	rs:		MET	-1.9	7
DST	-2.1	11	TPT	-1.7	11
CMM	-2.0	11	TEX	-1.3	5
MQA	-2.0	6	MAC	-1.1	11
MÂN	-1.9	9	FBT	-0.4	13
UTL	-0.9	6			
OSR	-0.6	13			

increase in official interest rates of 1.1 percentage points (equivalent to a one standard error shock to the interest rate). The analysis yields plausible results in that output is depressed in the first four to eight quarters after the shock. As a benchmark, the maximum decline in whole economy GDP is 1.3%, reached around three years after the (upward) shock to interest rates.

In the largest sectors of the economy—the components of GDP and of total services—the maximum decline in output generally occurs eight to twelve quarters after the shock. Most of this decline has been reversed after 30 quarters (see Chart 5, which shows the timing of the response in output to the monetary tightening), so in the long run the effects of policy can be described as 'neutral' with respect to the level of output.

## Chart 5 (a) Output responses of the major industrial groups



The largest absolute responses are in the construction and distribution sectors. For example, the results suggest that the decline in construction output will reach a maximum of 2.1% in the tenth quarter after the shock. This relatively large response is not unexpected, given the close links between the housing market and construction.

Among the other main sectors, the production sector shows a 1.5% reduction in output after a monetary tightening.

## Chart 5 (b) Output responses of the major industrial groups



Chart 5 (c)

Output responses of the major industrial groups



Within the production industries, output falls sharply in manufacturing in response to the monetary shock, reaching a maximum contraction of -1.9% after nine quarters; after 30 quarters it is steadily approaching zero. The utilities, but more especially mining and quarrying, show erratic output responses. These are difficult to interpret, but they may be linked to the predominance of public sector industries in these sectors over much of our sample period. In addition, the mining and quarrying data contain severe distortions owing to industrial disputes. Within services, the smallest reaction to the shock is in other services. This may reflect the inclusion in other services of public sector activities, whose output may in part move countercyclically. Overall, the responses of these broad sectors are consistent with the cyclical variations normally associated with them.

The smallest output contraction is in agriculture. This sector shows little reaction to the monetary policy shock for ten quarters and moreover this is largely positive. UK agricultural output is primarily of staple products whose production would not be expected to respond procyclically.

## (ii) Size and timing of the responses within manufacturing

We turn next to the output responses of the 14 industry groups within manufacturing. Rather than simply listing the results for all 14 of these industries, we group the results thematically into:

- industries which are closely linked to housing and construction;
- industries which are closely linked to changes in consumer expenditure; and
- industries which are principally selling on to other industries.

This taxonomy helps to clarify, in broad terms, the likely business-cycle properties of the industries, even though not all the industries fit exclusively into just one of these categories.

House purchase is highly interest rate sensitive and so housing starts might be expected to react rapidly to a tightening in monetary policy. This in turn is likely to result in a rapid downturn in the output of industries supplying construction, for example in the manufacture of basic building materials like glass, tiles, concrete and bricks (MIN) and in wood products (WOD). The results suggest that both of these industries have a maximum output response slightly above the average response of -1.9% for the manufacturing industries as a whole. In the case of wood products this is achieved quite rapidly, after only seven quarters—the second fastest response in manufacturing.

We also examine here the size of the output responses after one and two years. These are summarised in Table C. The responses one year after the shock show the greatest range in changes in industry output. Five industries contract by more than 1%. One of these is the construction sector and

 Table C

 Which sectors react quickest to a monetary shock?

	After 1 ye	ar:	After 2 ye	After 2 years:		
Rank	Industry	Output reduction per cent	Industry	Output reduction per cent		
1	RUB	-2.1	RUB	-3.4		
2	LEA	-1.9	OMN	-3.1		
3	WOD	-1.6	ELC	-2.6		
4	CON	-1.3	PET	-2.2		
5	MIN	-1.1	WOD	-2.2		
6	OMN	-1.0	PPP	-2.1		
7	DST	-0.8	CON	-2.0		
8	ELC	-0.7	MIN	-2.0		
9	MET	-0.7	MAN	-1.9		
10	CMM	-0.6	LEA	-1.8		
11	TEX	-0.6	MET	-1.9		
12	MAN	-0.5	DST	-1.8		
13	SER	0.5	CHE	-1.8		
14	PPP	-0.4	CMM	-1.6		
15	CHE	-0.3	PRD	-1.5		
16	OSR	-0.2	TPT	-1.5		
17	PET	-0.3	TEX	-1.2		
18	FBT	-0.2	SER	-0.9		
19	PRD	-0.1	MAC	-0.9		
20	AGR	_	UTL	-0.7		
21	MAC	0.2	OSR	-0.5		
22	MOA	0.4	FBT	-0.4		
23	UTL	0.4	MQA	-0.1		
24	TPT	0.5	AGR	0.1		

three of the remaining four sectors—wood, rubber and non-metallic mineral products—supply materials to construction firms.

Six industries are linked reasonably closely to consumer expenditure: food, drink and tobacco, textiles and leather goods, paper products, vehicle manufacture and other manufactured goods. But the reaction of personal consumption to monetary shocks may be quite diverse. Spending on durable items is likely to change sharply and with little delay—see for example the reaction of vehicle manufacture (TPT) in Chart 6 (a). Textiles and leather goods, as producers of clothing, footwear and household furnishings, both show their maximum response after only five quarters, the fastest responses across our whole data set. However, the absolute size of the maximum responses are quite different, with that in textiles surprisingly small at only 1.3%, compared with 2.4% in leather—which is perhaps more in line with our prior expectations [see Chart 6 (b)]. Non-durables could be much less affected since these purchases are more likely to be made out of current income than from borrowed funds. This is consistent with the subdued reaction of output in food, drink and tobacco (FBT) in Chart 6 (a).

Chart 6 (a) Selected output responses in manufacturing





## Selected output responses in manufacturing



A further six of the industries may be linked more closely to industrial demand than to personal consumption; these are chemicals, electrical equipment, machine tools, iron and steel, refining and rubber products. The demand for intermediate goods will include purchases of materials and of capital goods. Although the empirical evidence is mixed, we would generally expect investment expenditure to be interest rate sensitive, such that purchases of capital goods are likely to fall in a downturn. However, the effects of this on industry output may be delayed by the long lead times in commitments to buy new capital goods. Thus, while investment intentions may change rapidly in response to tighter monetary policy this may not show up in lower output for several quarters. So the reaction of these industries may be delayed. There is some evidence for this in our results, which show that four of the six industries (chemicals, electrical equipment, machine tools and rubber products) do not attain their maximum impulse response for ten or eleven quarters; the average time lag in attaining the maximum response across all 14 manufacturing industries is 8.5 quarters.

Among those industries closely linked to industrial demand, and indeed across manufacturing as a whole, the largest contraction in output, at -3.6%, is in rubber products. This is a very diverse industry, largely dependent upon industrial demand from construction, motor vehicle manufacture and services like haulage. The size of the response is consistent with the industry's links with construction and motor vehicle manufacture, both of which might be expected to show a marked response to changes in monetary policy. The timing of the maximum response in rubber products is also slower than average, which may be the result of a more gradual slowdown in purchases from service-related industries.

Overall, the results indicate that the impact of monetary policy is concentrated in some industries which, except in the case of rubber products, may also react first-thereby providing the authorities with early information on the impact of policy changes.

## Firm characteristics and the effects of monetary policy

Our results have shown that, at least in the short run, monetary policy can have varying effects on the output of different sectors in the economy. There remains considerable uncertainty in the wider literature as to precisely how these effects are obtained. A recent symposium in the Journal of Economic Perspectives (Fall, 1995) examines the many possible routes through which a monetary shock may be propagated. Gaps in some of the more conventional explanations have led a number of economists to explore whether asymmetric information between borrowers and lenders, and 'frictions' in credit markets, might help to explain the differing potency of monetary policy across sectors.

These frictions are based around the difficulties involved in extracting full information on the creditworthiness of certain types of borrower. Insofar as banks are experts in credit risk appraisal, borrowers whose risk is harder to measurenotably small firms and personal borrowers-may become almost exclusively reliant on banks as a source of external finance. As Gertler (1988) notes 'financial constraints are likely to have more impact on the real decisions of individual borrowers and small firms than large firms'. It has been pointed out, however, that these credit market frictions are not a distinct, free-standing alternative to traditional views of the monetary transmission mechanism. Rather, they are best interpreted as a set of factors that may amplify and propagate conventional interest rate effects.(1)

Larger firms are likely to be less dependent on bank credit because they will have access to external funds generated in the capital markets. This is because more information is available on large firms and this can often be pooled relatively cheaply-for example by ratings agencies-which allows dispersed investors in financial markets to assess their credit risk. With a greater range of external funds at their disposal, larger firms may be better able to 'smooth' their spending and output decisions.

Some evidence for the existence of credit market imperfections has been found in Dale and Haldane (1995). Using a VAR methodology similar to our own, they compare the response of the personal and corporate sectors to a monetary tightening. They find that, in the short run, companies raise their borrowing and reduce their deposits; the personal sector, by contrast, increases its deposits while its bank borrowing declines. The difference between personal and corporate sector responses-in particular the decline in personal sector borrowing-is attributable to the more acute credit market frictions faced by household borrowers. Similar results were found by Gertler and Gilchrist (1994) in a comparison of small and large manufacturing firms in the United States. Their results suggested that, after a monetary tightening, small manufacturing firms bore a disproportionate share of the downturn in aggregate output.

Disaggregated data on small and large manufacturing firms are not available in the United Kingdom. So we cannot test directly for the effects of credit market frictions in the manner of Gertler and Gilchrist. But data on the concentration, net output and number of firms in manufacturing can be used to give an approximate guide to the size of firms in particular industries. This allows us to examine indirectly the effects of credit market frictions insofar as these data reveal that particular industries are made up of small or large firms.

In Table D we compare the maximum responses in industry output with proxies of firm size, namely the concentration ratio and average firm size in each industry within manufacturing.<sup>(2)</sup> The concentration ratio indicates the

See Bernanke and Gertler (1995).
 The data on the concentration ratio and average output in Table D are averages over 1975 to 1991.

# Table DManufacturing industries: output responses and firmcharacteristics

				Ranking of :		
Industry	Maximum output reduction, per cent	Concentration ratio, per cent of output, 5 largest firms	Average output, £ millions	Maximum output reduction	Concentration ratio	Average output
RUB	-3.6	22.8	1.0	14	13	7
OMN	-3.2	27.3	0.2	13	9	13
ELC	-3.0	49.1	1.0	12	5	6
PPP	-2.5	23.7	0.5	11	12	10
LEA	-2.4	27.4	0.2	10	8	14
WOD	-2.3	16.5	0.2	9	14	12
PET	-2.2	76.0	15.9	8	1	1
MIN	-2.1	48.2	1.0	7	6	5
MET	-1.9	36.6	0.6	6	7	8
CHE	-1.9	49.3	3.1	5	4	2
TPT	-1.7	69.8	2.5	4	2	3
TEX	-1.3	26.3	0.4	3	10	11
MAC	-1.1	24.1	0.5	2	11	9
FBT	-0.4	55.7	1.5	1	3	4
Average	-2.2	39.5	<b>2.1</b> 1.0 (ex	cl PET)		
Spearman	rank correla	tion coefficient	, probability	value:	0.91	0.89
not available.						

proportion of net output accounted for by the five largest firms in each industry and gives a measure of how skewed that industry is towards large firms. We use this information in conjunction with the data on average firm size, which measures the average value added or net output of firms within each industry. These two industry characteristics appear to show some link with the effects of monetary policy shocks. For example, industries like other manufacturing and rubber products-with below average concentration and low average firm output-generally show a larger maximum response to the shock. Of course, there are exceptions to these linkages. Firms producing office machinery and electrical parts, for example, can be characterised as 'reasonably large', yet this industry shows the third strongest output reaction, while 'small' firms, such as those producing machine tools, show the second smallest response.

To determine whether these linkages have any statistical significance, Spearman rank correlation coefficients are calculated between the output responses from the VAR model and the two industry characteristics. Both the concentration ratio and the average firm size measures are significantly correlated with the output responses at around the 90% level.<sup>(1)</sup> So there appears to be some link between industry-size measures and the output responses. One possible interpretation of this is that credit market imperfections may play a role in the transmission mechanism. For example, the textiles and leather industries sell into markets which we would expect to behave similarly over the cycle. But their output responses to the monetary shock are very different. Textiles has the third smallest response, at -1.3%. Leather, where firms are on average little more than half the size of those in textiles, shows a much larger output contraction of -2.4%. Similar contrasts can be observed in other industries like wood products and

non-metallic minerals: both serve similar markets, but the firms in wood products are typically much smaller and generate a larger response to the shock than those in non-metallic minerals.

## Monetary policy and industrial output since 1992

The results above have shown that the industrial impact of monetary policy shocks has shown a distinct sectoral pattern on average over the last 25 years. In part this appears to reflect variations in the nature of the demand for the different industries' output, but it may also be related to the characteristics of the firms within each industry. Do these results also hold over the final years of the sample period and into 1995?

Sectoral developments in output from the final quarter of 1992 to the end of 1995 are shown in Charts 7 to 9. Vertical lines in these charts show the date of changes in official interest rates. There are several difficulties in translating the results discussed above to the output developments in Charts 7 to 9. First, as the main results confirm, output typically responds with a lag to monetary policy shocks, so the most recent output developments will reflect a combination of responses to prior changes in monetary policy. Second, to some extent the changes in monetary policy may have been anticipated. If so, our analysis tells us less about the likely output responses, since it is concerned with unexpected changes in interest rates. Third, other factors may have influenced industries' output over this period. Our full-sample results attempted to control for two such factors, namely changes in real GDP and in the price level (measured by the GDP deflator). Charts 7 to 9 attempt to control only for changes in GDP, by plotting industry growth rates as differences from total GDP growth.<sup>(2)</sup> To some extent, this should control for general cyclical influences.

### Chart 7 Selected output developments since 1992: main components of GDP



(1) We have not directly combined our mean (average output) and spread (concentration) measures of industry size into a composite indicator for these

<sup>(2)</sup> Growth of zero implies that an industry grew at the same rate as GDP, positive growth that the industry's output grew quicker than GDP, and negative growth that output grew slower than GDP.

Nevertheless, similar sectoral patterns to those in our main results—based on data from 1970 to 1994—can be observed. Chart 7 focuses on the main components of GDP, although agricultural output is excluded because it is determined largely by non-monetary factors. Of the other sectors, construction has been the most volatile relative to total GDP growth, and services the least. Although growth in construction was lower than GDP growth through 1993 to summer 1994, it recovered, albeit rather slowly, relative to growth in the economy as a whole following the substantial monetary easing in 1992. But through 1995, construction output growth fell rapidly relative to that in total GDP following increases in interest rates in late 1994.

Table C showed a slow response to monetary shocks in the production industries over the main sample period. So the rather delayed increase in their output growth (relative to overall GDP growth) during summer 1994 is consistent with the late 1992/early 1993 reductions in interest rates. As we found in our results in Table C, services generally show the least response to changes in interest rates. However, growth in the service sector has been atypically fast (relative to overall GDP growth) since early in 1995. For given rates of growth in the rest of the economy, this depresses the contribution that other sectors, eg production and construction, may make to GDP growth. This may have exaggerated the relatively slow growth during 1995 in production and construction in Chart 7.

In Chart 8 we consider a sub-set of the manufacturing industries. Their developments are typical and are consistent with the results for the main sample period. Rubber products and food, drink and tobacco showed the largest and smallest responses respectively to a monetary policy shock in the main results. Recent developments in the industries fit this pattern. Growth in food, drink and tobacco has closely followed that of GDP; while in rubber products growth expanded at a faster rate through 1993–94 following the prior interest rate reductions. Then in 1995 its quarterly growth fell below GDP growth, so that its annual

### Chart 8

## Selected output developments since 1992: manufacturing industries



growth rate began to fall back relative to annual GDP growth. Developments in electrical equipment (ELC) are also consistent with our results. Overall it exhibited the third largest response of all manufacturing sectors to monetary shocks, but unlike rubber products this response occurred with a relatively long lag (see Table C). This is also apparent in Chart 8: through 1993 growth in office machinery slowed (relative to GDP) following the monetary tightness of the ERM period, but then in 1994 its output recovered—approximately two years after the post-ERM monetary policy loosening.

But recent developments in some other industries are more difficult to interpret in terms of our main results. Vehicle manufacture for example appeared to have an output response which was both slow (Table C) and among the smallest in manufacturing (Table D). But through 1993 growth in vehicle production fell sharply relative to GDP growth, only to recover during 1994, before suffering another bad year in 1995. And other manufacturing seems to have responded more slowly than in the past.

In Chart 9 we compare developments in non-metallic minerals and wood products, and in textiles and leather. The main results suggested that firm-size characteristics influenced these different sectors' responses to monetary policy shocks. But recent developments are less consistent with our earlier results, with no obvious differences apparent between the two pairings. One possible explanation could be the financial retrenchment of industrial and commercial companies (ICCs). The 1992–95 period saw net repayments of bank credit by ICCs, which may have lessened the relative importance of different firms' access to credit finance in determining their response to monetary developments.

## Chart 9 Selected output developments since 1992: manufacturing industries



## Summary

The effects of monetary policy tightening seem to be unevenly distributed across sectors of the economy. The size and timing of contractions in output confirm that some industries are especially sensitive to a tightening of monetary conditions. As might be expected, sectors such as construction show a sizable and rapid decline in output whereas others, like services, show a much more muted reaction. Manufacturing as a whole also responds quite sharply to a monetary tightening but some large industrial sectors, notably the utilities, show a subdued response. Within manufacturing there is a quite wide variation in responses. The smallest is in the manufacture of food, drink and tobacco, which shows only a very modest decline in output, while others—including rubber products and electrical equipment—show much larger changes. Some of the industries showing the largest responses are made up of relatively small firms, perhaps indicating that credit market imperfections may play a role in the monetary policy transmission process.

## SIC (1992) industry definitions

AGR:	Section A; B	Agriculture, hunting and forestry; fishing
PRD:	Section C; D; E	Mining and quarrying (MQA); manufacturing (MAN); electricity, gas and water supply (UTL)
CON:	Section F	Construction
SER:	Sections G to Q	All service industries
DST:	Section G; H	Wholesale and retail trade, repairs; hotels and catering
CMM:	Section I	Transport, storage and communications
OSR:	Section J, K, L, M, N, O, P, Q	Financial and business services; public administration, education, health and other services
FBT:	Subsection DA	Manufacture of food products, beverages and tobacco
TEX:	Subsection DB	Manufacture of basic textile fibres and clothes
LEA:	Subsection DC	Manufacture of leather products and footwear
WOD:	Subsection DD	Manufacture of wood products and building materials
PPP:	Subsection DE	Manufacture of paper, publishing and printing
PET:	Subsection DF	Manufacture of refined petroleum products, coke and nuclear fuel
CHE:	Subsection DG	Manufacture of basic chemical products, paint, soap, pharmaceuticals
RUB:	Subsection DH	Manufacture of tyres, rubber products and building materials
MIN:	Subsection DI	Manufacture of non-metallic mineral products, glass, tiles, building materials
MET:	Subsection DJ	Manufacture of iron and steel, castings
MAC:	Subsection DK	Manufacture of machine tools, basic components
ELC:	Subsection DL	Manufacture of office machinery, electric motors and parts
TPT:	Subsection DM	Manufacture of motor vehicles, aircraft, shipbuilding
OMN:	Subsection DN	Other manufacturing of furniture, miscellaneous household goods

Source: Standard Industrial Classification of economic activities 1992 (London: HMSO) from which fuller details can be obtained.

