Money market operations in the United Kingdom

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Introduction

Two developments over the past few years have had a significant influence on money market operations in the United Kingdom:

- changes to the environment in which monetary policy decisions are made, such as the introduction of a new framework for monetary policy and the move towards a low inflation environment, have led to changes in both the timing and, recently, the size of official interest rate changes;
- structural changes in the commercial bill market – the main instrument for money market operations – and the role played by specialised money market intermediaries (discount houses) have led to the addition of a new operating instrument – a fortnightly repo in government debt with a wide range of counterparties.

In addition, four other developments are likely to influence the evolution of the Bank's money market operations to a greater or lesser degree in the future:

- the introduction of an open market in gilt repo in January 1996;
- the introduction of Real-Time Gross Settlement (RTGS) in the sterling wholesale payments system in April 1996;
- work in the EMI on how monetary operations should be conducted in Stage 3 of monetary union;
- the development of new sources of information on market expectations and new techniques for extracting this information.

The main part of this paper describes the questions posed by these developments, and the analysis – and in some cases the actions – the Bank of England has undertaken so far to respond to them. In addition, we discuss some more general issues raised by research on money market operations.

1. Objectives

The objectives of money market operations in the United Kingdom are, in order of importance:

- to steer short-term interest rates consistent with the authorities' monetary policy;
- to enable the banking system to manage its liquidity effectively; and
- to foster the development of efficient markets.

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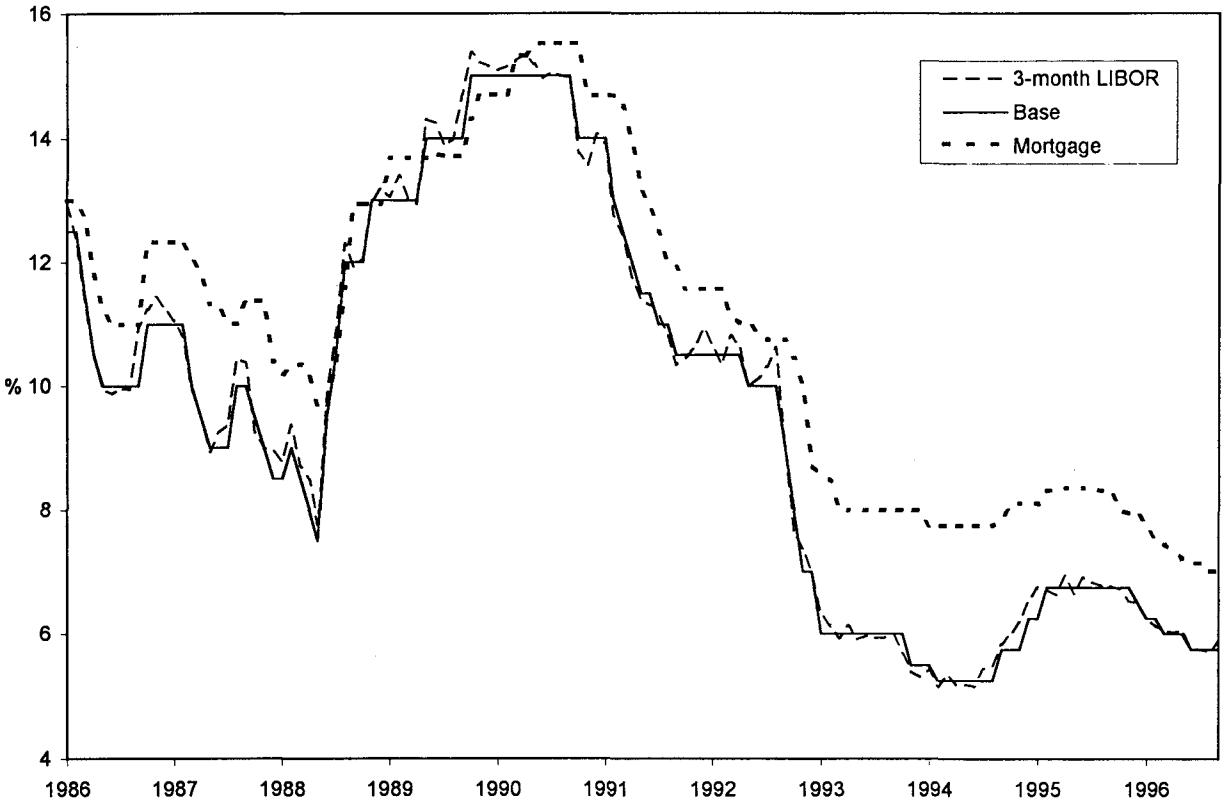
While the maturity of the official interest rate set by the Bank from day to day in its open market operations ranges up to a month, the average maturity is around two weeks. In setting this rate, the Bank seeks to influence a range of short-term rates which directly influence economic behaviour. These include:

- clearing bank "base rates" which are the reference rate for much lending to the personal and corporate sector. In theory an individual bank could change its base rate at any time. However, in practice all the main clearing banks charge the same base rate and change it only in response to changes in official rates.
- bank and building society "mortgage rates", which are also strongly influenced by movements in the official rate, but tend to be set at slightly different levels by the major financial institutions and have a greater degree of independence from official rate movements than the base rate.
- one to three month interbank rates, key reference rates for lending to major corporations in the syndicated loans market.