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## **Probability distributions of future asset prices implied by** option prices

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The most widely used measure of the market's views about the future value of an asset is the mean or average price expectation—a point estimate. This article shows how this information set can be extended by using option prices to estimate the market's entire probability distribution of a future asset price. It also illustrates the potential value of this type of information to the policy-maker in assessing monetary conditions, monetary credibility, the timing and effectiveness of monetary operations, and in identifying anomalous market prices. Finally, the article looks at the limitations in data availability and details some areas for future research.

## Introduction

Many monetary authorities routinely use the forward-looking information that is embedded in financial asset prices to help in formulating and implementing monetary policy. For example, they typically look at changes in the forward rate curve implied by government bond prices to assess changes in market perceptions of future short-term interest rates.<sup>(1)</sup> But, although implied forward rates are informative about the market's mean expectation for future interest rates, they tell us nothing about the range of expected outcomes around such estimates. For this, we can turn to options markets.

An option on a given underlying asset is a contract that gives the holder the right, but not the obligation, to buy or sell that asset at a certain date in the future at a predetermined price. Options that give the holder the right to buy the underlying asset are known as *call* options, while those that give the holder the right to sell the underlying asset are known as *put* options. The predetermined price at which the underlying asset is bought or sold, which is stipulated in an option contract, is known as the *exercise* price or strike price. The date at which an option expires is known as the *maturity date*, *exercise date* or *terminal date*. Options that can be exercised only on the maturity date are known as European options, while those that can be exercised at any time up to and including the maturity date are known as American options.(2)

If the option holder decides to take up his/her right to buy or sell the underlying asset then he/she would exercise the option against the person with which the contract was agreed (known as the writer of the option). So, for example, if the holder of a call option were to exercise that option against its writer, the writer would be obliged to supply the underlying asset to the holder at the pre-agreed exercise price. Of course, the holder of a call option would consider

exercising it only if the price of the underlying asset lay above the strike price at that time.

Consider a set of European options on the same underlying asset, with the same time-to-maturity, but with different exercise prices. The prices of such options are related to the probabilities attached by the market to the possible values of the underlying security on the maturity date of the options. Intuitively, this can be seen by noting that the difference in the price of two options with adjacent exercise prices will reflect the value attached to the ability to exercise the options when the price of the underlying asset lies between the two exercise prices. This price difference in turn depends on the probability of the underlying asset price lying in this interval.

Such probabilities can be estimated, using the full range of exercise prices, from observed options prices in the form of a risk-neutral probability density (RND) function. A probability density is a measure of the frequency with which a particular event occurs. The area under a probability density function for a given range of possible outcomes gives the probability of the eventual outcome being in that range. Since probabilities must sum to one, the total area under a probability density function must be one. Risk neutral, as used here, means that the probability density function depicts the weights attached by a representative risk-neutral market participant to the possible future values of the underlying asset.

This article describes a technique for estimating implied risk-neutral probability density functions from options prices, and illustrates how the information they provide is additional to mean estimates of future asset prices. Further details on the theory, and a comparison of different techniques for estimating implied RND functions will be given in a forthcoming Bank of England Working Paper on the topic.(3)

See, for example, Breedon (1995) and Deacon and Derry (1994).

 <sup>(2)</sup> For further details about options and other derivative securities, see Hull (1993).
 (3) Bahra, B (1996), 'Implied Risk-Neutral Probability Density Functions From Option Prices: Theory and Application', *Bank of England Working Paper series*, forthcoming.

## How are option prices determined?

The current price of a European option on a non dividend paying asset depends on five underlying parameters:

- (i) the current price of the underlying asset on which the option is written;
- (ii) the time remaining until the maturity date of the option;
- (iii) the (annualised) risk-free rate of interest over the remaining life of the option;
- (iv) the exercise price of the option; and
- (v) the annualised volatility of the underlying asset price over the remaining life of the option.

In order to calculate an option's price, one has to make an assumption about how the price of the underlying asset evolves over the life of the option. Many option pricing models specify a *stochastic* process for the price.<sup>(1)</sup> Each stochastic process is consistent with a particular RND function for the price of the underlying asset on the expiry date of the option. For example, the classic Black-Scholes (1973) option pricing model assumes that the price of the underlying asset evolves according to the stochastic process known as geometric Brownian motion. This implies that the underlying asset is expected to earn a constant rate of return, although the price is subject to independent, normally distributed shocks over the life of the option. Under the geometric Brownian motion assumption, the risk-neutral probabilities attached to various possible outcomes for the price of the underlying asset on the maturity date of the option take the form of a lognormal distribution: a lognormal distribution is a tilted, or 'skewed', bell-shaped curve.

## **Implied volatilities**

Out of the five parameters that determine the price of an option, the only one that is currently unobservable is the future volatility of the underlying asset price. But an estimate of this can be inferred from the prices of options traded in the market: given an option price, one can solve an appropriate option pricing model to obtain a market estimate of the future volatility of the underlying asset price. This type of volatility estimate is known as *implied volatility*.

Under the Black-Scholes assumption that the price of the underlying asset evolves according to geometric Brownian motion, the implied volatility ought to be the same across all exercise prices of options on the same underlying asset and with the same maturity date. But the implied volatilities observed in the market typically vary with the exercise price. In particular, the implied volatilities associated with exercise prices a long way from the current price of the underlying asset tend to be higher than those associated with exercise prices which are closer to the current price of the underlying asset. The relationship between implied volatility and exercise price is described by what is known as the implied volatility *smile* curve, as illustrated in Chart 1.



Implied volatility smile curve for LIFFE December 1996 options on the short sterling future<sup>(a)</sup>



(b) Implied volatility is an annualised estimate of the instantaneous standard deviation of the return on the underlying asset over the remaining life of the option.

The existence of the volatility smile curve indicates that market participants make more complex assumptions than geometric Brownian motion about the path of the underlying asset price. And as a result, they attach different probabilities to terminal values of the underlying asset price than those that are consistent with a lognormal distribution. The extent of the curvature of the smile curve indicates the degree to which the market RND function differs from the Black-Scholes (lognormal) RND function. In particular, the greater the curvature, the greater the probability the market attaches to extreme outcomes. This causes the market RND function to have 'fatter tails' than a lognormal density function. In addition, the direction in which the smile curve slopes reflects the direction in which the market RND function is skewed.<sup>(2)</sup>

Any variations in the shape of the smile curve are mirrored by corresponding changes in the curvature of the *call pricing function*—the plot of call prices across exercise prices for options on the same underlying asset and with the same time-to-maturity. The slope and curvature of the smile curve, or of the call pricing function, can be translated into probability space to reveal the market's (non-lognormal) implied terminal RND function. There are a number of techniques for doing this, all of which can be related to an approach first taken by Breeden and Litzenberger (1978).

A variable whose value changes over time in an uncertain way is said to follow a stochastic process.
 The skewness of a probability density function characterises the distribution of probability either side of the mean.

## The Breeden and Litzenberger approach

Breeden and Litzenberger (1978) derived a relationship linking the curvature of the call pricing function to the terminal RND function of the price of the underlying asset. In particular, they showed that the second partial derivative of the call pricing function with respect to the exercise price is directly proportional to the terminal RND function. Details about the derivation of the Breeden and Litzenberger result are given in Bahra (1996). The rest of this article focuses on how this result can be applied in order to estimate market RND functions for short-term interest rates in the future and how such RND functions can be used for policy analysis.

The simplest approach to estimating RND functions is to approximate the second derivative of the call pricing function by calculating the second difference of actual call prices observed across a range of exercise prices.<sup>(1)</sup> This approach produces the implied risk-neutral histogram of the price of the underlying asset at the maturity date of the options.<sup>(2)</sup> Chart 2 shows how the implied histogram for the three-month sterling interest rate on 19 June 1996 (as implied by the June short sterling futures price) changed between 6 March and 8 March 1996, a period which included a cut of 25 basis points in official UK interest rates and the publication of stronger-than-expected US non-farm payrolls data.(3)

### Chart 2 Implied risk-neutral histograms for the three-month sterling interest rate in June 1996<sup>(a)</sup>



### The main drawback of this approach is that it does not smooth out irregularities in observed call pricing functions. These may be due, in cases where bid-ask spreads are

observed instead of actual traded prices, to measurement errors arising from using middle prices. Irregular call pricing functions may also arise if readings are taken at slightly different times. Such irregularities can result in negative implied probabilities. Also, the procedure provides no systematic way of modelling the tails of the probability distributions, which are not observable due to the limited range of exercise prices traded in the market.

But sensible continuous RND functions can be obtained by smoothing the call pricing function in a way that places less weight on data irregularities while preserving its overall form under the assumption of no arbitrage. Since option prices are only observed at discrete intervals across a limited range of exercise prices, the procedures for doing this essentially amount to interpolating between observed exercise prices, and extrapolating outside their range to model the tail probabilities.

Three related approaches have been used in the literature:

- (i) the RND function is derived directly from a particular specification of the call pricing function (or of the implied volatility smile curve);<sup>(4)</sup>
- (ii) assumptions are made about the stochastic process that governs the price of the underlying asset and the RND function is inferred from it;<sup>(5)</sup> and
- (iii) an assumption is made about the form of the RND function itself and its parameters are recovered by minimising the distance between the observed option prices and those that are generated by the assumed functional form.<sup>(6)</sup>

## The lognormal mixture distribution approach

In our research we have adopted the third approach, which focuses directly on the RND function. This means we impose a minimum of structure on the stochastic process of the price of the underlying asset. For the purposes of policy analysis, the functional form assumed for the RND function should be relatively flexible. In particular, it should be able to capture the main contributions to the smile curve, namely the skewness and the kurtosis (ie fatness of the tails) of the underlying distribution. In light of these criteria, we assume that the RND function is a weighted sum of two independent lognormal density functions and we then estimate their parameters from observed option prices.(7) Each lognormal density function is completely defined by two parameters. The values of these parameters, and the relative weighting applied to the two density functions, together determine the overall shape of the implied RND function.

Such second difference estimates are directly proportional to the probabilities attached by the market to the underlying asset price lying in a fixed interval around each of the strike prices when the options expire. The constant of proportionality is the present value of a zero-coupon bond that pays £1 at maturity, with the discount rate being the risk-free rate of interest. For further examples of this approach, see Neuhaus (1995). The histograms were calculated using data for the LIFFE June 1996 option on the short sterling future. The LIFFE settlement prices were used to avoid the problems associated with asynchronous data. See Bates (1991). Jarrow and Rudd (1982), Longstaff (1992, 1995), Malz (1995a) and Shimko (1993). (1)

See Bahra (1996), Jackwerth and Rubinstein (1995), Melick and Thomas (1994), and Rubinstein (1994). Details of the minimisation problem are given in the Technical annex.

Chart 3 shows an example of an implied RND function derived from LIFFE options on the short sterling future using the method described above, which we call the two-lognormal mixture distribution approach. It also shows the (weighted) component lognormal density functions of the RND function.

#### Chart 3

## An implied RND function derived using the two-lognormal mixture distribution approach<sup>(a)</sup>



Chart 4 further illustrates the method, showing how the implied RND function for the three-month sterling interest rate on 19 June 1996 changed between 6 March and

#### Chart 4

## Implied RND functions for the three-month sterling interest rate in June 1996<sup>(a)</sup>



8 March 1996. The left axis of the chart depicts probability density. This is a measure of the frequency with which events occur. On the chart, the probability density associated with a given future interest rate is approximately equal to the probability of the outcome lying in a corridor of five basis points either side of that rate. The shape of the distribution would be expected to vary over time as news arrives and option prices adjust to incorporate changing beliefs about future events. The twolognormal mixture distribution can incorporate a wide variety of possible functional forms which, in turn, are able to accommodate a wide range of possible scenarios. This includes, for example, a situation in which the market believes that the terminal price of the underlying asset is most likely to take one of two possible values, in which case it attaches high probabilities around those levels, giving rise to an implied RND function with two modes, ie the market has a bi-modal view.

It is important to remember that the implied density functions derived are risk neutral, that is, they are equivalent to the true market density functions only when investors are risk neutral. In reality investors are likely to be risk averse, and option prices will incorporate these preferences towards risk as well as beliefs about future outcomes. To distinguish between these two factors would require specification of the aggregate market utility function (which is unobservable) and estimation of the corresponding coefficient of risk aversion. But, even if the market does demand a premium for taking on risk, the true market implied density function may not differ very much from the RND function, at least for some markets.<sup>(1)</sup> Moreover, on the assumption that the market's aversion to risk is relatively stable over time, changes in the RND function from one day to the next should mainly reflect changes in investors' beliefs about future outcomes for the price of the underlying asset.

## Using the information contained in implied RND functions

We now illustrate how the information contained in implied RND functions may be used in formulating and implementing monetary policy. We begin by describing various summary measures for density functions and then suggest a way to validate the two-lognormal mixture distribution approach. Next, we outline different ways in which implied RND functions may be used by the policy-maker. Finally, we discuss some caveats and limitations in data availability, and detail some areas for future research.

#### Summary statistics

Much of the information contained in RND functions can be captured through a range of summary statistics. For example, the mean is the expected future value of the underlying asset, or the average value of all possible future outcomes. Forward-looking information, whether derived directly from futures prices, or indirectly via bond yields is typically based on the mean. The median, which has 50% of the distribution on either side of it, is an alternative measure of the centre of a distribution. The mode, on the other hand, is the most likely future outcome. The standard deviation of an implied RND function is a measure of the

(1) For example, Rubinstein (1994) converts an RND function for an equity index to a 'subjective' density function under the assumption that the representative investor maximises his/her expected utility of wealth with constant relative risk aversion (CRRA). He finds that for assumed market risk premia of between 3.3% and 5%, the subjective distribution is only slightly shifted to the right relative to the risk-neutral distribution, and that the qualitative shapes of the two distributions are quite similar.

uncertainty around the mean and is analogous to the implied volatility measure derived from options prices. An alternative dispersion statistic is the interquartile range (IQR). This gives the distance between the 25% quartile and the 75% quartile, that is, the central 50% of the distribution lies within it. Skewness characterises the distribution of probability either side of the mean. A positively skewed distribution is one for which there is less probability attached to outcomes higher than the mean than to outcomes below the mean. Kurtosis is a measure of the 'peakedness' of a distribution and/or the likelihood of extreme outcomes: the greater this likelihood, the fatter the tails of the distribution. These summary statistics provide a useful way of tracking the behaviour of RND functions over the life of a single contract and of making comparisons across contracts.

Charts 5 and 6 show the RND functions, as at 4 June 1996, for the three-month sterling interest rate in December 1996

## Chart 5





(a) Derived using LIFFE December 1996 options on the short sterling future, as at 4 June 1996.

## Chart 6

## Implied RND function for the three-month sterling interest rate in March 1997<sup>(a)</sup>



(a) Derived using LIFFE March 1997 options on the short sterling future, as at 4 June 1996.

and in March 1997. Charts 7 and 8 depict the RND functions, also as at 4 June 1996, for the three-month Deutsche Mark interest rate in the same months. Table A shows the summary statistics for these four distributions.

### Chart 7 Implied RND function for the three-month Deutsche Mark interest rate in December 1996<sup>(a)</sup>



## Chart 8 Implied RND function for the three-month Deutsche Mark interest rate in March 1997<sup>(a)</sup>



The means of the distributions are equivalent to the interest rates implied by the current prices of the relevant futures contracts, and are lower in Germany than in the United Kingdom.<sup>(1)</sup> For both countries, the dispersion statistics (standard deviation and IQR) are higher for the March 1997 contract than for the December 1996 contract. One would expect this since, over longer time horizons, there is more uncertainty about the expected outcome. Chart 9 confirms this, showing the upper and lower quartiles with the mean and the mode for the three-month sterling interest rate on four different option maturity dates as at 15 May 1996. It can be seen that the IQR is higher for contracts with longer maturities. Also, the standard deviations of the two distributions for the sterling rate are higher than the

(1) The mean of an implied RND function should equal the forward value of the underlying asset. In this case the underlying assets are short-term interest rate futures contracts. The expected growth rate of a futures price in a risk-neutral world is zero. Hence, the means of the implied RND functions are equal to the interest rates implied by the respective current futures prices.

#### **Table A**

## Summary statistics for the three-month sterling and Deutsche Mark interest rates in December 1996 and March 1997<sup>(a)</sup>

Sterling	December 1996	March 1997
Mean	6.33	6.66
Mode	6.18	6.43
Median	6.27	6.56
Standard deviation	0.66	1.01
Interquartile range	0.80	1.19
Skewness	0.83	0.76
Kurtosis (b)	4.96	4.67
Deutsche Mark		
Mean	3.45	3.73
Mode	3.29	3.47
Median	3.39	3.62
Standard deviation	0.55	0.84
Interquartile range	0.69	0.95
Skewness	0.75	1.16
Kurtosis	4.27	6.06

(a) Derived using LIFFE December 1996 and March 1997 options on the short sterling and Euromark futures, as at 4 June 1996.

(b) A normal distribution has a fixed kurtosis of three.

corresponding standard deviations of those for the Deutsche Mark rate, suggesting greater uncertainty about the level of future short-term rates in the United Kingdom than in Germany. Another feature of all four distributions is that they are positively skewed, indicating that there is less probability to the right of each of the means than to their left. The fact that the mode is to the left of the mean is usually also indicative of a positive skew. This feature is discussed in greater detail below.

## Chart 9

Implied RND summary statistics for the three-month sterling interest rate on four different option maturity dates<sup>(a)</sup>



#### Validation

In deciding whether to place reliance on the information extracted using a new technique, one not only needs to be confident of the theory, but must also test whether in practice changes in the expectations depicted are believable in light of the news reaching the market. In the case of short-term interest rate expectations, we sought to do this by examining the way RND functions for short-term sterling interest rates change over time, and by comparing the RND functions for short-term sterling interest rates with those from Germany, a country with different macroeconomic conditions and monetary history.

#### Analysing changes in implied RND functions over time

Charts 10 and 11 show a convenient way of representing the evolution of implied RND functions over the life of a single option contract. Chart 10 shows the market's views of the three-month sterling interest rate on 19 June 1996 (as implied by the prices of LIFFE June short sterling futures

## Chart 10

## Implied RND summary statistics for the three-month sterling interest rate in June 1996<sup>(a)</sup>



options) between 22 June 1995 and 7 June 1996. Chart 11 shows the same type of information for the three-month Deutsche Mark interest rate on 17 June 1996 (as implied by

## Chart 11 Implied RND summary statistics for the three-month



the prices of LIFFE June Euromark futures options) between 20 June 1995 and 7 June 1996. Both charts depict the mean, mode, and the lower (25%) and upper (75%) quartiles of the distributions.

These time-series representations of implied RND functions convey how market uncertainty about the expected outcome changed over time; an increase in the distance between the lower and upper quartiles indicates that the market became more uncertain about the expected outcome. Charts 10 and 11 also convey information about changes in the skewness of the implied distributions. For example, the location of the mean relative to the lower and upper quartiles is informative of the direction and extent of the skew. Movements in the mean relative to the mode are also indicative of changes in skewness.

Generally, both sets of implied RND functions depict falling forward rates over the period analysed, as evidenced by the downward trend in the mean and mode statistics. At the same time, the gaps between these measures narrowed, suggesting that the distribution of market participants' expectations was becoming more symmetrical as the time horizon shortened. Charts 10 and 11 also show that as the maturity date of a contract is approached, the distributions typically become less dispersed causing the quartiles to converge upon the mean. This is because as the time horizon becomes shorter, the market, all other things being equal, becomes more certain about the terminal outcome due to the smaller likelihood of extreme events occurring. Another feature of the distributions is that the mode is persistently below the mean expectation in both countries, indicating a positive skew to expectations of future interest rates. In the United Kingdom, this might be interpreted as reflecting political uncertainty, with the market attaching some probability to much higher short-term rates in the future. However, in Germany the macroeconomic and political conditions are different and yet the RND functions are also positively skewed.

One possible explanation is that the market perceives there to be a lower bound on nominal interest rates at zero. In this case, the range of possible outcomes below the current rate is restricted, whereas the range of possible outcomes above the current rate is, in principle, unlimited. If market participants are generally uncertain, that is, they attach positive probabilities to a wide range of possible outcomes, the lower bound may naturally result in the RND function having a positive skew. Moreover, the lower the current level of rates, the more positive this skew may be for a given degree of uncertainty.

Charts 12 and 13 show how the skewness and kurtosis for the three-month sterling interest rate on 19 June 1996 changed between 22 June 1995 and 7 June 1996. It is notable that, unlike the measures of dispersion, these statistics exhibit no clear trend over their life cycles. Also, they appear to become more volatile towards the end of the contract's life.

## Analysing changes in implied RND functions around specific events

A detailed example of a change in perceptions following a particular news event is given in Chart 14 which shows the

## Chart 12 Implied skewness for the three-month sterling interest rate in June 1996<sup>(a)</sup>



Chart 13







# Change in the implied RND function for the three-month sterling interest rate in June 1996 around the publication of the May 1996 *Inflation Report*<sup>(a)</sup>



(a) Derived using LIFFE June 1996 options on the short sterling future, as at 13 May and 15 May 1996. change in the shape of the implied RND function for the three-month sterling interest rate in June 1996 around the publication of the May 1996 Inflation Report on 14 May. The Inflation Report concluded that it was marginally more likely than not that inflation would be above 2.5% in two years' time were official rates to remain unchanged throughout that period. This was followed by an upward revision of the market's mean expectation for short-term interest rates between 13 May and 15 May. However, it seems that this upward move was not driven so much by a rightward *shift* in the distribution as by a change in the entire shape of the distribution; a reallocation of probability from outcomes between 5.6% and 5.9% to outcomes between 5.9% and 6.6% resulted in a fatter right tail which was in part responsible for the upward movement in the mean. This type of change in the shape of implied RND functions is illustrative of how they can add value to existing measures of market expectations such as the mean.

A similar change in market sentiment can be observed in Germany between 16 and 21 February 1996, ahead of the publication of the German M3 figure on 23 February. Chart 15 shows how the implied RND function for the three-month Deutsche Mark interest rate in June 1996 changed between these two dates. There was a significant shift in probability from outcomes between 2.5% and 3.3% to outcomes between 3.3% and 4.5%, apparently driven by market speculation ahead of the publication of the data. In particular, on 21 February the market attached a much higher probability to short-term rates being around 4% in June than it did on 16 February.

#### Chart 15

# Change in the implied RND function for the three-month Deutsche Mark interest rate in June 1996<sup>(a)</sup>



The cut in UK official interest rates on 6 June 1996 provides an illustration of how market perceptions may change around a monetary policy decision. Chart 16 shows the change in the shape of the implied RND function for the three-month sterling interest rate in September 1996 between 5 and 6 June 1996. Table B shows the summary statistics for the RND functions on each of these dates.

## Chart 16 Change in the implied RND function for the three-month sterling interest rate in September 1996(a)



(a) Derived using LIFFE September 1996 options on the short sterling future, as at 5 June and 6 June 1996.

## Table BSummary statistics for the RND functions in Chart 16

	5 June 1996	6 June 1996
Mean	6.16	5.91
Mode	6.11	5.91
Median	6.12	5.91
Mean minus mode	0.05	0.01
Standard deviation	0.35	0.30
Interquartile range	0.27	0.31
Lower quartile	6.00	5.76
Upper quartile	6.27	6.07
Skewness	0.85	0.22
Kurtosis (a)	6.61	7.02

(a) A normal distribution has a fixed kurtosis of three.

The first point to note is that the mean moved down by 25 basis points, which was the size of the interest rate cut. Second, the distribution on 6 June was more symmetrical (in fact the mean was almost equal to the mode) and had a higher standard deviation compared to the previous day; ie the market was more uncertain on 6 June than on 5 June about the short-term interest rate in September, and attached the same weight to it being above the mean as to it being below the mean. The change in the degree of skewness can also be seen by the shift in probability from outcomes between 6% and 7% to outcomes between 5.5% and 6%, resulting in a much thinner right tail and a left tail which was only slightly fatter. By comparison with other day-to-day movements, this particular change in the shape of the implied distribution was quite large indicating the extent to which the market was surprised by the rate cut.

The above examples suggest that the two-lognormal mixture distribution approach is validated by recent market developments in the United Kingdom and in Germany. Although the mean expectation remains a key summary statistic, on the basis of these and other examples there is no reason to doubt that implied RND functions can add to our understanding of short-term interest rate expectations.

#### Use of implied RND functions by monetary authorities

We now discuss four ways in which the policy-maker may use implied RND functions.

### Assessing monetary conditions

Assuming that financial market expectations are indicative of those in the economy as a whole, RND functions have the potential to improve the authorities' ability to assess monetary conditions on a day-to-day basis.

In principle, the whole probability distribution of future short-term interest rates is relevant to the determination of economic agents' behaviour. A lot of this information is captured in the mean of the distribution, which can already be observed directly from the yield curve or forward rates, but other summary statistics may add explanatory power. For example, suppose that agents tend to place less weight on extreme interest rate outcomes when taking investment or consumption decisions than is assumed in the mean of the interest rate probability distribution. In this case, a trimmed mean-in which the probabilities attached to extreme outcomes are ignored or given reduced weightmay reflect the information used by agents better than the standard mean, and so may provide a better indication of monetary conditions for the monetary authorities. Much of the time the standard mean and the trimmed mean may move together, but one could envisage circumstances in which the standard mean is influenced by an increase in the probabilities attached to very unlikely outcomes, while the trimmed mean is less affected. Similar issues would arise if investors or consumers placed more weight on extreme interest rate outcomes than allowed for in the standard mean.

At present, this kind of scenario is entirely speculative. Further empirical research is required to assess whether summary statistics such as an adjusted mean, the mode, median, interquartile range, skewness and kurtosis can add explanatory power to the standard mean interest rate in conventional economic models.

RND functions may also provide evidence of special situations influencing the formation of asset price expectations. For example, if two distinct economic or political scenarios meant that asset prices would take very different values according to which scenario occurred, then this might be revealed in bi-modal probability distributions for various asset prices.

## Assessing monetary credibility

A monetary strategy to achieve a particular inflation target can be described as credible if the public believes that the government will carry out its plans. So, a relative measure of credibility is the difference between the market's perceived distribution of the future rate of inflation and that of the authorities.<sup>(1)</sup> Some information on this is already available in the United Kingdom in the form of implied forward inflation rates, calculated from the yields of index-linked and conventional gilts. But this only gives us the mean of the market's probability distribution for future inflation. Even if this mean were the same as the authorities' target, this could mask a lack of credibility if the market placed higher weights on much lower and much higher inflation outcomes than the authorities.

Unfortunately, there are at present no instruments which enable the extraction of an RND function for inflation. Future research on implied probability distributions for long-term interest rates revealed by options on the long gilt future may, however, help in this respect, to the extent that most of the uncertainty over long-term interest rates—and hence news in the shape of a long gilt RND function—may plausibly be attributed to uncertainty over future inflation.

## Assessing the timing and effectiveness of monetary operations

Implied RND functions from options on short-term interest rates indicate the probabilities the market attaches to various near-term monetary policy actions. These probabilities are in turn determined by market participants' expectations about news and their view of the authorities' reaction function.

In this context, implied RND summary statistics may help the authorities to assess the market's likely reaction to particular policy actions. For example, a decision to raise short-term interest rates may have a different impact on market perceptions of policy when the market appears to be very certain that rates will remain unchanged, (as evidenced by a narrow and symmetric RND function for future interest rates) from when the mean of the probability distribution for future rates is the same, but the market already attaches non-trivial probabilities to sharply higher rates, albeit counterbalanced by higher probabilities attached to certain lower rates.

Equally, implied RND functions may help in the *ex post* analysis of policy actions. For example, if the shape and location of the implied RND function for short-term interest rates three months ahead remains the same following a change in base rates, this suggests, all other things being equal, that the market fully expected the change in monetary stance. By contrast a constant mean is less informative because it could disguise significant changes in skewness and kurtosis.

Implied probability distributions may also be useful for analysing market reactions to money-market operations which do not involve a change in official rates, or events such as government bond auctions. These can be assessed either directly by looking at probability distributions from the markets concerned, or indirectly by looking at related markets.

## Identifying market anomalies

All of the above uses of RND data assume that markets are perfectly competitive and that market participants are rational. But provided one has overall confidence in the technique used, RND functions may help to identify occasional situations where one or other of these assumptions does not hold, essentially because the story being told is not believable.

For example, in the face of an 'abnormal' asset price movement-such as a stock market crash or a sharp jump in the nominal exchange rate, which is not easily explained by news hitting the market-the information embedded in options prices for this and related assets may help the authorities to understand whether the movement in question is likely to be sustained with consequent macroeconomic effects, or whether it reflects a temporary phenomenon, possibly due to market failure. For example, if RND functions suggest that the market factored in the possibility of the very large asset price movement because it purchased insurance against the move in advance, then the amount of news required to trigger the change might reasonably be expected to be less than in the situation where there was no advance knowledge. This in turn might make it more believable that the move reflected fundamentals and hence would be sustained.

## Limitations in data availability

The most important limitation, from the point of view of a monetary authority, is that there are no markets that allow us directly to assess uncertainty about future inflation. To learn about the market's future inflation distribution would require a market in options on inflation, for example, options on annual changes in the retail prices index (RPI), or a market in options on real rates, as in index-linked bond futures. This would reveal what price agents were willing to pay to insure themselves against the risks to the inflation outturn, and hence the probabilities they attached to various future inflationary outcomes. Neither inflation options, nor options on index-linked bond futures are traded on exchanges anywhere in the world. However, such instruments could conceivably be available in the future.

Another limitation is that the technique is restricted to European options, whilst many of the more liquid exchange-traded options are often American.<sup>(1)</sup> This restriction is a feature of most of the existing techniques for deriving RND functions. Fairly complex extensions of these techniques are required to estimate terminal RND functions from the prices of American options.<sup>(2)</sup> Even then the RND function can only be derived within a bound that allows for the possibility that the options may be exercised at any time before the maturity date.

There are also limitations to the quality of the data that is available. Some option contracts are fairly illiquid, particularly at those strike prices which are a long way above or below the prevailing market price of the underlying asset. The prices of such contracts may be less informative

about market expectations, or may not be available. This data limitation sometimes results in sudden changes in the degree of curvature of the option pricing function. The two-lognormal mixture distribution approach may in turn be sensitive to this. Chart 17 shows an example of the sort of (implausibly) spiked RND function that has on occasion resulted when there are relatively few data observations across strike prices.

## Chart 17

#### Implied RND function for the three-month sterling interest rate in September 1996(a)



<sup>(</sup>a) Derived using LIFFE September 1996 options on the short sterling future. as at 8 May 1996

To derive implied RND functions we need options prices across the widest possible range of strike prices. To ensure that they are representative of the market's views, and that they can be estimated regularly, we use exchange-traded options contracts. But these have a limited number of fixed maturity dates, which is problematic when deriving time series of distributions and when assessing changes in market perceptions of short-term rates in the very near future. For example, if there are three months remaining until the nearest option maturity date, it is not possible to determine the market's perceptions of the short-term rate in one month's time. Also, because it is not possible with exchange-traded options to ensure that intra-day call and put prices are observable across exercise prices at the same time, only (end-of-day) settlement prices are usable in practice.

## **Conclusions**

This article has shown how the information contained in implied risk-neutral probability density functions estimated from options prices can add to the type of forward-looking information available to policy-makers. To the extent that the distribution around the mean is observed to change in shape over time, measures such as the standard deviation, mode, interquartile range, skewness and kurtosis are useful in quantifying these changes in market perceptions. But, a

LIFFE options on interest rate futures, although American, can be treated as European. This is because they are margined daily, which means that (1)En response on meters have ruleurs, and use a more structure as the order of a second second

<sup>(2)</sup> 

good deal of further research, including event studies and the use of RND summary statistics in addition to the mean in classic economic models, is required to extract the maximum benefit from such information.

As a first step, it is important to be able to identify when a particular change in an implied probability distribution is significant by historical standards. One way of doing this is to establish suitable benchmarks. This would enable a large change in the shape of an RND function to be compared with changes in market perceptions at the time of a significant economic event in the past. In addition, RND

functions could be estimated over the life cycles of many historical contracts for the same underlying asset in order to calculate average values for their summary statistics at particular points in the life cycle. These average values would identify the characteristics of a typical implied RND function during its life cycle. The Bank plans to calculate this information for the implied RND functions of short-term sterling and Deutsche Mark interest rates. It is also in the process of implementing the technique discussed in this article for options on long-term interest rate futures and for currency and equity options.

## **Technical annex**

This annex describes the objective function that we minimise in the two-lognormal mixture distribution approach to estimating RND functions.

The price of a European call option can be written as the discounted sum of all expected future payoffs in a risk-neutral world, that is,

$$c(X) = e^{-r(T-t)} \int_{X}^{\infty} q(S_T) (S_T - X) dS_T$$
(1)

where c(X) is the price of a European call option with exercise price X, r is the (annualised) risk-free rate of interest over the remaining life of the option, T - t is the time remaining until the maturity date, T, of the option,  $S_T$  is the price of the underlying asset on the maturity date, and  $q(S_T)$  is the RND function of  $S_T$ .

In theory any functional form for the RND function,  $q(S_T)$ , can be specified in equation (1), and its parameters estimated by numerical optimisation. But, given that options are traded across a finite range of exercise prices, there are limits on the number of distributional parameters that can be estimated from the data. As noted in the article, a flexible and numerically tractable parametric specification for  $q(S_T)$ , which is consistent with observed financial asset price distributions, is a weighted sum of two independent lognormal density functions. Under this assumption the call pricing equation becomes:

$$c(X) = e^{-r(T-t)} \int_{X}^{\infty} \left[ \theta L(\alpha_1, \beta_1; S_T) + (1-\theta) L(\alpha_2, \beta_2; S_T) \right] (S_T - X) dS_T$$
<sup>(2)</sup>

where the weight parameter,  $\theta$ , lies between zero and one, and  $L(\alpha_i, \beta_i; S_T)$  denotes a lognormal density function for variable  $S_T$  with parameters  $\alpha_i$  and  $\beta_i$ .

For fixed values of X and T - t, and for a set of values for the five distributional parameters and r, equation (2) can be used to provide a fitted value of c(X). This calculation can be applied across all exercise prices to minimise the sum of squared errors, with respect to the five distributional parameters and r, between the option prices generated by the mixture distribution model and those actually observed in the market. In practice, since we can observe interest rates which closely approximate r, we use this information to fix r, and thereby reduce the complexity of the minimisation problem. So, the minimisation is carried out with respect to the five distributional parameters only.

Since both call and put options are priced off the same underlying distribution, we include both sets of prices in the minimisation. Also, in the absence of arbitrage opportunities, the mean of the implied RND function should equal the forward price of the underlying asset. In this sense we can use the incremental information provided by the forward price of the underlying asset by including it as an additional observation in the minimisation procedure. The minimisation problem is:

$$\underbrace{Min}_{\alpha_{1},\alpha_{2},\beta_{1},\beta_{2},\theta} \sum_{i=1}^{n} \left[ c(X_{i}) - \hat{c}_{i} \right]^{2} + \sum_{i=1}^{n} \left[ p(X_{i}) - \hat{p}_{i} \right]^{2} + \left[ \theta e^{\alpha_{1} + \frac{1}{2}\beta_{1}^{2}} + (1 - \theta)e^{\alpha_{2} + \frac{1}{2}\beta_{2}^{2}} - e^{r(T - t)}S_{t} \right]^{2} \tag{3}$$

subject to  $\beta_1, \beta_2 > 0$  and 0 "  $\theta$  " 1, over the observed strike range  $X_1, X_2, X_3, \dots, X_n$ , where  $c(X_i)$  and  $p(X_i)$  are the observed prices of call and put options, respectively, with exercise prices  $X_i$ , and  $S_t$  is the time-*t* (current) price of the underlying asset. The (weighted) sum of the first two exponential terms in the last bracket in equation (3) represents the mean of the mixture RND function.

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# **Expected interest rate convergence**

## By Neil Cooper and Jim Steeley of the Bank's Monetary Instruments and Markets Division.

In the previous edition of the Quarterly Bulletin, the authors described the method underpinning the Bank's approach to estimating yield curves for the G7 countries. This article presents an economic application of these curves. It looks at estimated forward rate curves for pairs of countries, in order to assess the interest rate differentials that bond market participants expect to occur at different times in the future. Although the prospect of EMU may account for expected interest rate convergence among some of these countries, there are other factors that could also explain the observed interest rate differentials.

In the May 1996 *Quarterly Bulletin*,<sup>(1)</sup> we described the method underlying the Bank's approach to estimating yield curves for the G7 countries. A natural application of these estimated curves is to see how the monetary stance between different countries is expected to evolve over time. In principle, nominal forward short-term interest rates can be considered as comprising the following components:

- real interest rate expectations and real interest rate risk premia;
- inflation rate expectations and inflation rate risk premia;
- liquidity premia; and
- default risk premia.

It follows that if there were no risk, liquidity or other premia, then the pure expectations theory of the term structure would hold, and forward interest rates would be unbiased forecasts of future short-term interest rates. In that case, or if any premia are small or stable over time, the implied forward short-term interest rate differential between a pair of countries at a particular maturity may provide information about the short-term interest rate differential expected in the future.

In addition to these theoretical considerations, there are a number of technical issues to be borne in mind when conducting cross-country analysis of forward interest rates. The forward curves in each pair of countries are estimated separately, and may be subject to quite different estimation errors along the maturity spectrum. For example, the curve may be more accurate at the long end for one country than for another. For instance, the relative scarcity of long German bonds makes the long end of the German curve less well defined than the long end of the US curve. Such differences may change from country to country and from day to day. So it is essential to consider these forward rate differentials over a period of time and look at the broad trends, rather than focusing on the exact differentials at specific points in time.

The charts show monthly data for six-month annualised forward short-term interest rate differentials between Germany and the United Kingdom, France, Italy and the United States at the beginning of 1999, 2001 and 2004, as implied by yield curves calculated for those countries. The

## Chart 1 Differential between UK and German forward rates<sup>(a)</sup>



horizontal axes show the dates at which the forward rates were measured and so, subject to the caveats mentioned above, each chart displays how expectations of the future interest rate differentials between a pair of countries have evolved. The short-term variability in the data mentioned earlier is quite visible.

Since early 1994, the implied interest rate differential at the beginning of 1999 between the United Kingdom and Germany has been consistently greater than 100 basis

(1) Cooper, N and Steeley J, 'G7 yield curves', Bank of England Quarterly Bulletin, May 1996, pages 199-208.

#### Chart 2 Differential between French and German forward rates<sup>(a)</sup>



<sup>(</sup>a) Each monthly observation is taken on the business day nearest to the beginning of the month.

#### Chart 3





points. The implied differentials at the beginning of 2001 and 2004 are, by contrast, smaller. The implied differential between France and Germany at the beginning of 1999 has been consistently smaller than the UK-Germany differential and has recently been less than 50 basis points.<sup>(1)</sup> Implied interest rate differentials between Italy and Germany are larger than those between the United Kingdom and Germany for all three dates in the future. Recently the differentials have fallen; the current differential implied for

#### Chart 4 Differential between US and German forward rates<sup>(a)</sup>



1999 is around 250 basis points. The differential between German and US forward rates has fluctuated around zero.

These patterns of implied interest rate differentials can be interpreted in a number of different ways. One possible interpretation relates to the probabilities attached by the bond market to particular countries joining the European Monetary Union (EMU). EMU is due to start on 1 January 1999, and so from that date the countries taking part will have identical interest rates. The current position of the forward rate differentials among the European countries is consistent with a higher probability-but something short of a complete certainty-being attached to France and Germany entering a monetary union around 1999 than to the United Kingdom and Italy joining at that point. The smaller interest rate differentials between the United Kingdom and Germany implied for more distant dates than 1999 may indicate that the market attaches a greater probability to the United Kingdom joining a monetary union after 1999.