Chart 1 shows how a selection of these rates have moved over the last ten years.

Chart 1
UK base, 3-month LIBOR and mortgage rates



To aid effective liquidity management, individual banks should be able to obtain short-term funds to meet their own needs and obligations to their customers at any time during normal business hours without triggering a significant change in price. In the United Kingdom only a small group of banks have settlement accounts at the Bank of England. These settlement banks need to manage their liquidity to meet the needs, inter alia, of the non-settlement banks which are their customers.

An efficient market in short-term funds has a number of benefits: in ensuring that changes in monetary policy are transmitted quickly to a wide range of economic agents; in supporting liquidity in markets for other (longer term) instruments; and in enabling agents to discover prices revealing information on market expectations of future interest rates and market perceptions of the credit risk of different bank counterparties. A central bank can help foster such a market by, for example, ensuring that information on its official operations is evenly spread among potential participants, and by ensuring that it does not, through its own actions, reduce the incentive for financial institutions to participate in the market.

It is also desirable as far as possible to have a system in which market forces deliver the required behaviour on the part of commercial banks, rather than having to rely on ad hoc interventions from the central bank. At the same time, the system needs to be able to deal with the accumulation of market power by large institutions – particularly where banking markets are heavily concentrated – and to be capable of evolving gradually in the light of changing circumstances, so as to minimise any risk of a loss of control in monetary policy, or a loss of credibility for the central bank.

2. Changes to the monetary policy context

In the past few years the United Kingdom has seen the establishment of a *new monetary framework* for achieving price stability, and a shift to low inflation. Both these developments have had implications for the Bank's money market operations and sterling money markets.

2.1 New monetary framework

Following sterling's suspension from the Exchange Rate Mechanism (ERM) in September 1992, the objective of monetary policy in the United Kingdom remained the pursuit of price stability, but a new framework for implementing this policy was required to replace ERM membership. As is well known, this was provided in October 1992 by the adoption, for the first time, of an explicit inflation target by the UK Government. A target of 1-4% for the RPIX measure of inflation (consumer prices excluding mortgage interest payments) was set at the outset, with the aim that we should be in the lower half of that range by the end of the current Parliament (taken to be April 1997). This was updated in June 1995 and the authorities now seek to achieve an underlying inflation rate of 2½% or less over an indefinite period.

Under this framework, the Governor of the Bank of England advises the Chancellor on the interest rate policy the Bank believes is necessary to achieve the inflation target, but the ultimate decision about the level of official interest rates remains with the Chancellor. The Governor gives his advice at regular (in practice, roughly monthly) *Monetary Meetings* with the Chancellor which are timed as far as possible to follow the release of a new month's data on the state of the economy (allowing an appropriate period for analysis). The dates of these meetings are published up to 6 weeks in advance. The Bank has discretion over when precisely to implement any interest rate changes which have been decided at these meetings, although in practice it has increasingly chosen to implement changes as soon as practicable after each meeting.

Thus a significant feature of the new framework is greater regularity in, and pre-announcement of, the timing of decisions on monetary policy. This does not rule out changes in interest rates at other times in response to sudden shocks, such as may be reflected in very sharp shifts in the exchange rate or other asset markets. But in the normal course of events the market knows in advance when decisions will be made and when any change in official rates is likely to occur.

Another important feature of the new framework is greater transparency in the advice that the Bank gives the Chancellor, and in the analysis that underlies it. This is in part achieved by the publication of the Bank's quarterly *Inflation Report*, an independent assessment of actual and

prospective inflationary pressures in the economy; and in part by the publication of the minutes of each monthly Monetary Meetings two weeks after the next meeting has occurred. A press release is also published by H M Treasury after each interest rate change.

These changes have had a number of implications. First, market participants are likely to be clearer about the information set on which any individual monetary policy decision is made, thereby making it easier for them to identify the authorities' pattern of behaviour in response to news (reaction function). Second, flexibility in the timing of interest rate decisions should be needed only in order to respond to sudden and large economic or financial shocks. Moreover, if such an event were ever to occur, it is likely that the shock which triggered the authorities to act would also be visible to the market, thereby reducing, if not eliminating, the degree to which the action itself was unexpected. Thus, under the new arrangements there should be fewer occasions on which the authorities' behaviour – as opposed to the underlying economic developments – causes uncertainty in the markets. And more generally the enhanced flow of information to the market provides a ready means for the authorities to signal their views on future economic and financial developments. This means that money market operations are no longer the sole means of signalling official views about the future course of interest rates, so they can concentrate on stabilising and maintaining the current official rate.