But while the prospect of EMU is a sufficient condition for expected interest rate convergence between countries, it is not a necessary one. The behaviour of the US-Germany differential shows that forward interest rates in two countries may be aligned for reasons quite independent of proposals for monetary union. Leaving aside the possible presence of the various premia which could bias forward interest rates, forward rate convergence could simply indicate that the stance of monetary policy in two countries was expected to be similar in the future.

 The negative differentials between France and Germany in 2001 and 2004 probably reflect either estimation problems or a market anomoly, rather than economic factors.

## **Payment and settlement strategy**

The Bank of England announced in November last year that it proposed to review, with market participants and other interested parties, the strategic requirements for payment and settlement for UK financial markets. The review was conducted during the first half of this year and this note summarises its findings. It was presented by the **Governor** to the City Promotion Panel on 3 July.

Over the past 10–15 years there has been an increasing awareness of the risks involved in the expanding volumes of payments and settlements both domestically and internationally. At the same time advances in information technology have made it possible to reduce or eliminate these risks. This note describes the key steps that have already been taken in this direction and the further steps envisaged in the period ahead.

## The starting point

The starting point was one in which sterling payments were based on end-of-day net settlement between settlement banks which had no effective means of controlling their exposure to each other during the course of the day. Securities settlement involved slow paper-based transfers, which, because of the difficulties of the payment system, could not be synchronised with the related payments, so that neither the seller nor the purchaser of a security could be sure that he would retain title to either the security or the cash payment in the event of default by his counterparty. Similar weaknesses applied to the settlement of foreign exchange transactions.

## **Progress to date**

A series of steps have been initiated over the past decade to reduce these weaknesses.

In 1986 the Bank developed, with the Stock Exchange, a book entry transfer system for settling gilt-edged securities called the Central Gilts Office (CGO). This permitted faster and cheaper transfers and provided a very high degree of certainty of delivery of good title to securities in the system. The CGO service also introduced an assured payment mechanism under which the settlement banks provided a form of delivery versus payment (DVP) for all members of the system except themselves. This was a considerable advance in terms of reducing risk in the system, but as with the payment system, settlement banks still incurred intra-day exposures to each other which were settled net at the end of the day.

In 1990 the Bank introduced a broadly similar service for settling money-market instruments such as commercial bills, Treasury bills and Certificates of Deposit. This service, called CMO, did not include an assured payments mechanism. A further major step in improving settlement efficiency and reducing risk will be taken later this month when the CREST system for settling equities, corporate bonds and other securities goes live on 15 July. It will provide automated links with banks and brokers on one side and companies' registrars on the other, thereby enabling it to provide faster and cheaper transfers through book entry. It will also include an assured payment mechanism.

The CGO service itself is being upgraded using CREST software to accommodate recent and prospective innovations in the gilt-edged market such as repos and strips. The augmented service will operate from spring 1997. The use of common software for CGO and CREST opens up the possibility of merging the two settlement systems in due course, and that option is being studied.

The elimination of the intra-day exposures between settlement banks in the payment system took rather longer than the initial development of CGO and CMO. But in April of this year the Real Time Gross Settlement (RTGS) system, which the Bank developed jointly with APACS and the CHAPS settlement banks, went live. It provides final payment in central bank funds as each individual high value payment is made between settlement banks. The receiving bank therefore has immediate good funds which can safely be made available to its customer for immediate use without the risk that the transaction might not settle or might be unwound.

#### **Future developments**

The steps already taken represent the essential building blocks for further progress towards risk reduction in our domestic settlement arrangements.

Under the present arrangement for assured payments, settlement banks guarantee their customers' payments when the securities they are buying move in the system. To give such a guarantee, however, settlement banks accept potentially very large exposures to each other which are similar to the exposures they ran in the CHAPS system before RTGS was introduced. Although the exposures incurred by settlement banks *vis-à-vis* their customers will be controlled in CREST, and in the augmented version of CGO, by caps on exposures, the interbank risks can be eliminated only by linking the movement of securities to the

real-time movement of central bank funds between settlement banks in a full form of DVP.

The RTGS system, together with the development of efficient book entry transfer systems for securities settlement, provide the building blocks for full DVP arrangements. They offer the possibility of synchronising the exchange of final funds against good title.

There are a number of different ways in which DVP can be achieved in practice, each involving different IT and legal issues. The priority, in terms of risk reduction, is to achieve DVP in CGO as the average daily values settled in that system amount to £85 billion—almost as much as settled in the RTGS payment system, which is currently around £110 billion per day. CREST expects to settle around £8 billion per day and CMO settles around £11 billion per day. But, given the great similarity between the CREST system and CGO—particularly when CGO is upgraded—it will be very likely that any technical solution for CGO will work in a similar form for CREST.

To plan the introduction of full DVP in domestic securities settlement the Bank is establishing a working group to examine these technical options for CGO, and presumptively for CREST, in detail. In the meantime the Bank will be exploring the legal problems relating to the exchange of title to money-market instruments electronically as a necessary step towards DVP also in relation to CMO.

Implementation of this programme over the next few years will address most of the weaknesses in our domestic payment and settlement arrangements. But we need also to improve the relationship between our domestic arrangements and those in the rest of the world. In this connection we are working on two fronts—on intra-European arrangements, connected with the possible introduction of the euro and on improving foreign exchange settlement more generally.

#### **European arrangements**

Within the European Union, all central banks are committed to introducing domestic RTGS systems. In addition the European Monetary Institute is co-ordinating the development of a cross-EU system called TARGET to link domestic systems as part of the preparation for the single currency. TARGET would operate in euros and would enable a bank in one country to send a high-value euro payment to a bank in another participating country in central bank funds within minutes. All countries in the monetary union would take part and other EU countries, not in the monetary union, would be able to connect to the system. In the latter group the euro would be a foreign currency. In just the same way as domestic RTGS systems eliminate domestic interbank exposures, the European TARGET system would eliminate interbank exposures in euro for crossborder payments. The United Kingdom will join TARGET whether or not the United Kingdom becomes part of the monetary union. The Bank of England will offer a connection to the TARGET system together with settlement accounts in euro, which will enable banks in the United Kingdom to make safe high-value euro payments. The settlement banks, through CHAPS, have established a working group to consider what mechanism they might wish to establish to enable them to make use of these facilities.

## Foreign exchange settlement risk

The largest settlement risk, in terms of the sums involved, is foreign exchange settlement risk. That issue has been reviewed by a group established by the G10 central banks meeting at the BIS in Basle and which reported in March this year. The G10 group analysed the risks in detail and surveyed banks' ability to monitor and control their foreign exchange settlement exposures. The results were disturbing and the G10 has put in place a three-point strategy to achieve significant progress within two years. That strategy is a clear priority for improving payment and settlement arrangements in all major countries.

In settling a foreign exchange transaction a bank is exposed to the risk that its counterparty may fail from the moment its instructions to transfer the sold currency become irrevocable to the moment it receives the bought currency with finality. The risk is for the entire principal amount—it is like an unsecured loan to its counterparty. The G10 report showed that these exposures were much more than an intra-day risk and could last several days. In some cases, the exposure to a single counterparty could exceed a bank's capital.

The three-point strategy in relation to foreign exchange risk involves action by individual banks, by industry groups and by central banks. Individual banks can improve their ability to monitor exposures. They can also reduce their exposures by more careful control of the release of payment instructions, by demanding better service from correspondents, and by monitoring receipts carefully. Industry groups can improve settlement arrangements through well-founded bilateral or multilateral netting arrangements or through other collective arrangements to synchronise better the exchange of payments. And central banks will publicise the issue, monitor banks' responses in conjunction with banking supervisors, and review progress after one and two years. If progress is not adequate, central banks will consider what further action is required.

## Practical issues arising from the single currency

The Bank intends to publish a broadly quarterly series of papers as part of its efforts to ensure that the practical issues arising from the single currency, whether the United Kingdom is inside or outside the euro area, are fully understood and appropriate action is taken. This paper was originally prepared for the House of Commons' Select Committee on the Treasury, and subsequently made publicly available on 10 May. It reports the outcome of the Bank's discussions with banking and other sectors in the United Kingdom in the period up to May.

## Introduction

Since the European Monetary Institute (EMI) concluded its work last autumn to define the way in which the single currency should be introduced, a framework subsequently endorsed at last December's Madrid Summit, the Bank has engaged in wide-ranging informal discussions with the trade bodies and associations representing many areas across the UK economy including, but going much broader than, the financial sector. We have explained what would be involved during each of the different stages identified for the transition to the single currency, on the basis of a short paper now published in the February 1996 *Quarterly Bulletin*; and invited each set of interlocutors to identify within their associations those areas where some form of collective or co-ordinated activity could be required, including the role for the authorities.

The banking industry is naturally at the centre of the preparations for the euro, and the Bank therefore regards it as essential to maintain a close relationship with the banking community on the practical issues raised by the single currency. Accordingly, with the Bank's encouragement and with Bank representation, the BBA established with APACS<sup>(1)</sup> last spring a European Monetary Union (EMU) Steering Committee to help formulate collective bank views on the practicalities of introducing the euro and to keep abreast of relevant developments in official thinking. Representation has recently been augmented to embrace LIBA. In addition to attending regularly the EMU Steering Committee, the Bank has initiated a series of meetings to exchange views with the participating banking associations and with a range of individual banks. A full list of those associations with whom we have conducted discussions, including those outside the financial sector, is attached in the Annex. This work has helped to identify and clarify the areas where analysis, planning and development appear essential, whether the United Kingdom opts in or out, if the United Kingdom is to prepare adequately for the introduction of the euro. If Stage 3 begins without the United Kingdom's participation, the impact of the euro might be expected to be largely confined to wholesale financial market activity. If the United Kingdom participates, initially the euro is

similarly likely to be a largely wholesale instrument, but it will thereafter permeate the whole economy, with much of the impact on the retail sector probably only after euro cash becomes available some three years after the start. That would clearly involve far wider changes, very substantial investment by both retail banks and non-bank retail organisations, and a public information campaign, all of which would no doubt require extensive co-ordination. But we believe the focus of preparations now and in the immediate future should be primarily on wholesale activity, where the Bank will aim to provide the necessary degree of co-ordination.

The areas we have identified so far as requiring a co-ordinated approach, and the issues for further study, are set out in the next sections which explain what the issues are, the efforts in hand to address them, and the bodies which we know are involved.

So long as the areas for co-ordination are adequately identified, the appropriate work is agreed and undertaken, and it is communicated to all who need to know, this should provide a sound infrastructure *permitting* the euro to be used in wholesale financial transactions in the United Kingdom. Then it will be for individual economic agents, including financial institutions, to determine the particular use of euro which they actually plan to make, and the kind of euro facilities they wish to provide, whether the United Kingdom is in or out, consistent with the 'no compulsion, no prohibition' principle which underpins the EMI's scenario for the introduction of the euro.

## **Financial sector**

#### Wholesale payments and settlements

It is clear that, whether or not the United Kingdom is a participant, the present sterling real time gross settlement (RTGS) system will need to be adapted to cope with euro-denominated payments. If the United Kingdom chooses to opt *in*, whether initially or subsequently, there will inevitably be a period, potentially quite long, when sterling and euro-denominated wholesale transactions could

co-exist before the entire payments and settlement system becomes exclusively euro-denominated. If the United Kingdom opts *out*, it will be important for London still to have the capacity to trade in foreign currency instruments denominated in euro, which would be supported by associated UK payments arrangements.

Many payments will continue to be within the United Kingdom, between UK customers, where the domestic payments system is the obvious medium for effecting settlement. But whether the United Kingdom is in or out, there will be a number of competing ways to make cross-border payments to countries participating in the euro area. As now, there will be the possibility of correspondent banking relationships, or the use of banks' own foreign branches or subsidiaries with direct access to local payment systems; but the Bank believes that it is important to provide in addition a direct link from the UK (euro) RTGS system to the RTGS systems elsewhere in Europe through the TARGET project (which will interlink European RTGS systems). It has been agreed that Member States outside the euro area will have access to TARGET, although the terms and conditions of such access have yet to be determined. We will be seeking to ensure in the forthcoming EMI discussions that the principles of the single market are upheld. The particular mechanism chosen by banks to effect individual cross-border payments will depend on relative efficiency and cost considerations.

The Bank has been in dialogue with CHAPS, whose board commissioned in December 1995 a study to review the high-level business and technical options for CHAPS euro facilities and to identify the associated critical paths for the planning and implementation of these options. The study has been completed and last month the CHAPS board accepted its recommendations.

These involve a two-pronged strategy. To cater for the situation where the United Kingdom is *within* the euro area, they have identified that CHAPS message formats could be amended in a relatively straightforward way so that both sterling and euro denominations could be handled interchangeably (which would be necessary during the 3<sup>1</sup>/<sub>2</sub>-year transition period). There is sufficient time to plan and undertake the necessary development so that it is ready for the beginning of 1999.

On the other hand, if the United Kingdom is *outside* the euro area, the domestic payments network would need to be able to handle euro as a foreign currency. This could involve the addition of a parallel payments arrangement for euro, alongside that for sterling. The CHAPS board has agreed that this second strategy should be further studied before any decision is taken, presumptively in the autumn. Both of these options will require access to euro-denominated settlement accounts, which will be provided by the Bank.

Aside from the need for payments system development, there are separate, though potentially related, questions about the development of facilities to settle euro-denominated securities. If the United Kingdom is in, there could be a demand for settlement facilities to handle both sterling and euro-denominated securities and their associated payments during the transition period. The more uncertain issue is to what extent settlement facilities for euro securities will be required if the United Kingdom is out. The Bank's wide-ranging discussions with practitioners have revealed quite a wide range of views. Some argue that such facilities would be an important element in sustaining the City's competitive position; but others argue that we already have satisfactory ways of settling deals in European currencies, in respective Continental centres, which do not inhibit London from having a significant, and sometimes dominant, share of trading in these instruments. Discussions about the options which the markets would like to have available, and what the various securities settlement systems could be capable of delivering, are still at a relatively early stage.

The main bodies involved in the payments area are the Bank and APACS, particularly the CHAPS Clearing Company. These bodies are also involved with securities settlement issues, together with CREST for equities, and the London Clearing House for various commodity and derivatives markets.

There has been good progress to date in the analysis and thinking of those responsible for the payments system, and this work is set to proceed at a satisfactory pace. We will continue our dialogue with those directly involved, primarily CHAPS. We will also continue to encourage those with an interest in, or responsibility for, securities settlement to consider the issues raised by the introduction of euro-denominated instruments, with the aim of determining the extent of the desired provision for the euro.

#### Market and exchange infrastructure

We believe it important for the City and the United Kingdom that financial markets should have a capacity to quote prices in, and trade, euro-denominated instruments, whether or not the United Kingdom is a participant in the euro area. We have therefore invited a wide range of market associations and exchanges, responsible for a broad spectrum of markets, financial and commodity, cash and derivatives, to consider the associated practical questions. In some areas further encouragement, which the Bank will continue to provide, is required. But many markets and exchanges are already actively considering what might be involved.

Some issues will be relevant whether or not the United Kingdom is participating, like the capacity to provide price or interest rate quotation in euro-denominated instruments and the need for standardised terms and conditions in relation to the underlying instrument (for example whether there is to be a 360 or 365-day year for interest calculation or the treatment of securities due to mature on non-business days, not least because Bank Holiday dates vary across Europe). These are largely issues for market practitioners, in the United Kingdom and elsewhere in Europe, to address.

If the United Kingdom opts in, it is probable that many markets may switch from sterling to euro-based quotation quite quickly, or even immediately, but it is important to consider any problems which might arise in the event of co-existing quotations in two denominations. If the United Kingdom is out, markets and exchanges will need ongoing facilities to allow price quotation and trading of both sterling and euro-denominated securities but in most cases that should be a quite straightforward adjustment to make, since it would involve simply substituting euro-denominated quotations for those securities and financial instruments at present denominated in the participating currencies, at a pace no doubt determined by the speed of changeover in the relevant overseas markets. Corresponding issues will arise in both cash and derivatives markets.

In almost all of this work, market practitioners are, in our view rightly, in the lead. Nevertheless our discussions have helped to identify a number of practical issues and we will give what help we can to market associations and exchanges to address them, including making connections between those facing similar problems or bringing together all the parties necessary to resolve particular questions.

Some exchanges are further forward in their planning than others. LIFFE is a good example. They have had to consider how to amend their three-year interest rate futures contracts to reflect the fact that from March 1996 onwards, all such contracts begin to mature after the beginning of 1999. We discussed with LIFFE the issues raised and the possible options available, and LIFFE engaged in extensive market consultations with their membership. They subsequently amended the terms of the contracts so that they will convert unequivocally to euro-denomination if EMU starts on time with the particular currency in question a participant. The contract amendments apply equivalently to LIFFE's interest rate futures contracts denominated in sterling, Deutsche Mark and lira.

The LME will have to address similar issues in relation to its contracts before this autumn. And in relation to off-exchange swap contracts, we have had some discussion with ISDA, and are participating as observers in two of their working parties (on market practices and legal aspects). *Inter alia* they have raised a question about the supervisory treatment of swap contracts between participating currencies which would effectively become annuities in Stage 3 and so might no longer be part of the trading book for Capital Adequacy Directive purposes.

Those exchanges and exchange associations we have consulted are the Stock Exchange (which is still considering its approach to EMU within the context of its overall strategy review), LIFFE, the FCA and the LME. The market associations with whom we have had discussions are GEMMA, LDMA, LIBA, IPMA, ISDA, IMMTA, the FOA and the FIA.

#### End-users of markets—insurance companies etc

End-users of markets of course have an interest in the infrastructure developments described above. In addition, individual sectors have problems specific to themselves. Our discussions have begun to identify these, but in several areas thinking is at too early a stage for concrete issues yet to have emerged.

Insurance companies and pension funds will be keenly interested, from a fund management point of view, in how the wholesale financial infrastructure adapts to the euro, but acknowledge that those responsible for the payments system and the relevant market authorities are in the forefront of planning. On the liabilities side of their business, no problems are foreseen in the insurance field at the underwriting level, whether the United Kingdom is in or out. Much business will remain denominated in non-EU currencies and the addition of the euro, or its substitution for existing denominations, would raise no difficulties of principle. It will, of course, be essential that the banks are in a position to provide the appropriate currency facilities. The only concern so far identified by the pension funds relates to the need for education of beneficiaries and contributors if the United Kingdom participates in the euro area. For both sets of institutions, there will be some regulatory issues to be addressed-for example, in relation to currency matching and solvency calculations (given that the basis on which contracts were drawn up might have changed). No concerns have yet been identified at the retail end of the insurance sector (although, as with pension funds, public education will be important), but thinking is still at an early stage.

The insurance representatives we have so far consulted are the ABI, ILU, LIIRMA and Lloyd's, while the NAPF has represented the pension funds. We have also spoken to the DTI and Government Actuary's Department on regulatory aspects.

Other end-user representatives—such as the BSA, FLA, AITC and BVCA—have also been consulted, but have not yet identified any significant issues beyond those identified elsewhere in this paper.

## **Overarching issues**

Aside from the practical issues involved in preparing the wholesale payments system and markets to accommodate the euro, there are a number of overarching issues which will have far-reaching ramifications and where it will be important to develop close liaison between the authorities and the private sector.

#### The law

The first of these involves the precise manner in which the euro is introduced *under the law* to secure legally enforceable equivalence between it and the national currencies which it replaces; and how the continuity of contracts and financial instruments denominated either in national currencies or the basket ECU will be appropriately

secured. The issue of continuity extends to non-EU jurisdictions, where markets will need assurance that the relevant third country (eg US) law under which contracts are drawn up will recognise the euro as replacing the existing currency in which obligations are denominated and treat the contract or instrument as non-revocable, subject to the individual terms of contracts. Separately, there will be issues relating to the effects of redenomination and rounding conventions on financial obligations (including registered stocks and shares); and there may be implications for netting arrangements.

The background to the general issues of the introduction of the euro under the law and continuity of contracts was set out in the Madrid Summit Conclusions; and, as requested by the Summit, work is in hand to draw up a draft Regulation by the end of this year. It will ultimately be for the Commission to introduce such legislation. EMI and national central bank lawyers are at present addressing the underlying issues, with Commission lawyers participating as observers.

There is one relevant legal technicality which is worth mentioning: this is that the precise Article of the Maastricht Treaty under which the Council Regulation for the euro is introduced has some significance. Article 1091(4) is the most obvious route, but this Article would not apply to the United Kingdom if it opted out. This could have implications not just for the United Kingdom but for all other European countries in relation to contracts subject to English law.

With the Bank's encouragement, the Financial Law Panel is playing a leading role in relation to the continuity issue, and has established a Single Currency Liaison Group, which includes academics, bankers and practising lawyers from the major financial centres of the European Union. This group has initiated a major study of the impact of the single currency in the main financial and trading jurisdictions outside the European Union. We understand that the Commission has put out to tender a parallel project examining EU and Member State law. Many other groups of lawyers are now becoming involved in this and related areas. A Joint City Working Group on EMU has also been established, chaired by ISDA, including lawyers from BBA, LIBA, FLP, IPMA, the FOA, the LBMA and the Bank. These groups will liaise with each other, as well as with the authorities.

Other groups involved in this area are the City of London Law Society (in particular the Banking Law Sub-Committee, which itself has a Single Currency Sub-Committee) and the Law Society's Company Law Standing Committee. The FLP will also be contacting certain other legal groups to check if they are engaged in any EMU-related activity or have any planned.

#### Accounting

Another overarching area relates to the possible implications for accounting standards and methodology arising from the introduction of the euro. Many of the issues will be relevant to the United Kingdom only if it opts in, and relate particularly to how the transition to euro accounts would be made during the changeover period. None of the issues so far identified is of fundamental principle. Specific questions include whether there should be dual company accounts; how the accounts of overseas branches of domestic companies should be converted for UK accounts purposes; how consolidation should be effected in relation to overseas subsidiaries (where the position under UK accounting standards is more straightforward than elsewhere in Europe); and the interaction of share capital redenomination with capital-maintenance requirements, because of possible rounding implications. If the United Kingdom were out, there could still be potential implications for UK multinational companies with subsidiaries in the euro area; but more generally the euro would be simply treated as a foreign currency under the appropriate accounting standards. There might also be issues in relation to tax accounting.

We are aware of the Federation of European Accountants' comments on last year's European Commission Green Paper on the single currency. And we have initiated discussions with the ICAEW, the Accounting Standards Board and the International Accounting Standards Committee, with a view to encouraging them to identify all the relevant accounting issues, including whether or not a harmonised treatment of the euro needs to be applied throughout the EU. We aim to make contact with the Consultative Committee of Accounting Bodies. The Bank also participates as an observer in a working party of the 'Hundred Group' of Finance Directors; and we have held discussions with the Association of Corporate Treasurers. We plan to meet the Inland Revenue.

#### Rounding

A third overarching issue, if the United Kingdom opts in, relates to *rounding* differences which may arise when converting values from national currency denomination into euro and vice versa, because the relevant conversion rate is unlikely to be a neat decimal. All wholesale or retail transactions would potentially be affected. Rules and conventions will need to be established and, at least in some areas, possibly enshrined in law. The precedent of decimalisation in 1971 may be of some help: then the rules to be applied in banking transactions were given legal force, but not the suggested conventions for retail transactions.

The Bank has prepared and circulated a paper to a number of interested parties in the United Kingdom, as well as to the EMI and European Commission, setting out some mathematical considerations relating to rounding. Anyone with an interest is welcome to have a copy (see contact number below). We know that the issue is of particular concern to IPMA and ISDA. We also know at the other end of the spectrum that the British Retail Consortium has concerns, especially against the background of the recent EU requirement for unit pricing. The Bank has suggested to the BBA that, in order to progress work in this area, we jointly establish a small group of officials and practitioners with a remit carefully to specify the full range of rounding problems which could arise, to offer possible solutions, and to share these more widely subsequently to see if a consensus on particular solutions might emerge.

## **Other sectors**

#### Corporate sector

It is evident, from discussions with the CBI and BCC, that the corporate sector is only just becoming alert to the potential implications of EMU, whether the United Kingdom is in or out. Both organisations are contemplating an educational programme, organising workshops/seminars, in order to raise the level of awareness. The Bank is willing to provide assistance where it can. In addition the CBI is considering the establishment of a working group on EMU, and we have discussed the possibility that they might produce in due course a practical guide on how companies might need to respond to the introduction of the euro. In addition we have offered to discuss the practicalities of the euro with the TUC.

#### Retail sector

As already noted, there is more time to address issues at the retail level because, even if the United Kingdom opts in, most of the issues raised will materialise largely or only during the final transition period. We have nevertheless had preliminary discussions with the British Retail Consortium. They are concerned about the possible implications of dual pricing which, coming on top of the new unit-pricing Directive's requirements, would lead to a proliferation of pricing displays. They are also concerned that credit contracts should not need renegotiation. The historical experience of decimalisation may contain useful lessons in this area.

#### Regulators

Apart from legal issues relating to continuity of contracts, the financial regulators have not raised any concerns (save the comments on insurance/pension funds made above). Their own systems are capable of accommodating a new reporting currency. Clearly it will be necessary, if the United Kingdom is in, that sterling and the euro are treated interchangeably from a regulatory perspective during the transitional phase. We will take up with the banking and securities supervisors those policy issues which are raised with us.

#### Public sector

If the United Kingdom opts in, it is clear that the timing of the transition from sterling to euro for public sector receipts and, particularly, the myriad of public sector payments, will have considerable significance for the public. The EMI transition scenario allows Member States at their discretion to accept receipts denominated in euro from the start of Stage 3 but suggests that public sector payments should change to euro on one day in the final stage of the transition after euro cash becomes available. Further elaboration in this area will be required. There would clearly be a need for close co-ordination within the public sector of the vast range of activities involved, and between the public sector and the banking system.

Separately, it is also a feature of the changeover scenario that all new public debt issues—for an 'in' Member State—will be denominated in euro; but the precise timing of the redenomination into euro of the stock of existing public debt is for Member States' discretion. Decisions would be required on this in due course if the United Kingdom does join the euro area. It is not relevant if the United Kingdom exercises its opt-out. The Bank will be liaising closely with HM Treasury in these areas.

## The way forward

As this paper makes clear, the Bank has been engaged in discussions with a large number of interest groups over the last few months on the implications of the euro for the United Kingdom, whether it is in or out.

We believe it important that the wholesale financial areas of the economy are adequately prepared technically for the introduction of the euro.

Given its position and wide-ranging contacts, the Bank believes it would be welcomed if it continued these discussions and continued to act as a focal contact point. We propose to do so. Any individual institution wishing to raise practical issues associated with the single currency should, in the first instance, approach its own representative body. The Bank would be grateful if these bodies could then draw any such issues to its attention: the focal point of contact in the Bank is John Townend, a Deputy Director (0171-601 4541).

The Bank will henceforth produce a regular, roughly quarterly, report on progress in the areas where co-ordinated or collective activity is required, identifying the issues and who is doing what to help resolve them. This is the first such report. We will circulate the report widely, including beyond the financial sector. We would like to use this report as a basis for regular meetings of the range of representative bodies with whom we have already made contact, and any other appropriate bodies if they are identified to us.

In addition the Bank will aim to participate in, and where appropriate organise, regional workshops and round-table discussions for the financial and business community, through the Bank's Agents.

Within this general framework, the Bank sees its role as essentially to:

• identify the areas where co-ordinated or collective activity is necessary;

- seek to ensure that the necessary work is agreed and undertaken, including by the Bank where appropriate;
- act as a catalyst to stimulate private sector activity where necessary;
- put in touch groups facing similar problems; and
- communicate widely about issues and progress to satisfy the thirst for information.

All this relates to communal activity. Once the necessary infrastructure is in place, it will be for firms' commercial decision how best to take advantage of it, consistent with the 'no compulsion, no prohibition' principle.

## **Organisations consulted**

#### Wholesale payments and settlements

Association for Payment Clearing Services (APACS) British Bankers' Association (BBA) Clearing House Automated Payment System (CHAPS)

#### Markets and exchanges

Federation of Commodities Associations (FCA) Futures and Options Association (FOA) Futures Industry Association (FIA) Gilt-Edged Market Makers' Association (GEMMA) International Money Market Trading Association (IMMTA) International Primary Markets Association (IPMA) International Swaps and Derivatives Association (ISDA) London Bullion Market Association (LBMA) London Clearing House (LCH) London Discount Market Association (LDMA) London Investment Banking Association (LIBA) London International Financial Futures Exchange (LIFFE) London Metal Exchange (LME) London Stock Exchange (LSE)

#### End users

Association of British Insurers (ABI) Association of Corporate Treasurers (ACT) Association of Unit Trusts and Investment Funds (AUTIF) British Venture Capital Association (BVCA) Building Societies Association (BSA) Finance and Leasing Association (FLA) Institute of London Underwriters (ILU) Institutional Fund Managers' Association (IFMA) Lloyd's of London London International Reinsurance Market Association (LIRMA) National Association of Pension Funds (NAPF)

#### The law

Financial Law Panel (FLP) Joint City Working Group (JCWG) City of London Law Society (CLLS)

#### Accounting

Institute of Chartered Accountants in England and Wales (ICAEW) Accounting Standards Board (ASB) International Accounting Standards Committee (IASC)

#### Retail and corporate

British Chambers of Commerce (BCC) Confederation of British Industry (CBI) British Retail Consortium (BRC) The Hundred Group

#### Regulators

Department of Trade and Industry (DTI) Government Actuary's Department (GAD) Securities and Futures Authority (SFA) Securities and Investments Board (SIB)

# Economic growth and employment through stability

The **Governor** argues<sup>(1)</sup> that at present there is a remarkable consensus on what macroeconomic policy can be expected to achieve, namely stability. But the really interesting questions are about what policies can best achieve stability. The task is complicated by imperfect information and because economies are subject to various kinds of economic shock. The **Governor** argues that we cannot aspire to continuous stability because we do not have sufficiently reliable information on the rate of change in the supply-side capacity of the economy, or sufficient control over aggregate demand in the short term, and there is the ever present possibility of shocks. The question then is, given these uncertainties, which macroeconomic variable is it most sensible to target? The **Governor** considers three broad choices—nominal external anchors, real domestic targets and nominal domestic anchors—and summarises the United Kingdom's experience with the last, namely an explicit inflation target.

The subject I have chosen for my lecture is 'Economic growth and employment through stability', and what I will try to do is to explain just what it is that we are trying to do through monetary policy—essentially short-term interest rate policy—at the Bank of England and why.

### The objective of stability

To begin at the beginning—the very beginning, I take it as common ground that the fundamental objective of economic policy in this country is to promote the economic welfare of our people through the growth of economic activity, high levels of employment, and rising living standards within the United Kingdom as a whole. I say in the United Kingdom because I am talking about our national policy objectives, but of course I agree that those objectives can be pursued more successfully in the context of a flourishing, open, world economy, which we can help to promote through international policy co-operation—in the IMF and IBRD and WTO, for example, and within the European Union. All that I take as given.

But to say that we are aiming to promote economic welfare is simply to state an objective. The really interesting questions—for economists and other commentators, and for policy-makers alike—are about how best that objective can be achieved. And it is the debate about the means rather than the end which has over the years generated so much heat and just occasionally some light.

A leading article in *The Independent* newspaper recently began by asking 'Where is Keynes? Where is Friedman? Economics once debated the very future of the nation: how it should be governed, how it could generate growth'. The article went on to describe the present state of the debate about macroeconomic policy as 'deadly dull, embraced in a suffocating classical consensus' which is subsequently defined to include the control of inflation and fiscal prudence, as well as free trade and market competition. Macroeconomics has become less controversial, the article suggests, in part because we recognise that some problems, for example, unemployment, are treatable only in the long term. The real debates now, it says, are about microeconomic issues—training policies, gas prices and education strategies, for example.

I must say it makes a change to be associated with spreading suffocating dullness. But I agree with the underlying point that there is, internationally and not just in this country, a remarkable consensus on just what macroeconomic policy can be expected to achieve, which can be summed up in one word—stability. On this view, the long-term objectives of raising the underlying growth rate and increasing employment need to be addressed through more fundamental, structural, policies.

Now it would be wrong to suggest that the present consensus is radically new. In fact, Keynes—referring to my illustrious predecessor, Montagu Norman—noted in 1923 that:

'All of us, from the Governor of the Bank of England downwards, are primarily interested in the stability of prices, business and employment'.

You might equally have made the same remark in your introduction this afternoon, Vice Chancellor. What stands out is that Keynes clearly regarded these objectives as mutually compatible. And Milton Friedman, too, was not interested in the money supply simply as an end in itself but as a means to the end of stability in the broader sense of prices, output and employment—which is the objective of today's macroeconomic orthodoxy.

Let me try to explain why by illustrating the effects of macroeconomic instability—and the uncertainty associated

<sup>(1)</sup> In a lecture given at the University of Exeter, Thursday 23 May 1996.

with it—on real economic decision-making. I take two every day examples.

First, think of a firm contemplating an investment project which is to be financed by a bank loan. In deciding whether to undertake the project, the firm tries to calculate future profit streams from the investment, after allowing for debt repayments, on a suitably discounted basis—it makes a present value calculation. Now in the textbooks that all seems fairly straightforward. But instability in prices or in activity—or indeed in interest rates or exchange rates—makes these calculations a real nightmare. Forecasting future cash flows from sales becomes a lottery; so too does assessing the likely real cost of servicing the debt.

Faced with such uncertainties a firm would rationally respond by demanding a higher expected rate of return on its investment as compensation for the risk. And the greater the uncertainty, the larger the risk premium, and the more it foreshortens firms' planning horizons because of the higher discount they need to apply to more distant projected profit streams.

Similarly, the greater the uncertainty about inflation, the harder it is for businesses of all kinds to distinguish between real and nominal returns. A year or more ago a Bank survey found that companies were still looking for nominal returns on investment of 20% or more as they had been for some years, even though inflation had fallen in the meantime from over 10% to less than 3%. When I suggested that such target rates of return were only appropriate when we had 'funny money' but not now that we had 'real' money, and that they were missing out on attractive investment opportunities, they told me that was all very well in theory but they would begin to believe it when we had shown that inflation would *stay* below 3%.

So the result of uncertainty, very simply, is that 'good' investment projects—projects which could have been profitably undertaken in a more stable economic environment—end up being rejected. Both business and financial investors become preoccupied with short-term returns, and it is easy to see how long-term economic growth suffers as a consequence. Macroeconomic uncertainty is in this respect a far more persuasive explanation, in my view, of the short-termism that has inhibited our investment performance than the particular characteristics of our financial system.

My second example of the effects of instability and uncertainty on everyday decision-making concerns the problems faced by households contemplating investment decisions—for example when considering whether to buy a house financed by a mortgage. Here, too, there is depressing scope for decisions to be made which are subsequently undermined by events—for example when households are unwittingly sucked in to a bubble in property prices that inevitably then bursts. The 350,000 home owners whose properties have been repossessed during the 1990s would, I think, vouch for the devastating consequences.

These two examples, of firms and households, well illustrate the distortions in every day investment decision-making that are rooted in the general instability of prices and activity. And, even though our economy has now been relatively stable over the past few years, uncertainty as to whether that stability will continue is still very much with us.

## **Stability of what?**

I hope that I have said enough to explain why macroeconomic stability in its broadest sense is judged to be so important to the promotion of rational economic decision-making and, through that, to the promotion of economic welfare. The more difficult question remains, how we can achieve macroeconomic stability?

Essentially what it involves is trying to ensure that aggregate demand in the economy does not get too far out of line, in either direction, with the capacity of the economy to meet that demand over the medium and longer term.

Now of course that's much easier said than done.

The capacity of the economy to supply goods and services at any particular time-the economy's 'productive potential'-is determined by its structural features, for example by the size, and the level of training and skills, of the workforce, by the size and productive efficiency of the capital stock, the degree of labour and capital market efficiency, and so on. And the rate at which productive potential grows depends largely on the changes affecting these factors-demographics and the effectiveness of the education system, for example, or on the rate of investment and the extent to which technological progress is being absorbed into new products and techniques, or on microeconomic changes in market flexibility. These supply-side factors are, in the main, beyond the reach of monetary policy. We can, however, help indirectly, if we are successful in providing a stable macroeconomic backdrop against which more rational and efficient, longer-term, decisions can be made. In this way monetary policy can contribute indirectly to improving the supply side of the economy in much the same way as, for example, better training and education. And, monetary policy aside, the Bank of England can help, too, by encouraging the financial sector to provide more effective support to the wider economy—as we have, for example, by encouraging lenders to provide a wider range of facilities to small businesses.

But, for the most part the immediate role of monetary policy is to influence the *demand* side of the economy, seeking to maintain macroeconomic stability by keeping aggregate demand in line with productive potential as it evolves over the medium and longer term.

The task is complicated not just by imperfect information and knowledge and by the time it takes for policy changes to have their full effects, but also because the economy is subject to various kinds of economic 'shock'. Such shocks may originate either at home or abroad, and they may affect either the demand or supply side of the economy. Examples include a change in world oil or other commodity prices, conjunctural or structural developments in overseas markets, or changes in domestic consumer or labour market behaviour.

Policy cannot necessarily reverse the effects of these shocks. But it can try to offset them so that they do not set in train a continuing destabilising effect on the domestic economy. Monetary policy was, for example, powerless to reverse the initial effects on import prices of sterling's depreciation following our exit from the Exchange Rate Mechanism in 1992. But, alongside fiscal policy, it did help to ensure that this shock did not have second-round effects leading to a general inflationary upsurge. Similarly we used monetary policy to head off possible second-round effects following the rise in world commodity prices in 1994 and sterling's further depreciation in the spring of 1995.

Now clearly in an ideal world we might conceivably hope to keep demand continuously exactly in line with the supply capacity of the economy. That would, in principle, ensure price stability, steady growth at the underlying sustainable or trend rate, a broadly stable level of employment at its 'natural' or non-accelerating inflation rate (NAIRU), and a reasonably stable exchange rate against the currencies of other countries successfully pursuing similar polices. Even in this ideal world we could not expect stable short-term interest rates, because they are the instrument we would still need to use to keep demand and supply in balance and to offset shocks; but to the extent that we were successful in maintaining stability over time interest rates-both short-term and long-term interest rate-would typically be lower, and fluctuate less, than we have been used to because they would include a smaller uncertainty or risk premium.

We frankly cannot aspire to *continuous* stability in the real world. We do not have sufficiently reliable information on the rate of change in the supply capacity of the economy; we do not have sufficient control over aggregate demand in the short term; and there is always, as I say, the possibility of economic shocks of greater or lesser degree. So in the real world you may have to choose to seek to stabilise one dimension of the macroeconomy at the expense, at least in the short term, of others.

The danger in this situation is that if you try to juggle too many balls at once in this way you end up with them all on the floor. The Dutch economist, Jan Tinbergen, first established the principle that policy-makers can, in effect, only successfully juggle as many balls as they have free hands. For much of the time after the war this principle was neglected in operating macroeconomic policy. Fiscal *and* monetary policy, supported for much of the time by various forms of direct controls, were jointly applied to juggling objectives which were seen to be in conflict in the short term—including growth and employment, on the one hand, and price stability and balance of payments equilibrium, as well as a fixed nominal exchange rate, on the other. In practice, policy as a whole was directed to expansion, until the inevitable imbalances become critical, at which point policy shifted abruptly to restraint—in a go/stop policy cycle, which contributed to the notorious boom and bust economic cycle. And the cycle tended to become more unstable as people learned to take advantage of the upswing while the going was good, before the rain came. In trying to be a jack of all trades, policy ended up the master of none.