In practice, the changes described above have not of themselves required any change in the mechanics for setting official interest rates in the United Kingdom. In particular, we have not found that the greater regularity in, and effective pre-announcement of, the timing of interest rate decisions has increased the *general* level of speculation over interest rate moves. In practice, such speculation tends to be focused on release dates for significant data and the days of monetary meetings.

2.2 Low inflation

UK inflation – measured by RPIX – has been below 3.5% since January 1993, while nominal short-term interest rates, at about 6%, are around their lowest level for the past thirty years. In this context the size of the last four interest rate moves has been ¼ percentage point, in contrast to the previous pattern of moves of ½ or 1 percentage point. Indeed the market currently perceives ¼ point change as the norm.

What determines the size of official interest rate steps? Table 1 provides descriptive statistics for official rate adjustments in the United Kingdom, Germany and the United States over the period 1986 to 1996.

In choosing a policy interest rate, we are looking for one that embodies the monetary authorities' view about the appropriate stance of monetary policy. In the case of the United Kingdom, this is straightforward since the authorities only move one rate. However, in other countries, particularly those which operate a corridor system, a number of different rates may be used to signal the authorities view, and the significance of a particular rate may change over time. For this reason the choice of the discount rate in Germany and the United States may not be ideal, but the analysis should provide a useful starting point.

The table shows that official interest rate adjustments in the United Kingdom have tended to be relatively large. In the period 1986-1996, they have averaged 0.7 percentage point, compared to around 0.5 point in Germany and the United States; and this has been the case both for rate increases and decreases. At the same time, rates have changed more frequently in the United Kingdom as compared to the other two countries. Table 1 also shows that when UK official rates have been tightened (+ +), the adjustments have tended to be larger, on average, than those implemented when rates are being eased (– –). This has also been the case in Germany, but the ratio of the average size of continued rate increases to that of continued rate reductions is lower than for the United Kingdom. By contrast, for the United States, the average sizes of the adjustments during tightenings and easings

have been equal. In all three countries, the rate adjustments implemented during tightenings have occurred less frequently (i.e. after a longer duration), than those implemented during easings.

Table 1
Adjustments in official interest rates*

	United Kingdom			Germany			United States		
	Number	Average size (p.p.)	Average duration (m)	Number	Average size (p.p.)	Average duration (m)	Number	Average size (p.p.)	Average duration (m)
Adjustments:									
Increases (+).....	13	0.96	n.a.	11	0.61	n.a.	7	0.54	n.a.
Decreases (–).....	20	0.60	n.a.	16	0.45	n.a.	12	0.52	n.a.
Total.....	43	0.72	3.05	27	0.52	4.33	19	0.53	6.21
Continuations:									
+ + ...	7	0.93	3.00	9	0.64	5.33	5	0.55	5.20
– –	24	0.58	2.25	16	0.45	4.44	10	0.55	3.40
Total.....	31	0.66	2.42	25	0.52	4.76	15	0.55	4.00
Turning points:									
+ –	6	0.71	23.40	1	0.50	n.a.	2	0.38	61.00
– + ...	6	1.00	20.80	1	0.50	n.a.	2	0.50	80.00
Total.....	12	0.85	22.10	2	0.50	n.a.	4	0.44	70.50
Summary statistics:									
+ / –		1.60			1.36			1.04	
+ + / – –	0.29	1.60	1.33	0.56	1.42	1.20	0.50	1.00	1.53

Note: Rates used are: United Kingdom = base rate; Germany = discount rate; United States = discount rate. All are month-end rates; p.p. = percentage points; and m = months.
* January 1986 to August 1996.
Sources: Bank of England and Datastream.

Differences in inflation performance in the United Kingdom compared to the other two countries over the period may be linked to these differences. For instance, the greater variability of inflation in the United Kingdom (implying larger inflation shocks) may have required larger absolute adjustments in nominal interest rates. Table 2 shows that expressing the absolute size of official interest rate adjustments as a percentage of the level of official rates makes behaviour in Germany and the United Kingdom appear more similar. This fits with an explanation based on greater inflationary shocks to the extent that higher inflation volatility tends to be associated with a higher average level of inflation and hence higher average nominal interest rates.

Table 2
Proportionality of interest rate adjustments[1]

Countries	**Average level (in percentages)**	**Average of adjustments[2] (as a percentage of the level)**
United Kingdom	9.60	2.56
Germany.....	4.95	2.35
United States.....	5.23	1.59

[1] Based on the same data as in Table 1. [2] Absolute values.