Progressively over the past 20 years or so, it came to be recognised that there is in fact no trade-off—except in the short term—between growth and stability, and the emphasis of macroeconomic policy has shifted to maintaining stability in the medium to longer term. But the question remained—stability of what? While the ultimate objective clearly is to achieve long-term stability in the broad macroeconomic sense I have described, given that the different dimensions of stability can diverge in the short term, which particular macroeconomic variable is it most sensible to target?

There were—and are—in effect three broad choices: a nominal external anchor, typically the exchange rate against another currency or group of currencies that were themselves expected to reflect stability-oriented policies; a real domestic target, such as employment or output; or a nominal domestic anchor such as the money supply, nominal income or inflation. The issue is which of these various regimes offers the best prospect of long-term macroeconomic stability in the broader sense—or which minimises the risks of macroeconomic *in*stability.

## An exchange rate target

The United Kingdom has had long—if intermittent experience of an exchange rate target in one form or another, from the international Gold Standard, through Bretton Woods to the European exchange rate mechanism. In each case the regime eventually foundered. And the principal cause was an asymmetric shock affecting the anchor currency—the dollar under Bretton Woods in the context of the Vietnam War, for example, or the Deutsche Mark within the ERM in the wake of Germany's reunification.

In the face of such asymmetric (country specific) shocks, which could affect either partner country, the *external* demands of policy need no longer be consistent with *internal* stability of prices and activity. Tying yourself to the mast can, even for quite long periods in the right circumstances, pay dividends. But if you are tied so tightly that the blood circulation becomes cut off in a storm then it can become self-defeating.

This was precisely the United Kingdom's experience within the ERM. In the end Germany's legitimate domestic policy needs following the economic shock of reunification diverged from the domestic stability needs of the British economy (and those of much of the rest of Europe). And if the external need to maintain sterling's parity against the Deutsche Mark had continued to take precedence, then monetary policy would have itself become a source of greater domestic instability in the form of loss of output and employment. It is true that in principle this dilemma can be avoided by timely exchange rate adjustment-but in practice this is extraordinarily difficult to achieve. And it was particularly difficult to achieve in the wake of German reunification which, analytically, required a real exchange rate appreciation of the Deutsche Mark against other currencies as a whole, in order to support the reconstruction of East Germany, rather than the depreciation of particular ERM partner currencies-although, for quite separate reasons, there may in some cases have been a need for that as well.

In fact there is an intrinsic potential Catch 22 situation in relation to exchange rate arrangements of this sort. The intention is that the commitment to nominal exchange rate stability between the partner currencies should serve as an external discipline on domestic policies. But nominal exchange rate stability cannot in itself ensure real exchange rate stability; nor can it accommodate asymmetric shocks, like German reunification, which require a real exchange rate adjustment. Because it is real exchange rates that affect domestic activity, such arrangements are necessarily vulnerable to domestic/external policy dilemmas. The Catch 22 is that the easier it is made to change a parity in a 'timely' way (or the wider the permitted margin of fluctuation around the parity) the less effective the exchange rate regime is as an external discipline on domestic policy; whereas the tighter the exchange rate regime the more vulnerable it is to policy dilemmas of this sort and to associated exchange market disturbance.

These considerations would apply to any successor to the ERM seeking to link non-participating EU currencies to the euro just as much as they have applied to the ERM hitherto.

There are related risks in relation to monetary union and the single currency itself, although the potential tensions would manifest themselves in a different form. The risk is that macroeconomic imbalances become locked in-either because of inadequate economic convergence between the participating currencies at the outset or because of significant asymmetric shocks affecting particular participating countries after the single currency has come into being. The danger is that the intended 'zone of stability' might then become a source of *instability*, resulting in tensions of various kinds-ranging from long-term stagnation in parts of the euro area, or unwelcome migration in search of work or pressures for larger intra-area budgetary transfers or pressures for protection against either inside or outside competition. These risks were recognised in the Maastricht Treaty itself; and the convergence criteria, as well as the emphasis attached to the sustainability of convergence, were introduced precisely in order to minimise them. It remains the case that how serious the risks are

depends crucially on the criteria not only being rigorously applied in substance at the outset, but also being realistically expected to be sustained over the longer term. Experience with exchange rate targets has been mixed. There is no doubt that they have served as a useful policy discipline for many countries, particularly smaller countries, helping them to achieve relative domestic policy discipline. And they have functioned perfectly well, without great tensions, for quite long periods of time. But they necessarily involve risks-as we have seen in practice in other cases—risks that can be largely avoided by arrangements that put the emphasis on the domestic stability horse rather than the nominal exchange rate cart. The point is not that exchange rate stability is unimportant. It is that you can achieve reasonable exchange rate stability between the currencies of countries pursuing domestic stability with less risk. You certainly will not achieve it for long without domestic stability in the partner countries.

## A real domestic target

An alternative policy regime that *does* place the emphasis on domestic stability might be for macroeconomic policy to target output growth around its trend rate, or, roughly equivalently, unemployment around its so called 'natural' or non-accelerating inflation rate (NAIRU). Let me be quite clear. I am not talking about targeting an arbitrarily chosen growth rate or an arbitrarily chosen rate of unemployment-based simply upon political aspiration. However desirable faster growth and lower unemployment are, such an approach to achieving them would be an absolute recipe for instability. As I explained a moment ago the sustainable rate of growth or the natural rate of unemployment depend upon structural features of the economy, and while it is reasonable-and very desirablethat we should aspire to raise the sustainable growth rate, or lower the natural rate of unemployment, over time by structural policies, if you tried to do the same thing simply by macroeconomic, demand management-simply pumping up demand—it would lead directly to accelerating inflation. What we are talking about here, in the context of a possible macroeconomic objective, is targeting the trend rate of growth or the *natural* rate of unemployment, whatever they are at any particular time, given the structural characteristics of the economy.

On this basis such a scheme has considerable conceptual attraction—the essence of monetary policy is after all, as I said earlier in my lecture, to maintain equilibrium between demand and supply, and this would seem an obvious way of seeking to do that. The trouble with this approach is that in practice we do not know at any particular time, within a wide margin, what the appropriate numbers are. There are just about as many guesstimates as to the magnitudes as there are economists! Present estimates of the 'output gap', ie the extent to which we are currently below trend in terms of output, range from virtually nothing to 5% or even 6%. And estimates of the natural rate of unemployment range from around the present level of recorded unemployment (just below 8%) to 4% or even 3%.

So you can see that depending on the numbers that you choose the appropriate monetary policy stance would be wildly different. This makes such concepts as the 'output gap' or the 'trend rate of growth' or 'the natural rate of unemployment' or NAIRU dangerous to use directly as a practical guide to policy, however helpful they are in thinking about policy.

#### A nominal domestic target

This then leaves the third policy framework option—which again places the emphasis on domestic stability—a *nominal* domestic target. These come in various guises, but the three most widely advocated are targets for measures of the money supply, for nominal income, and for inflation. The differences between these three regimes are really more technical than philosophical. All of them in the medium to long run ought to be capable of delivering a high degree of nominal stability, which should equally result in substantial real economic stability. But they raise different issues and difficulties that need to be considered in making the choice between them.

Let me take monetary targets first. These are intermediate targets in the sense that the assumption underlying them is that there is normally a broadly stable, or at least predictable, medium to long-term relationship between the money supply on the one hand and nominal income on the other-in other words, to use the jargon, that money velocity is relatively stable. This has, in fact, proved to be a reasonably reliable approach to policy, for example, in countries like Germany, although even there it requires a good deal of creative interpretation. But in a number of other countries, including this country, that has not been the case. Money velocity has varied unpredictably as a result particularly of continuing financial innovation and changes in the pattern of financial intermediation, so that, even with the most careful interpretation of the monetary data, money supply targets have not in practice been a reliable guide to developments in the economy. In fact our experience in the early 1980s was that failure to achieve our monetary targets damaged the credibility of monetary policy even though we were reasonably successful at that time in achieving the end objectives of policy. While, therefore, we continue to monitor monetary developments very carefully, alongside all the other available evidence, for what insights they can give us, and while we retain guidelines for the growth of both narrow and broad measures of money, we no longer use monetary targets as the primary guide to policy to the extent that we did.

Where the relationship between the monetary aggregates and nominal income *is* reasonably robust, and where the relationship operates with a lag, monetary targets have in principle a considerable advantage in that the money supply, for which firm data become available quite quickly, acts as a *leading* indicator for policy. In practice, of course, the process is never automatic and the policy message even under this regime is looked at in the context of forecasts which bring in other information. Other nominal domestic regimes—for nominal income and inflation targets—are, as a matter of degree, more heavily dependent in their operation on macroeconomic forecasts.

As between these alternatives, there is perhaps not any very fundamental difference operationally. But inflation is more readily understood by the public at large and likely, therefore, to have more impact on expectations and behaviour. Moreover, *a nominal income target* would need to incorporate a view about the trend rate of growth, which means that it suffers to a degree in much the same way as a growth target pure and simple from uncertainty about both the trend rate and the starting point. There are, too, familiar problems relating to the timeliness of nominal GDP data and the frequency with which, and extent to which, it has to be revised, compared with data on inflation.

The criticism that is sometimes made of *inflation targeting*—and the reason perhaps why some people would prefer to target nominal income—is that it focuses only on price stability to the neglect of stabilisation of output and employment. If this were true, it would be a serious criticism because policy would be failing to address some of its fundamental objectives. I think, however, that this criticism is misplaced.

As we saw from our earlier experience there is no trade-off between inflation and growth and employment in anything other than the short run. In creating a permanently stable price environment we can in fact enhance the prospect for growth and employment through encouraging more rational, longer-term, decision-making.

But there is no necessary conflict between inflation and output objectives even in the short run. To illustrate the point let me take the example of the recent slowdown in domestic and particularly external demand growth here in the United Kingdom. Because it had a depressing influence on both prices and activity, monetary policy could be eased-wholly consistently with the inflation target-as indeed it was. Shocks to the supply side of the economy pose potentially bigger problems, because they do tend to affect prices and output in opposite directions. The rise in world commodity prices in 1994 and 1995 would be an example. In practice what tends to happen in this case is that policy accommodates the initial first round price effects rather than trying to offset them, but then tries to ensure that they do not have second-round domestic inflationary repercussions. This may, I accept, involve restraining domestic activity in the short term.

A forward-looking approach to inflation targeting does therefore necessarily take account of what is happening or likely to happen to the real side of the economy—output and employment—because this influences the outlook for inflation itself. In focusing on inflation over the medium and longer term, we are in fact using it as a barometer, if you like, of the prospective balance between aggregate demand and the supply capacity of the economy. In this sense it is not in fact so far removed from stabilising output and employment around their trend rates, except that instead of seeking to estimate those trends directly—which as I say is a hazardous process—we monitor the prospect for inflation as evidence of an emerging imbalance between them.

Now it has to be said, Vice Chancellor, that our experience of a monetary framework based upon an explicit inflation target is still rather limited. The inflation target was introduced less than four years ago, and the supporting arrangements for making the policy process more transparent, through the Bank's independent quarterly *Inflation Report* and through the publication, six weeks in arrears, of the minutes of the monthly monetary policy meeting, which I and my senior officials have with the Chancellor, are somewhat more recent.

But the results so far are encouraging. Inflation itself over the past four years, on the target measure, has averaged 3.0%. This compares with an average of nearly 10% in the 20 years before we adopted the inflation target in 1992, including one single year when inflation rose by nearly 25%. Notwithstanding the various shocks that I have described (for example rising world commodity prices and weak economic activity in continental Europe), activity has grown consistently—and reasonably steadily—for 16 successive quarters. Unemployment has fallen fairly steadily during this period, from a peak of over 10<sup>1</sup>/<sub>2</sub>% to below 8% now. And the prospect for the next two years—the extent of most forecasting horizons—remains very encouraging, with most forecasters predicting continuing steady growth with low inflation, within a range, in each case, of some 2%–3% a year.

On this basis I believe that stability—not just price stability, but stability in the broader macroeconomic sense that I have described, including steady growth and lower unemployment—is closer than it has been for a very long time. I find that rather an exciting prospect—not in the least bit boring or dull, and I hope that you might share some of that enthusiasm, even after listening so patiently to this lecture!

Of course it is not yet in the bag. We have to persist year after year before we really will have persuaded people, and industrial and commercial businesses, and financial markets, that stability is a permanent, normal, state of affairs on which they can rely. But if we can succeed in establishing macroeconomic stability in this way, that will allow policy-makers in other areas to concentrate on the structural features of our economy—the long-term, microeconomic, debates—that can raise our potential rate of growth and lower our natural rate of unemployment. That is what we also need to do to maximise economic welfare—and it will provide plenty to debate and argue about.

## **EMU**—a British perspective

The Governor of the Bank, Eddie George, discusses<sup>(1)</sup> the potential economic benefits and risks of greater monetary integration. He argues that the economic case for greater integration within Europe is an application of the wider argument for free trade. The Governor notes that, while monetary integration within Europe is not a requirement in order to derive the substantial benefits of the single market, it is important to consider how far it can increase the benefits of the single market, and at what cost. It is beyond doubt that the single market would work better in an environment of reasonably stable intra-European real exchange rates, but the issue is how best to bring that about. The Governor considers this issue in relation to both the ERM and monetary union, noting that the latter would represent a much more powerful discipline on the participating economies, but also involve greater risks if they had not converged at the outset or if they subsequently became subject to serious country-specific economic shocks.

I am very honoured to be here at Bocconi University and to participate in this series of lectures organised by the Paolo Baffi Centre for Monetary and Financial Economics.

I have, perhaps inevitably at the present time, chosen to speak about Economic and Monetary Union (EMU) from a British perspective. Specifically, I will try to explain both the potential economic benefits and the economic risks, as I see them, of greater monetary integration, in the context of the progress we have already made towards economic integration through the European single market.

But I begin by recognising that EMU is not just about economics, it is fundamentally about politics. The relevant decisions will, of course, quite rightly, be taken by elected politicians in the light of their perceptions as to how best to promote long-term political harmony and stability within Europe. And the spectrum of political opinion remains very wide, ranging from pragmatic, case by case, co-operation between sovereign states, on the one hand, to a vision of a federal Europe, with varying degrees of supra-national authority centred in Brussels, on the other. As a central bank governor, I take no position on the politics, though I would make two observations.

The first is that, if the objective of collective arrangements of whatever kind is lasting political harmony within Europe, then those arrangements have to be freely entered into by the member governments with the support of their peoples. I do not see that the cause of lasting harmony between countries would be advanced by coercion or majority insistence, provided of course that minorities do not behave in a disruptive way; on the other hand, I recognise, too, that minority views should not be allowed to obstruct collective steps that other member states choose to take, provided that their legitimate rights are protected. Those principles were

essentially accepted at Maastricht; they have wide application, it seems to me, extending even to elaboration of apparently technical arrangements.

Secondly, although EMU is not *just* about economics, it is nevertheless also about economics, and the economics can go either way. If the economics go wrong-as they could-then that could equally blow back on the politics of Europe and give rise to tensions. But it is on the economics of Europe that I want to concentrate in the rest of my lecture.

#### **Economic integration**

The economic case for economic integration within Europe is essentially an application sub-case of the wider international argument for competition and free trade.

The argument is certainly familiar to you. The removal of barriers to international trade increases the scope for competition between producers of tradable goods and services. Increased competition increases aggregate economic welfare within the free trade area through benefits to consumers and as productive resources are redeployed to take advantage of comparative efficiencies and economies of scale. Additional income generated in this way in one part of the area is then available to be spent on goods and services produced at a comparative advantage elsewhere, making the elimination of trade barriers-internationally, and, consistently with that, at the regional, European level, a potentially powerful positive sum game.

Of course the benefits of free trade are aggregate benefits. It does not guarantee that everyone in the free trade area is an immediate winner. In particular, pre-existing producers-individual businesses, their employees, and the

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national governments representing them—may well see increased international competition as a threat rather than an opportunity. Those who stand to benefit—consumers and producers with the potential to take advantage of the new market opportunities—are less easy to identify, so there is an important asymmetry in public perception. Not surprisingly, therefore, there is an undertow of sometimes vocal opposition to free trade from potential short-term losers. And such latent opposition inevitably increases at times of weak overall economic activity and high unemployment, so that there is a continuing danger of retreat into protective nationalism, with the risk of the destructive spiral of retaliation that would be likely to follow.

Generally speaking, world trade arrangements have proved to be remarkably resilient against pressures of this sort—indeed there have been some remarkable achievements, including the successful conclusion of the Uruguay Round of trade negotiations in very unpromising circumstances. Nevertheless, the threat of backsliding is continuously present, and it is a more potent threat when those who feel threatened are able to point to aspects of partner country economies which appear to give those partners an 'unfair' competitive advantage.

The difficulty is that we do not have a precise, objective definition of what should be regarded as 'unfair' in this context. International trade arrangements, now within the framework of the World Trade Organisation (WTO), already seek to preclude gross discrimination and distortion of competitive markets. And some people would like to see the definition of what is 'unfair' extended, on the general principle that the benefits of free trade are likely to be greater-in terms of efficient resource allocation-the more level the playing field. But there are no absolutes in any of this-only questions of degree. Few people would argue that the benefits of free trade depend on a perfectly level playing field or that perfection would be a realistic objective in practice. And some suggestions that market access should be made to depend, for example, upon labour market or social standards or even on action against corruption or in support of human rights, can appear as defensive or to go beyond questions of economic efficiency to much wider political concerns.

These considerations apply *mutatis mutandis*, at the regional level, just as much to the European Union. The fact is, of course, that we have already moved well beyond just free trade within Europe in creating the European single market. That involves not just free trade in goods and services but also the free movement of both labour and capital. It further involves supporting European legislation to avoid market distortions—through rules relating to state aids or public procurement policies, for example, or to restrictive practices within the private sector. And it involves, too, the setting of minimum standards in a number of areas, not least in my own field of financial services. Creation of the single market has necessarily involved much more than the removal of trade barriers; it has involved a limited measure

of pooling of national sovereignty, by unanimous agreement, including the agreement of the British government. There is much that remains to be done in terms of implementation and enforcement of what has already been agreed in relation to the single market, but a great deal has been accomplished. The effects are not easy to measure, but from the United Kingdom's perspective it is clear that our trade with the rest of the EU has grown consistently faster than our trade with the rest of the world since we joined the common market. Last year the share of UK trade with EU countries as a proportion of our total trade was some  $57^{1/2}$ %, compared with just over 44% 20 years before. And there is little doubt that our involvement in the single market has been an important factor, though one factor among many, in attracting overseas investment to the United Kingdom. British business, as best I can tell from my own contacts and those of the Bank of England, remains enthusiastically committed to the single market, and so I would suppose does a large majority of the British people.

There is perhaps more hesitation about the justification for extending the principles underlying the single market legislation into other areas. Europe has, as I say, already come a long way and is already (or at least prospectively in some cases) enjoying most of the more obvious economic benefits that the single market can offer. It is not at all clear that we *need*, in any absolute sense, to go further in terms of harmonisation or the setting of common or minimum standards in other fields, or that there would be significant incremental benefit from doing so. There cannot, I think, be any general presumption in that sense; the argument would need to be made case by case.

Some of the suggested extensions would affect sensitive areas of social policy and taxation, which can have important implications for economic structural flexibility, and where there are substantial political divisions, both within EU member states as well as between them, as to the appropriate policy choices. The issues would be far more complex than simply abolishing obstacles to trade where the economic rationale is much more immediately obvious. And they would need to be examined in the wider international context. It is not just Europe that is confronted with the problems of rapidly changing technology and global competition. In order to succeed in increasing levels of activity and employment in this environment, Europe as a whole and its individual member states will need to be able to respond flexibly, taking account of the policy responses elsewhere. That flexibility could be reduced if we tried to agree upon too much at the European level.