But changes in *real* short term interest rates are likely to be the main conduit for monetary policy, and it does not necessarily follow that larger changes in nominal rates produce larger changes in real rates, which is what one might actually require to combat greater inflationary shocks.

The greater *asymmetry* in United Kingdom rates may reflect the nature of the exogenous shocks hitting the United Kingdom economy over the period. Alternatively, monetary policy in the United Kingdom may have been more reactive than in the other countries. By the time short-term interest rates were raised, inflationary pressures were already well entrenched, and so relatively large rises in interest rates were then required to bring inflation under control. The United Kingdom's new monetary framework emphasises the need for monetary policy to be forward looking. To the extent that this helps the authorities to react sooner by raising official interest rates in an inflation upswing, it could enable them to move rates by less overall – i.e. "a stitch in time saves nine".

Another factor that may have contributed to both the size and the asymmetric pattern of rate moves in the United Kingdom is that – in contrast to the United States and Germany – the United Kingdom has operated an exchange rate target anchored in effect on another country for a period in the last decade. In these circumstances, and in the absence of close economic convergence with the target country, official interest rate changes may have had to be sharper (for example during the United Kingdom's membership of the ERM) in part to respond to market pressures on the exchange rate target.

Testing these hypotheses is complex since one first needs to separate out all the other influences on the transmission mechanism from the timing and size of official interest rate moves. We are currently conducting research on this issue, but as yet have no firm results to report.

3. Market microstructure

The sterling money markets – unsecured interbank loans, certificates of deposit, Treasury and bank bills etc. – are well established. The greater part of activity remains in the interbank market (but see gilt repo below) with tight spreads ($\frac{1}{16}$) quoted out to 6 months. What follows focuses, however, on the steps taken to reduce volatility at the very short end of the market since the United Kingdom's ERM exit, which created persistent strains for a period.

3.1 Causes and costs of volatility in very short-term rates

Volatility in short-term money market interest rates may occur under *any* system for setting official interest rates as a result of market speculation over future changes in official interest rates. However, the way in which this volatility manifests itself will depend on the form of money market operations and/or standing facilities used by the central bank. For example, in a system with standing facilities for taking in and lending out funds at a particular maturity, volatility at that maturity will be confined to the upper and lower bounds set by the facilities. However, at other maturities rates may rise or fall depending on market expectations.

Equally, if the operating system includes periodic monetary decision points, and the market expects the official rate to rise at the next decision point, there will be a tendency for participants to borrow as much as they can for maturities spanning the next decision point, while lending out the proceeds so that they mature before the decision point. In the case where the maturity at which the central bank provides liquidity does not span the next decision point, this will tend to push up longer term rates until the underlying implied forward rates are consistent with the market's expectations for the future path of the official rate. However, in a system – such as those in the United Kingdom or Germany – where the central bank may conduct open market operations setting an official rate whose maturity overlaps with the date of the next normal decision, market participants will have an incentive to borrow as much as they can from the central bank in its open market

operation, and then lend the proceeds out short-term so that they can be relent later on at the higher rate. This may depress very short-term rates below the official rate and could add to their volatility as the market's view over the likelihood of a rise in official rates varies.

Other possible causes of volatility include errors by the central bank, or its counterparties, in forecasting the amount of funds the market needs to meet its reserve requirement at the end of the maintenance period; and non-competitive behaviour among participants in the market for central bank funds.

It is unlikely that any of these kinds of volatility matter much for the first objective of money market operations – steering key lending and borrowing rates in line with the monetary authorities' monetary stance. This view is supported by econometric studies that have examined UK overnight rate volatility transmission along the yield curve. For example, Ayuso, Haldane and Restoy (1994) employed ARCH techniques to assess the extent of any volatility spillover to one-month, three-month and one-year rates, using daily data for the period 1988 to 1993.[2] They found statistically significant volatility transmission effects only at the three-month maturity, but the extent of the spillover was quantitatively small.

However, short-term volatility may matter for other reasons:

- Some users of the market may be relatively uninformed about the speculative behaviour underlying short-term rate moves. For these participants, uncertainty in the overnight funds market may disrupt their liquidity management, or at least force them to pay for insurance against unexpected movements, and make it harder for them to interpret market expectations on the future course of official rates.
- Average volatility arising from forecast errors could have costs for all participants in the market and may, in certain circumstances, be reduced by lengthening the maintenance period over which average reserves have to meet the required level (see the later discussion of Monetary Union).
- Volatility may be a symptom of the accumulation of market power by certain market participants.

Accurate measurement of overnight volatility is difficult because the picture can vary a lot according to the time of day that rates are measured – a system with low volatility in business hours may have much higher volatility out of hours. Chart 2 shows volatility in UK overnight rates (adjusted for changes in official rates) over the past ten years. In this case the overnight rate is measured at 8.30 a.m. each morning. Charts 3 and 4 show alternative representations of the same raw data – a monthly average of the absolute difference between overnight rates and official rates, and a 250-day rolling standard deviation for policy adjusted overnight rates. Lastly, Chart 5 shows the daily highs and lows in the overnight rate over the same period.