Whatever hesitations there may be about extending European economic integration into new areas, that does not in any way diminish the importance of holding on to the benefits we have already achieved through the European single market—not in any sense at the expense of our economic relations with the rest of the world, but over and above the benefits from those outside relations. Our immediate priority in this area, therefore, should be to keep the single market intact.

## **Monetary integration**

The economic—as distinct from the political—debate about European *monetary* integration is somewhat similar to the debate about further economic integration. You do not actually *need* monetary integration within Europe to derive substantial benefits from the single market any more than you need monetary integration with third countries to derive substantial benefits from free trade with them. The question is how far monetary integration can *increase* the benefits of the single market, and at what cost; and whether, in particular, there would be advantage in collective arrangements designed to stabilise intra-European exchange rates—the ERM or the single currency.

Now I do not think that anyone seriously questions the proposition that the single market would indeed work better in an environment of reasonably stable intra-European real exchange rates. The issue is how best to bring that about.

In discussing that issue it is important to recognise first of all that there is a very remarkable consensus throughout the European Union at the present time on the need for macroeconomic stability—involving disciplined fiscal policies to limit the burdens placed on the wealth-creating private sector as well as monetary policies directed to maintaining permanent price stability—in each country's long-term national economic interest as well as in our collective regional interest. The idea that there is a meaningful long-run trade-off between growth and stability which can be exploited through short-term demand management policies—whether at the national or the European level—has largely gone.

Against that background, it might be argued that if each EU member state individually pursued the consensus macroeconomic policies successfully, producing sustained domestic stability, then that would be likely also to produce substantial *de facto* real—and indeed nominal—exchange rate stability between them. Certainly you are unlikely to achieve exchange rate stability without domestic stability in the member states. In that case, it might further be argued that a collective exchange rate arrangement would in fact add very little—though, by the same token, it would cost very little either in economic terms or in terms of the perceived costs of surrendering national policy discretion.

But, the argument then goes on, one cannot rely upon consistently prudent macroeconomic behaviour—certainly on past performance—so that a collective exchange rate arrangement *is* needed as a helpful discipline to ensure that the EU member states do in fact remain on the path of macroeconomic virtue, and incidentally, are not tempted to seek 'unfair' advantage within the single market through competitive depreciation.

Up to this point the argument would seem to depend upon how far one can in fact rely upon member states pursuing appropriate policies as a matter of their perceived national self interest, and, if not, upon whether a collective exchange rate arrangement would be effective as an external discipline. That clearly depends in part upon its form. A very loose collective arrangement is unlikely to make much difference. A tight collective exchange rate arrangement can clearly be a tougher external discipline—but it could equally impose more substantial costs. With the best will in the world, individual EU member states are vulnerable to country-specific economic shocks of various kinds, which may mean that the macroeconomic policies they need to pursue to maintain domestic stability are not necessarily the same as those required in their partner countries. A tight exchange rate relationship might then involve substantial sacrifice in terms of domestic stability which might exceed the incremental benefits from the more effective functioning of the single market that the collective exchange rate arrangement was intended to deliver.

Let me illustrate these arguments by reference to the ERM and monetary union in turn.

## The ERM

There is no doubt that for a number of countries—including even some larger EU countries—the ERM, particularly in its narrow-band form, did serve as a very valuable external anchor for domestic policy. It had some potential disadvantages. Specifically:

- (i) it was a *nominal* exchange rate arrangement so that countries with relatively high domestic inflation tended to experience *real* exchange rate appreciation, creating persistent price distortions within the single market; and
- (ii) partly as a result but more generally, it invited market speculation against existing parities; and although in principle this might have been kept within bounds by timely parity adjustment, that proved to be extraordinarily difficult to achieve in practice.

In fact for most of the period from 1987 to 1992 the arrangements worked well, without serious tensions. What caused it to collapse in the end was more than anything the economic shock of German reunification, which meant that Germany's legitimate domestic policy needs came to conflict with those of other countries.

A number of countries were, as you know, driven out of the mechanism in 1992, including both Italy and the United Kingdom; and the fluctuation margin was increased very substantially to 15% for those countries remaining in the mechanism in 1993. In its wide-margin form the ERM is clearly less prone to market speculation against the parity. But it also represents less of an external discipline on member countries' policies, and so contributes less potentially additional exchange rate stability within the single market, compared with simple reliance on national policy discipline without a collective exchange rate arrangement.

A variant on the wide-margin ERM is, of course, being discussed now as a framework for the relationship between the single currency and currencies of countries that initially remain outside the single currency area. And while it is accepted that participation in this framework cannot be mandatory, there is some suggestion that it should be a precondition for eventual membership of the single currency itself. I am bound to say that from my perspective what we should be concerned with, in this context, but also as a matter in its own right so far as the functioning of the single market is affected, is not the technical form of belonging to the wide-margin ERM but the substance of economic stability-including exchange rate stability within a substantially narrower range than the wide-margin ERM would allow. What people need to recognise is that the ERM-even in its earlier form-was not synonymous with exchange rate stability, and it could certainly not ensure such stability in the absence of appropriate macroeconomic policies. It would be far more meaningful, in my view, to exercise collective surveillance over member countries' macroeconomic policies as a whole than to focus narrowly on the nominal exchange rate.

### **Monetary union**

The issues in relation to monetary union are much more fundamental. Monetary union involves the once-for-all, irrevocable, locking of exchange rates and subsequent replacement of participating currencies by the euro as the single currency. That would have unique advantages beyond any that can be conferred by the ERM.

Monetary union would represent a very much more powerful discipline on the participating economies. A single monetary policy in the euro area would, by statute, be directed to price stability in the area as a whole. National fiscal policies-in the sense of overall public sector deficits-would need to be tightly constrained. This might be done through something akin to Germany's proposed stability pact, which met with considerable support, in substance if not necessarily in precise form, from other finance ministers at the recent meeting in Verona. They supported it because they recognised that a self-denying ordinance would serve their own interests by simultaneously constraining the behaviour of others, who could otherwise impose monetary policy burdens on the whole of the euro area. And there would be no possible escape route through exchange rate depreciation from undisciplined wage or price behaviour, which would then tend to result directly in falling activity and rising unemployment in those parts of the euro area in which it occurred. To this extent monetary union would provide greater assurance of macroeconomic stability, as well as removing permanently uncertainty about nominal intra-European exchange rates as a factor in investment decisions by the financial and business communities.

But monetary union would also involve greater risks if the economies of the participating countries had not sufficiently converged at the outset or if they subsequently became subject to serious country-specific economic shocks. The Maastricht Treaty itself, of course, recognises these risks and seeks to limit them through the convergence criteria, which provide important benchmarks against which initial convergence can be measured. It is important that those criteria should be strictly applied. But it is equally important, and this too is reflected in the Treaty, that convergence should not simply be achieved at a particular point in time, but that there is a realistic prospect of it being sustained into the future.

Now it is not clear that any of the major countries will in fact succeed in meeting the convergence criteria to the present timetable—though the political determination to do so in both Germany and France especially is unmistakable. My own concern is as much about how—in conditions of extraordinarily high, and very different, levels of unemployment around Europe—we could be confident that convergence would be sustained even if the convergence criteria are initially met.

Unemployment is much the most important and urgent economic, and social, issue confronting us in Europe. I accept-with most other commentators-that it is not primarily to do with the economic conjuncture, although the present weakness of economic activity in the major continental countries is certainly not helping. So I agree that conventional macroeconomic policy, and exchange rate adjustment, cannot, certainly on their own, provide a solution. More and more of the EU member states identify the cause as structural features of their economies and are looking for remedies through deregulation, greater labour market flexibility, lower non-wage employment costs, and cutting back in particularly generous areas of social provision, for example. (This incidentally is a particular reason for being cautious about extending principles underlying the single market into some of these areas.) My concern is that no matter how the unemployment issue is addressed in individual countries, its resolution is bound to have substantial consequences on the whole of the rest of their economies. And, although we cannot know for sure, such changes could well have important implications for the sustainable pattern of real wages and exchange rates within the prospective euro area.

In these circumstances some national flexibility of fiscal and monetary policy, and some capacity to adjust real exchange rates, may well be helpful in rebalancing the different national economies when one can see the likely impact of their respective structural changes. Without that, in the context of a single currency, real adjustment would need to come about through changes in nominal wages, which would be extraordinarily difficult to achieve. It is not difficult in those circumstances to envisage tensions arising for the single monetary policy, or in the form of unwelcome migration or demands for increased transfers through the EU budget, or in the form of national pressure for protection against other countries whether they are within the euro area or outside, within the rest of Europe or more widely. It is in this sense that one can envisage political disharmony if the economics of Europe go wrong.

There are still some two years to go before the extent of these risks have to be assessed and the political decisions have to be taken. In the meantime, as far as the United Kingdom is concerned, we remain intensively—and I hope constructively—involved in the technical preparation for the single currency, and we continue in our national economic interest to pursue domestic macroeconomic policies directed to stability—sustained growth with low inflation—which are taking us towards meeting the Maastricht criteria. Notwithstanding the recent fiscal slippage, I am still hopeful that we will have a genuine choice as to British participation in monetary union when the time comes.

In that case I would expect that the government and parliament would examine the arguments very carefully. Our economic interests are the same as those of our European partners, that is to say that monetary union should only go ahead if there is reasonable confidence that it will be successful. That is much the most important consideration for British membership. Without that confidence it is not clear that we should wish to join if it went ahead anyway. But there is no conceivable circumstance in which it could be in our interests for it to be unsuccessful.

The other main consideration will be whether we can afford to stand aside if others do go ahead. There are potential risks in doing so. We might be penalised by financial markets which would require an interest rate premium to protect themselves against the exchange risk of holding sterling rather than the euro. We might become subject to discrimination in some form if the euro area were to see a need to protect itself against perceived predatory behaviour by non-participants within the single market. We might find that the United Kingdom became a less attractive location for overseas foreign investment—including investment in the financial services industry in the City of London. But there is no inevitability about any of this. The remedy lies largely in our own hands. There is no reason that I can see why we should be significantly damaged in these ways so long as we persist in responsible macroeconomic policies directed to stability. But we could be damaged economically if remaining outside the euro area were to be seen as a soft option, allowing the United Kingdom to revert to the sort of opportunistic short termism that has sadly characterised our macroeconomic policies on occasion in the past.

#### Conclusion

Mr Chairman, I recognise that in concentrating on the economics of Europe I run the risk of appearing to confirm the perception of many here on the continent that the United Kingdom is only interested in Europe as a free trade area. I do not think that is true—as I say we have already gone well beyond just free trade in constructing the European single market, with enthusiastic British involvement. The fact is, however, that the *economics* of Europe *is* essentially about maximising the potential benefits of free—and fair—trade within the region. That is more obviously true in relation to single market issues; but it is equally true of our common interest in macroeconomic stability throughout the region, and the contribution that collective exchange rate arrangements, including a single currency, might make to that.

Of course I understand that the single currency project in particular has been identified as a convenient lead ship in the convoy by those wishing to drive forward the political integration of Europe. I would only caution that even on this course, unless we are confident that the economic conditions are favourable the convoy could be led into rough water.

# The economics of equal opportunity

The **Deputy Governor** of the Bank, Howard Davies, reviews<sup>(1)</sup> the economic case for equal opportunity and examines the statistical evidence for discrimination in the British labour market. He argues that both economic theory and market logic are working in the right direction, but that there can be a case for targeted intervention by the public sector to overcome market failures.

The debate about the economics of equal opportunity is fraught with received wisdom, on all sides.

In the reactionary corner, so to speak, there are employers who argue—nowadays rather quietly and behind closed doors—that an equal opportunity policy is bound to cost you money. Women, they say, have a tiresome habit of getting pregnant and having babies, a habit which, despite many technological advances, they find it difficult to shake off. Partly as a result they are less committed to the business in the long term, and the demands of the job often come second to the demands of the family. So they are less useful and flexible employees, and more expensive than the alternative—particularly if they get above themselves and start asking for employer assistance with the costs of childcare. You can also sometimes hear a related case made in relation to disabled people.

Similar, even less printable arguments are advanced on the ethnic minority front where assumptions about educational attainment and work ethic are made which make it look 'risky' to recruit extensively from ethnic minority communities. That is even disregarding more straightforward forms of racial prejudice, which are mercifully rare among employers, at least in my experience.

When it comes to age, the received wisdom is more openly heard. People say that older workers are sicker, more prone to absenteeism and less able to work in demanding jobs. They are less flexible, less adaptable and tiresomely set in their ways. The short work horizons ahead of them make it not worthwhile to invest heavily in their training. You just will not get the needed return on your outlay. And, anyway, older people should have made provision for their retirement; retirement which comes increasingly early. They should not need a job much after the age of 50. They should be digging the garden and revising their wills. Surely it is right, instead, to give youth a chance?

Most of us could make a reasonable stab at demolishing some of these preconceptions and prejudices. But the counterarguments are, I find, often collapsed into an alternative set of received wisdom, more acceptable round dinner tables in N1, but sometimes just as glib. So the 'seconds' in the progressive corner maintain loftily that equal opportunity recruitment and retention practices are both good ethics and good business. The ethics bit, as they say, goes without saying and therefore isn't often said; the business argument gets an abbreviated outing. Any business which does not recruit a balanced workforce, so the case goes, is not making full use of the range of skills available in the labour market. That any whiff of discrimination in the workplace will damage employee morale across the business: staff of all shades, ages and sexes don't like it these days. And that businesses should wish to recruit a workforce which reflects the balance of its customer base. Only that way will they maximise their appeal to the total potential market.

I have, indeed, advanced such a case myself from time to time on CBI platforms to the evident approval of the assembled multitudes—though one might add that those multitudes are generally self-selected people who are interested in, and enthusiastic about equal opportunities.

Occasionally, as I put these points so, I asked myself just how persuaded I was of its validity. Are all employees quite so committed to increasing the intensity of competition for their jobs? Do all employers really need to tap every conceivable segment of the labour market? Surely at a time of high unemployment it is quite possible to get the people, with the skills you need without working terribly hard? And the unbalanced workforce good for pleasing customers bit? Fine in the hairdressers, perhaps, but do we all know, or care, about the composition of the workforce which assembled our car, or our washing machine? Or, indeed, in my own case, produced the Bank's monetary policy advice, or supervised Barings?

So, afflicted by these wholly non-PC doubts, I decided to go back to first principles in reviewing the economic case for equal opportunity. And I asked the economists at the Bank, an intellectually aggressive and unsentimental bunch of people for the most part, to review the arguments and give me an objective view of the strength of the economic case for equal opportunity policies.

Their response began uncompromisingly, and unpromisingly. 'Discrimination', I read 'is a desirable

<sup>(1)</sup> In a speech given at the Equal Opportunities Commission Conference on the Economics of Equal Opportunities on Monday, 20 May 1996.

activity for economic agents to engage in'. I began to wish I had not asked the question.

But things began to look up when the author explained that what was meant was discrimination in the sense of seeking to identify the skills and characteristics of the available workforce, in order best to match them to the needs of the job. Discrimination as used in common parlance, is a different matter altogether. Kenneth Arrow, a Nobel Prize winning economist who wrote 25 years ago on the theory of discrimination defined it as 'the valuation in the marketplace of personal characteristics of the worker that are unrelated to productivity'. A somewhat bloodless definition, you may think, but in fact a helpful one if the aim is to identify the economic impact—the costs and benefits—of restricting one's choice of employees, based on factors unrelated to aptitude and ability.

For economists, then, the relevant question becomes: if an employer includes other factors in the employment choice, whether based on gender, ethnic status or race, what should one expect the consequences to be? Some people talk about this in terms of the consequences of operating in segregated labour markets. The point is essentially the same.

To try to answer the question, let us take a fairly straightforward example. Suppose that an employer is, for whatever reason, prejudiced against women. Let us assume that this prejudice is not based on pure misogyny, but instead on some version of the argument advanced at the start. The employer believes that the output, the productivity of women, is lower than that of men.

In that case, the employer's response will, if he offers women jobs at all, be to offer them a lower wage. That is a commonsensical outcome, and one we have certainly seen occur in the real world.

Now, if we then assume that the prejudiced employer is wrong, and that the productivity of women is the same as men, or closer to men's than his wage differential suggests, then in only being prepared to pay a lower wage, he is leaving the field open to a competitor to pay more, attract the best women employees, and still undercut the employer who chooses only to employ men at the higher rate. In the end, if there is free entry into whatever market the employer is in, then prejudiced firms will be driven out and wages between men and women will be equalised since competition in the labour market should ensure that women's wages increase until they equal those of men.

This is fairly robust economic theory, and is at the heart of quite a lot of academic literature which maintains that discrimination is an irrational thing to do from an economic point of view. Of course, like many aspects of economic theory it assumes that the world is one in which perfect competition rules and, therefore, that prejudiced employers will be driven out of the market. But we know that the evidence suggests that discrimination between different groups of employees does persist, and is not necessarily removed by market forces. Why might that be? There are a number of possible reasons. There are still monopolies, or near monopolies, which are in some sense protected from the laws of the market. Not too many at national level, these days, but still a number in local labour markets. There are also monopsonists—employers who are in effect almost the only significant purchasers of certain types of employee in a particular local labour market. There are also firms in which the external market plays a relatively small role in determining pay relativities within the company. They may offer long-term employment and career prospects to reduce their vulnerability to competition for their employees. In such circumstances differentials between men and women can persist for some time. And of course there are cultural stereotypes which push women into certain types of job.

There is also the development of two sorts of employment. Long-term, core employees on the one hand, and short-term or temporary workers on the other where the pay in the two sectors may be determined by rather different considerations. And, as we know, women are particularly significant in the second, if you like, secondary job market.

Lastly, there is the phenomenon known as statistical discrimination. Suppose it is true that, on average, the productivity of a particular group of workers is lower than that of another group. That might conceivably be the case for some ethnic minority groups in the United Kingdom, whose educational attainment, and training, is lower than the average. It might also be true of women. An employer might consider that he should pay in relation to the average productivity of that group. That means that those within it who have higher skills and higher productivity are significantly underpaid, because they are dragged down to the average. This may be rational for the employer; it is tough on the victim. And it is clearly an area in which the work of the Equal Opportunities Conference can be very valuable. They should be arguing for discrimination, in the economist's sense I talked of at the start.

So economic theory can take us a reasonable way in this area. It can show us that, theoretically, discrimination on grounds other than ability and productivity makes no sense and is likely to impose a cost on employers who practice it. At the extreme, they would be driven out of business. And theory also tells us why this does not necessarily happen. It therefore presents us with an interesting agenda of policies which ought, if rigorously pursued, to work against discrimination of the sort we wish to eradicate. We should be outlawing or regulating monopolies and monopsonies, whether national or local. We should be looking for measures which encourage employers to provide training for part-time workers, as well as core long-term employees. We should be trying to increase the employment choices available to people subject to discrimination. We should be trying to increase skill levels in particularly disadvantaged groups, and to offer women better childcare options.

I very much hope that the Commissioner, Padraig Flynn, makes these points strongly to his colleagues in the Commission in debates about opening up markets in Europe, markets like energy and telecommunications which still remain closed. Market opening measures are likely to contribute to equal opportunities objectives, for the reasons our economists, through me, have explained today.

But before I finish, a few words about what the latest statistics show about discrimination in the British labour market.

Taking gender discrimination, first, the bald statistics suggest that women earn around 20% less than men, per hour of full-time work. On the other hand, they are less likely to be unemployed though almost twice as likely to be economically inactive. It is reasonable to suggest, however, that more of women's inactivity is voluntary than is men's.