One way of gauging the potential costs of this volatility is suggested by Lippman and McCall (1986), who argue that the volatility of interest rates at a particular maturity is inversely related to the liquidity of financial instruments of that maturity. One way of measuring the liquidity of overnight instruments is to calculate the spread between overnight LIBOR and LIBID; expressing this as a percentage of LIBID gives the "mark-up", which may provide a more useful metric for making comparisons of market liquidity over time.[3] Chart 4 also shows the mark up on overnight interbank rates over the past ten years and suggests some degree of correlation between this and the rolling standard deviation measure of volatility. More generally, the clear picture is that overnight volatility in the United Kingdom has varied considerably over-time, but has been falling since 1994 and is now

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2 Replicating this approach using daily data for the period 1988 to 1996 did not materially affect the results of this study.

3 This is because, unlike the spread, the mark-up is invariant to the level of overnight rates.

at its lowest point over the past six years. Developments in the structure of the market for central bank funds may explain to a large degree the rise and fall in overnight volatility in the United Kingdom.

Chart 2
Overnight LIBOR less base rate

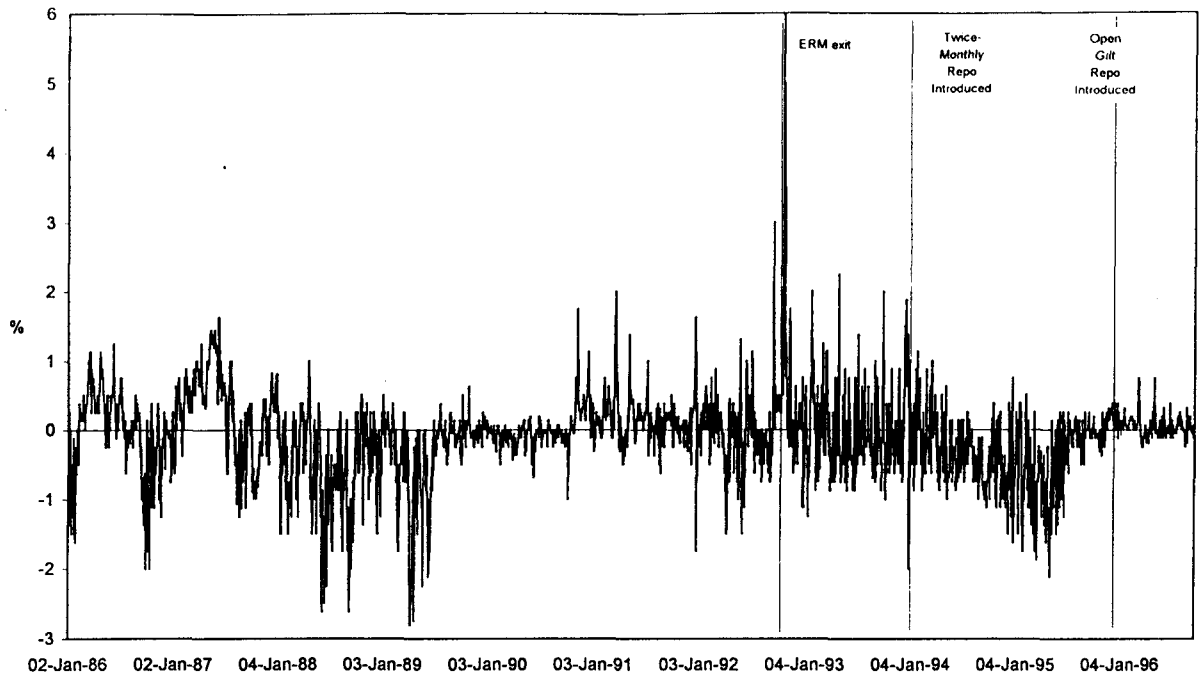


Chart 3
Monthly mean absolute difference: overnight LIBOR less base rate

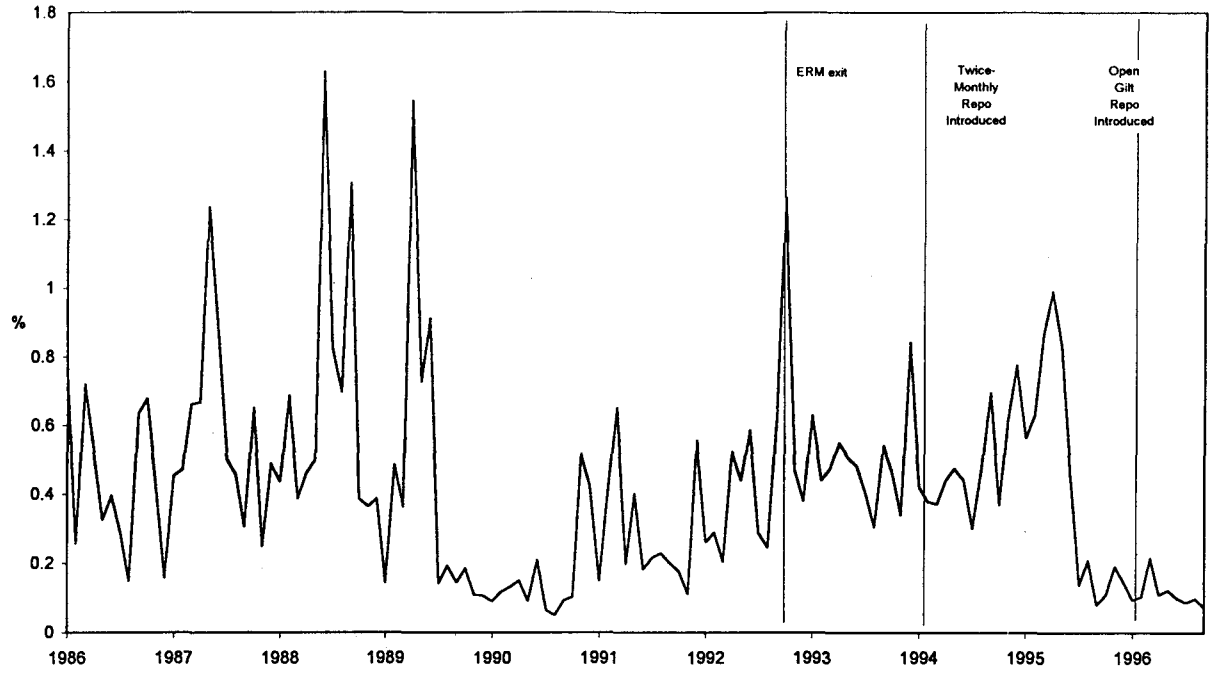
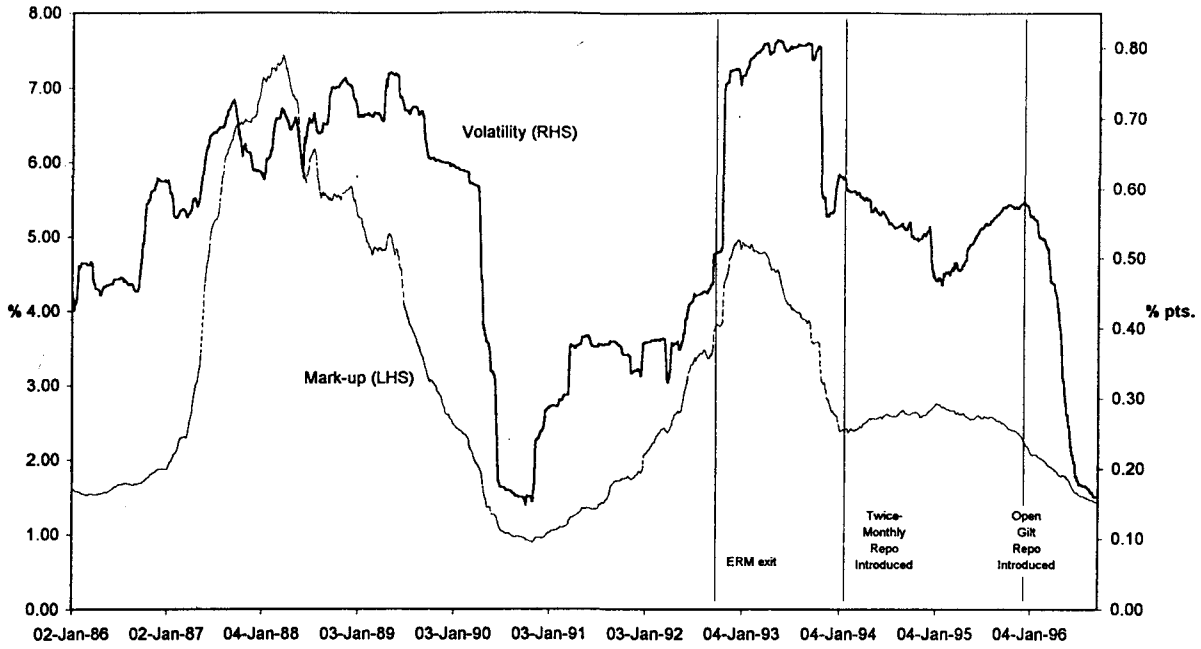
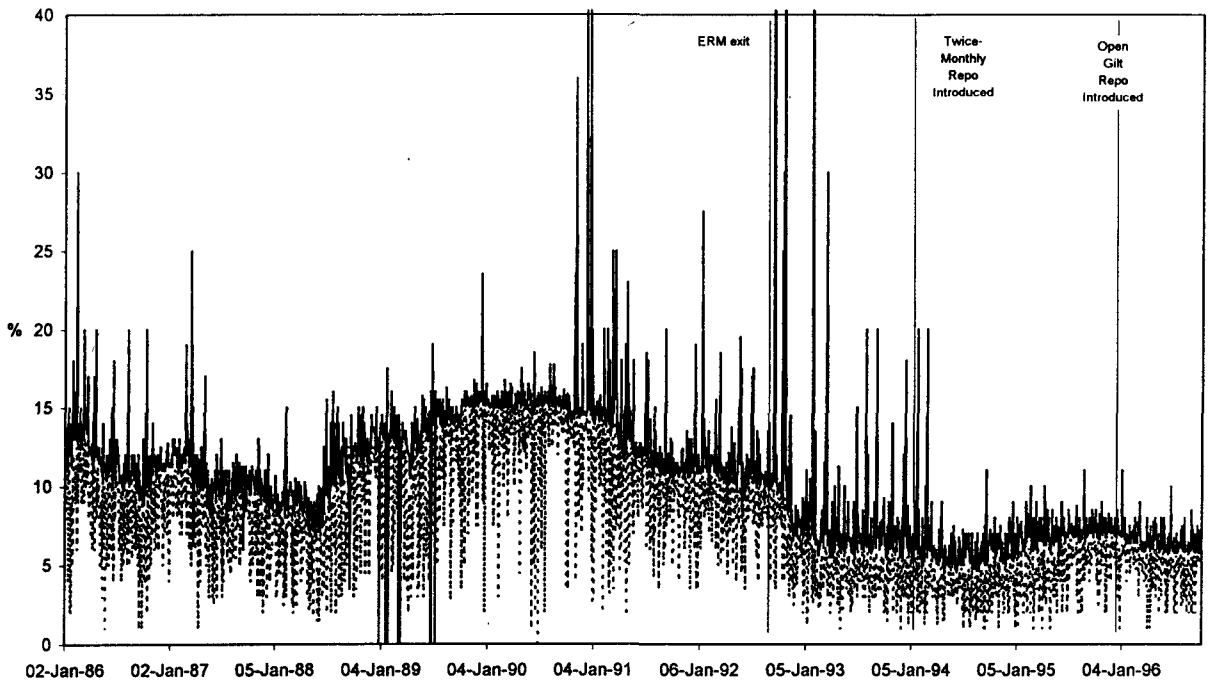


Chart 4
Policy-adjusted overnight LIBOR volatility and mark-up



Note: Volatility is defined as the standard deviation, computed using daily data, over rolling 250-day periods; mark-up is defined as the spread expressed as a percentage of LIBID, computed as a rolling 250-day average.

Chart 5
Overnight LIBOR: daily highs and lows



3.2 Strains in the bill market

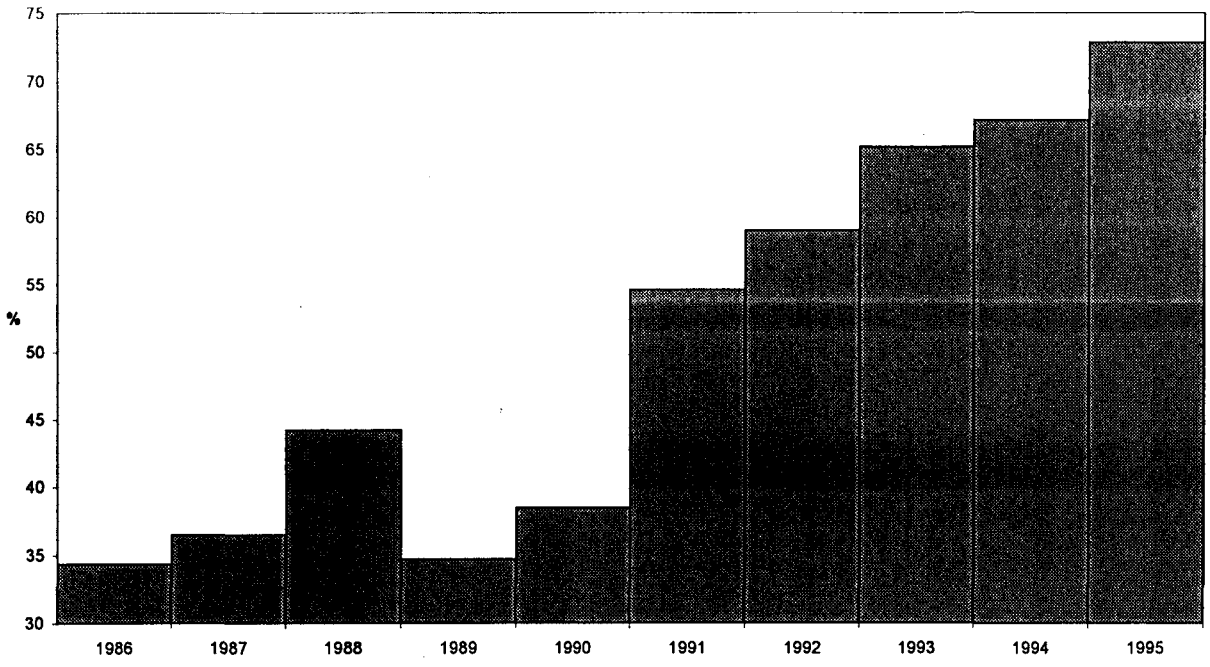
The Bank has traditionally conducted its money market operations in bills – public sector bills (largely Treasury bills) and "bank bills" (private sector obligations which are accepted by a bank and meet certain other requirements). It has also traditionally dealt with the discount houses – specialist money market banks which make markets in bills and offer secured deposit facilities to the rest of the banking system. The traditional arrangements (as revised in the 1980s) were designed to allow cash surpluses and deficits among the banks to be equilibrated in the money markets – including the bill markets and the market in secured deposits – while allowing the Bank of England to provide the liquidity needed by the system as a whole by buying bills (outright or on repo) from the discount houses. Since settlement banks have to keep their accounts at the Bank in credit each day (and there are no reserve requirements with averaging provisions) the Bank offers to provide its estimate of the system's need each day.