It is fair to say, too, that some of the earnings differential can be explained by differences in skill levels or educational attainment. For example, although the proportion of women in the university population is now close to a half, in the workforce as a whole just under 10% of women have a degree, compared to over 14% of men. And, at the other extreme, 24.5% of women have no qualifications at all, compared to 17% of men. In quoting these figures, I do not mean to imply that we should be happy with them, merely that they may be part of the explanation for a continued earnings differential when average salaries in the economy as a whole are compared.

But even after making such adjustments it still seems that there is a residual element that cannot be explained in that way and can only be ascribed to continued discrimination—discrimination of the sort our economists disapprove of, not the sort they like. And of course, some of the lower attainment levels may be attributable not to free choice, but to what one might call pre-market discrimination, in that women may be channelled into jobs which offer less in the way of personal development opportunity.

The position of ethnic minorities is more complex. Looking at ethnic minorities as a whole, their wage rates are perhaps 8.3%, on average, below those of the white population. But their unemployment rate is significantly higher.

This average figure is, however, somewhat misleading since it conceals very different positions in the different types of ethnic community. Inactivity rates are particularly high among people of Pakistani or Bangladeshi origin (especially among women, for cultural and religious reasons), and particularly low among blacks. The educational attainment of people of Indian origin is higher than that of the average of the white population, though the community is more polarised in that both the percentage with degrees and the percentage with no qualification at all are higher than for the white population.

In these circumstances it is important to look at trends to try to understand what is going on. Until the last recession they were painting a slightly more optimistic picture, in that unemployment rates between the different ethnic communities in this country were gradually converging. By 1990 unemployment in the ethnic communities was 'only' one and two-thirds times the figure for whites.

Unfortunately, unemployment rates in ethnic communities have recently risen again relative to the rest and are now two and one-third times the rate for whites. The implications are not entirely clear. Perhaps, on average, people from ethnic communities were more recent employees, and some form of 'last in first out' rule was applying. But, whatever the reason, it would appear that the employment status of people from ethnic minorities remains more fragile and vulnerable than for the white population as a whole. That is a continuing source of concern.

The problem of age-based discrimination remains rather different in character. And the statistical analysis needed is also different. Unemployment declines with age and inactivity rises as people retire. So, while the unemployment rate for men and women at retirement age, (ie 59 for women and 64 for men) is only around 7%, the inactivity rate is 32%. Some of this inactivity is undoubtedly voluntary as people consider that they have adequately secured their future incomes and prefer to increase their leisure time or, perhaps, to spend more time in a caring role. But there is nonetheless some persuasive evidence of age discrimination. That is to be found in the duration of periods of unemployment among older workers. Although older workers are less likely to be unemployed than younger people, once they are unemployed they tend to experience longer periods out of work. So while 40% of the unemployed in their 20s and 30s are long-term unemployed that figure rises to 45% for workers in their 50s and 52% for people over 60. Once older workers become unemployed, they find it harder to get another job. And, indeed, some of what is categorised as early retirement should more properly be regarded as unemployment. The proportion of discouraged workers, in other words people who would like a job but who are not looking because they believe none are available for people like them, increases with age.

It seems likely, therefore, that employers are to some degree at least discriminating against older workers. They do appear to believe that older workers are more difficult to train, or that it is simply not worth doing so because of their short time left in the workforce. That, even though the average life of acquired skills has, by one measure, reduced by a half in the last 15 years, from 14 to 7 years. In other words, skilled workers need retraining every seven years now to keep them competitive and productive. That means the traditional calculations about the over 50s may need to be revised. And at the same time, of course, people are living longer, and more healthily, lengthening their potential participation time in the workforce.

I conclude, therefore, that there remains a considerable agenda for those who are committed to equal opportunities to pursue. My thesis is that both economic theory and market logic are working in the right direction and that market forces will, if they are properly supported, tend to deliver a positive outcome. But, that is not to say that there is no case for targeted intervention by the public sector to overcome the market failures which undoubtedly still exist. The market needs a lot of support to achieve a desirable outcome. I hope that, today, I have presented the beginnings of an agenda of such interventions, and provided a discriminating set of arguments to support it.

## Gilt repo-and beyond

Ian Plenderleith, Executive Director for monetary operations praises<sup>(1)</sup> the start of the gilt repo market in January 1996 and its subsequent steady and sustained pace of development. He also reviews the programme of reforms in the gilt market and describes the Bank's current thinking about possible structural changes in the sterling money markets.

I want to begin today by celebrating a palpable success.

Nearly six months from launch, the gilt repo market is cruising confidently along the glide path on track for the global market. Its development so far has been marked by:

- steady, sustained growth;
- built on a sound market structure;
- attracting a steadily widening range of participants;
- generating rising turnover; and
- already delivering evidence of the benefits we looked for—enhanced liquidity and improved efficiency in the gilt market and in other sterling markets.

In sum, the market is now approaching critical mass as a major international repo market. That is a remarkable achievement after less than six months.

#### Gilt repo: progress so far

The introduction of gilt repo trading undoubtedly represents the biggest change in the structure of the gilt market since Big Bang, whose tenth anniversary we reach this October. Like Big Bang, the start of gilt repo trading was preceded by an extended period of careful planning and preparation. Also like Big Bang, the change had to happen on a single day. But unlike Big Bang, the new market has thus far exhibited a pattern of growth that has been substantial in size and sustained in its pace of expansion, but above all steady and orderly. It is wholly to the good that there has been no sudden explosion of activity, because that kind of headlong rush would inevitably force dealers into trading misjudgments and overstretch both management control and back-office support, at precisely the time when all concerned were most exposed as they worked their way up the learning curve. And the impression that would give, of a market that was trying to run before it could walk, would actually serve to discourage the client base from using the market and hence delay its long-run development.

It is an enormous gain, therefore, that we have avoided these potential pitfalls and have instead achieved a pace of

(1) In a speech given to the Annual Open Gilt Repo Market Conference in London, on 12 June.

development that is steady and sustained. This is evident if we look at various aspects of the market's growth so far. We have seen, first a steady expansion in the *range of participants*. Naturally, the key professional market participants were there at the outset—the gilt-edged market-makers, the discount houses, the major banks and securities firms and the wholesale brokers. Joining this core group, we have seen additional participants enter the market at a pace determined essentially by their perception of what gilt repo can add to their business and by the practical requirement for them to vet and sign up the necessary legal agreements with their chosen counterparties and to have the necessary front-office and back-office (or delegated triparty) arrangements in place.

At quite an early stage, we saw the entry of some of the major building societies, for whose treasury management activities the gilt repo market has obvious relevance. Alongside them, we have seen central banks progressively begin to sign up, attracted particularly by the opportunity to place funds on a secured basis and by the facility repo offers for managing their liquidity.

Beyond them, we have begun to see some of the domestic UK institutional investment firms enter the market. Many of these are, of course, extremely important to the gilt market as lenders of stock, and it is good news for the market that stock lending has continued to flourish alongside repo, with indeed some new lenders entering the market as others extend their activity into repo. Fund managers more generally can be expected to take longer to enter the repo market, because of their need first to observe proper procedures for segregation of client funds. But some hedge funds have already begun to participate in the market, and we expect international participation more generally to grow considerably further as gilt repo takes its place alongside the other major international government bond repo markets. Beyond that, the involvement of corporate treasury managers is in prospect and there should be interest from all who would see value in placing money against the security of an asset-government bonds-which carries no credit risk. In that sense, as the modern form of secured money, repo has potential attraction to a huge range of participants; but it will remain important that new participants first take care that they have the necessary vires to operate in repo.

From the statistical data we have collected, we can see a similar picture of a progressive expansion of activity. We collect data quarterly, and have figures so far to the end of February: the end-May figures are coming in during this month and we will publish them when they are complete. Already by the end of February, we believe there were up to 100 firms participating in the market and, from data reported by over 60 of the main participants, we estimate that by the end of February the market had already reached at least £36 billion outstanding, with daily turnover in the first two months of the market's life averaging at least £12 billion a day. This, of course, is in addition to the substantial volume of stock lending still being undertaken; it has indeed always been the intention behind the reform that market participants should have genuine freedom of choice between repo and stock lending, utilising whichever best meets their needs. The activity in repo, not surprisingly in the early months, is concentrated in the shorter maturities, with 65% at maturities up to one week, though with some 20%-25% reported at maturities above one month. The monthly M4 data give us an indication of repo activity by banks and building societies since then. They show that banks' and building societies' repos had reached £23 billion, and their reverse repos £29 billion, by end-April, suggesting continuing sustained growth in the market as a whole.

On these figures, gilt repo had already, by the end of February, grown to around three times the size of stock lending and around twice the size of the eligible commercial bill market.

Alongside this sustained growth in the scale of activity, it is encouraging that repo has also begun to develop the pricing characteristics we would expect to see in a fully fledged trading market. General collateral rates have moved closely in line with the overall constellation of money-market rates, with overnight GC repo rates usually very close to interbank rates, but term GC rates trading ten basis points or more below interbank rates: this is the relationship one would expect, given the secured nature of money placed on gilt repo. All of this is evidence of active matched-book trading, which provides a firm foundation for the new market's liquidity. The result has been to reduce the cost of financing gilt positions, from at least Libor to a margin below Libid; and in parallel, basic stock lending fees have been more than halved, from 25 basis points to ten basis points or less. This reduced cost of financing, and the ability for any participant to take short positions through repo, has helped new players to enter the market, which in turn improves the liquidity of the gilt market and thus achieves one of the principal benefits we looked for in gilt repo. It has also enhanced the quality of the sterling money markets and deepened the swap market.

As importantly, the repo market has, as expected, generated differential rates for stocks on *special* delivery, ie the market is clearing by price. Holders of particular stocks wanted on repo have been able to repo them out against money costing typically up to 100 basis points below GC rates. Differential repo pricing in this form is a normal characteristic of a mature repo market and it is therefore a sign of healthy development that specials are a growing feature of gilt repo activity. That specials rates have generally been more moderate than in other repo markets may reflect the highly developed network of gilt stock lending arrangements which gilt repo has inherited and which has facilitated efficient supply of stocks in special demand. The range of stocks trading special may be expected to broaden as the market grows.

The Bank welcomes such activity and will in no way seek to impede specials trading, though, as we have indicated, we stand ready to take action if we encounter tactics designed to distort or disrupt the market, because such activity can reduce market efficiency, deter end-investors and raise funding costs. In fact, extreme special rates have only appeared once, in relation to 15% Exchequer 1997, and that situation was quickly resolved.

Equally encouraging have been the dogs that did not bark, by which I mean the notable absence of any significant problems with the market infrastructure-legal, regulatory and operational. A great deal of work was undertaken last year to develop a standard legal agreement for gilt repo, and a Code of Best Practice, as well as tax changes designed to facilitate repo trading, and enhancements to the CGO settlement system. This preparation, in which market practitioners were closely involved, has been taken to heart by the market: undocumented trades are few and far between (and we hope they will become even fewer), and the Code has been adopted as an essential guide to best market practice by virtually all players. The CGO, too, has worked effectively in handling the introduction of repo trading; drawing on experience to date, we will shortly be putting round proposals for some minor adjustments to the CGO daily timetable for settlement. The gilt repo market has benefited enormously from a safe and efficient infrastructure, and all of you who contributed to the hard work last year deserve a great deal of credit for a job well done.

But, as I urged last year, continued vigilance is essential to ensure that repo activity is prudently conducted and properly controlled. If there is one aspect of gilt repo trading that gives me pause, it may not surprise you to learn that it is the question of margin. One reason why repo can be such a safe instrument while also being so flexible is through remargining during the life of a repo. Many repo transactions are, as I have mentioned, very short term, and participants may or may not be happy to undertake overnight transactions without margin; that is a matter for them. But market sentiment can change very rapidly, and the counterparty risk and price risk of repos, particularly term repos, should not be ignored. The Code is explicit on the importance of marking to market and then remargining to cover any material exposure, and it is vital to the well-being of the market as a whole that all market participants adhere to this; we do hear reports of some that do not: they are the ones who would suffer if anything went wrong.

### Reform of the gilt and sterling money markets

All of this is a considerable success story and I have no doubt that we shall see gilt repo take its place in the core group of major international repo markets. But having described progress so far, I want to outline where we go from here in building on this very successful start. I want first to talk about further reforms in the gilt market, and then describe where we have got to in our thinking about possible structural changes in the sterling money markets.

In relation, first, to the *gilt market*, it is helpful to see the series of changes that have been implemented in the last few years, or are in train for the immediate future, as forming five parallel planks which, taken together, constitute a coherent platform for a modern trading market in gilts.

The first plank is the debt management framework, which was extensively reviewed in the joint Treasury/Bank of England Report of the Debt Management Review published last year. This set out clearly the objectives the authorities pursue in the debt management field, and it provided for the authorities to issue at the beginning of each financial year a clear statement of their debt management plans for the year ahead, in the form of a public remit from the Treasury to the Bank of England as its debt manager. That process provides a clear framework within which debt management policy can be developed each year in the light of needs in the year ahead, and within which the Bank of England can then carry forward the necessary market operations to finance the central government's borrowing requirement. Importantly, the remit is published, so that the market is fully informed of the authorities' plans, and that commitment to transparency has undoubtedly yielded benefits, both to the authorities in more effective debt management, and to market participants in enabling the market to function more effectively.

This work is, however, not yet complete. Policy decisions in the debt management area need to be rooted in a clear understanding on the part of the authorities of the structure of debt they would like to have—for example what proportion at fixed rate or floating rate or in index-linked form, and what maturity structure. Essentially the need is to identify an optimal debt portfolio, both as a long-run target for debt management policy and as a benchmark for the debt manager's performance. These are difficult issues, which no country has yet successfully resolved. We have work in hand in this area and hope to offer it for public discussion in due course.

The *second plank*, of reform in the gilt market, is the *selling programme*—the means by which we sell gilts. Here we have introduced changes with two aims in mind—to make the selling programme more *structured*, and more *transparent*. In terms of a more structured approach, we have clarified that we sell gilts essentially through three avenues—a regular monthly programme of auctions is by

far the predominant method of sale, in line with a calendar published at the beginning of each year; occasional tap sales in specified circumstances; and a third leg which we are just in the process of putting in place, the so-called 'shop window', through which we will post details of very small amounts of official holdings of which we are ready to dispose if there are buyers. To make these three avenues as transparent as possible, we publish on our screens full details of our operations as they are undertaken. And we will very shortly be publishing a full 'Operational Notice' which will bring together in one handy reference document complete details of how our operations are conducted in this new, more structured and transparent approach.

Here too, however, we have work still in progress, in particular in relation to index-linked gilts. In a fruitful conference last September, we organised a discussion with market participants, academic experts and overseas debt managers of ways in which the index-linked market might be developed further. Part of the discussion addressed the particular role of auctions in selling index-linked debt. Views were mixed, but the sense on balance was that the index-linked market was probably not yet sufficiently developed to sustain a regular programme of auctions. Hence, we took the view that we should continue for the time being with our current approach of selling indexed gilts by tap sales timed to respond to perceived demand. But as the index-linked market grows, we will want to keep in sight the possibility of introducing auctions. And the very welcome recent decision by the US Treasury to issue US government bonds in a form that protects against inflation seems likely to deliver a substantial boost to worldwide interest in index-linked debt: this could bring forward the time when we can reconsider auctions here.

It is in the *third plank* of gilt market reform that repo makes its contribution, through improving the *liquidity* and *efficiency of the secondary market*. I have outlined above the gains already evident from repo, but I should add to the score card the important contribution of tax reform, where big changes, particularly in relation to withholding tax, aim substantially to remove tax anomalies, and hence improve the efficiency of the market and enhance its attractiveness to international participants.

The *fourth plank* is the less glamorous, but critically important, field of *market infrastructure*. The membership from March of this year of CGO by the main international depository and settlement systems helps to improve international access to the gilt market. But we have major work in hand on CGO itself: CGO is well on track for a substantial upgrade which, *inter alia*, will provide an improved service for settling repo and the facilities necessary for gilt stripping. This upgrade is being conducted utilising CREST software, and in parallel with CREST, so that the option of merger of these two systems can be kept open. Merger will be for consideration in the future, but the first priority remains to get both of these systems into operation, with the start date for the CGO upgrade still set for the early months of the next year. Looking further ahead, there are other aspects of the market's infrastructure where we want to pursue improvements—for example, in the relationship between the CGO, which provides same-day book-entry electronic transfer, and registration, which takes place some days later; and in relation to the ex-dividend period, which has already been substantially shortened but should ideally be removed altogether. And the successful inauguration in April of real-time gross settlement (RTGS) for wholesale payments offers the prospect in due course of full delivery-versus-payment (DVP) for gilt settlement.

The *fifth plank* of gilt market reform is to continue to improve the *gilt-edged instruments* themselves. Here, too, we have major work in hand, in the development of strips for gilts. With the tax reforms now in place, and once the CGO upgrade is operative, it should be possible to start strips in the early months of next year. Strips will greatly enhance the flexibility of gilts as an investment and will be a further significant enhancement to the market's liquidity and efficiency.

In parallel, we will continue to consider the scope for new instruments and innovation in instrument design, where our touchstone is always to look at investor demand and seek to respond if the scale of demand is sufficient. This has led us to develop a wider range of debt instruments than any other major government borrower and we continue to see merit in maintaining a diverse portfolio of borrowing instruments, though built on a bedrock of liquid benchmark issues which provide the basic building blocks for trading activity.

These five planks form the basic structure of the reform programme in the gilt market and, as I have indicated, there is more work there still to do—notably in the analysis of the government's optimal debt portfolio, in developing strips for gilts and in expanding the index-linked sector, and in the CGO upgrade. Repo is an important step in carrying forward this platform of reform. But repo also opens up opportunities for changes in the structure of the *sterling money markets*, and here, too, we have work in hand.

We have said that the development of gilt repo trading activity could make it sensible to contemplate changes in our money-market operations, and that we would consult at the appropriate time. That remains our intention, but in recent months there have been several important developments helping to carry this process forward.

First, with the track record we now have of the performance of the repo market to date, we can be much more confident that it would prove capable of providing an effective avenue for our official money-market operations if we wish to make use of it, ie that operations by us, designed to influence repo rates, would be transmitted to the structure of interest rates across the economy as a whole. We may not quite be there yet, but repo activity is approaching critical mass and we can now have much greater confidence that it will develop into a fully mature market. We quite recognise, of course, in this connection, that a decision by the Bank to operate in repo would itself be likely to be a major stimulus to the market's continued growth.

But we have also had important information in other areas in recent months. With the inauguration of RTGS in April, we are now engaging in the provision of liquidity within-day against collateral to the banks participating in that system. Looking further ahead, we now have a clearer idea of how money-market operations are likely to be conducted by the European central banks participating in EMU if and when monetary union takes place.

These apparently unrelated developments matter, because they are pieces in the jigsaw that we need to put together coherently in planning any change in our money-market operations. It is not just a matter of whether or not we extend our operations into repo. In addressing that question, we need to consider the full range of the instruments in which, and the counterparties with which, we deal in a variety of current and possibly prospective operations-our within-day operations for RTGS, which I have mentioned, our twice-monthly gilt repo facility open to the monetary sector as a whole, our dealing relationship in gilts with the GEMMs, and the nature of possible future operations by the participants in EMU, as well as our current daily operations in bills in the money market. We need to consider these various dealing and counterparty relationships as a coherent whole, rather than focusing on just one of them in isolation. The past several months have given us a much better read of developments in a number of these areas-notably in relation to repo. We now have several important pieces of the jigsaw that we lacked before, and we hope that we will soon be able to bring our thinking to you for wider discussion.

## Symbols and conventions

- .. not available.
- nil or less than half the final digit shown.

Because of rounding, the sum of the separate items may sometimes differ from the total shown.

On the horizontal axes of graphs, larger ticks denote the first observation within the relevant period, eg data for the first quarter of the year.

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