A number of structural developments have put these arrangements under strain in recent years. First, the bill markets have not grown in line with the balance sheet of the banking sector. The government has not relied on Treasury bills as permanent finance, and the share of commercial bill finance in bank lending has been in secular decline. Moreover the discount houses have also not grown in line with the banking system in general – until the beginning of 1996 when the introduction of a gilt repo market (see below) brought mergers with other institutions and new business opportunities.

Perhaps more important, the traditional arrangements relied on the banks holding a proportion of their liquidity as secured deposits with the houses, but this requirement was removed in 1986, and some of the large banks have since then taken the opportunity to manage their liquidity by holding larger amounts of bills on their own balance sheets, and holding correspondingly fewer secured deposits with the discount houses. Chart 6 shows how the big four clearing banks' share of bills has increased rapidly since 1990. Although the Bank still deals with the discount houses in its

Chart 6

"Big 4" clearing banks' bill holdings as a percentage of total non-official holdings



Note: "Big 4" clearing banks are: Barclays, NatWest, Lloyds TSB and Midland; end-year figures.
Sources: BBA Annual Abstract of Statistics (1996) and Bank of England Monetary Statistics.

daily operations, the houses have had to rely much more on obtaining bills from the large banks to "put through" to the Bank of England, to the point where some have been willing to do this at no charge to the banks.

Assets eligible for use in the Bank's operations can from time to time be concentrated in relatively few hands. This gives a degree of market power to those institutions which do hold paper eligible for use in the operations. Some are sufficiently large that overnight rates have been significantly affected by their decision to take part or not to take part in the daily operations.

The extent of these strains depends on the circumstances. At times, if the amount of central bank refinancing of the banking system was large (see Bank of England, 1995a), then the Bank could find itself owning a significant part of all the bills that were in the market, and mobilising remaining bills through operations could become more problematic.

3.3 The Bank's response – the fortnightly repo[4]

After the large scale foreign exchange intervention of 1992 this potential problem was very great, and the Bank had recourse to alternative ways of providing finance. It provided finance using a different instrument – repos of government bonds (gilts) rather than bill transactions – and with a wider set of counterparties – not just the discount houses but also large banks and building societies and its counterparties in the gilt-edged market (gilt-edged market makers).

At first this supplementary finance was provided on an ad hoc basis, but since early 1994 has been regularised in twice-monthly repo operations (known as *rough tuning* operations) available to all banks and building societies and to the gilt-edged market makers. This extra facility has operated as a useful safety valve, with take-up tending to grow when the scale of refinancing would otherwise have put strain on the bill market. Charts 2 to 5 confirm that overnight volatility has been significantly reduced since the introduction of the fortnightly repo, although a precise link can only be made under some of the measures.

4. Open gilt repo market

At the time the twice-monthly repo facility was introduced there was no private repo market in gilts. But since 2nd January 1996 trading in gilt repo has been fully liberalised.[5]

While gilt repo was introduced to help promote the liquidity and efficiency of the gilt market, it also has implications for the sterling money markets. Most obviously, it provides another way of trading secured money, which has the potential to expand given the large size of the gilt market, and the wide dispersal of holdings.

The new market has expanded progressively. By the end of August, there were thought to be around 100 firms participating in the market, drawn from a wide range and including clearing banks, discount houses, major European banks, international securities houses, Gilt Edged Market Makers, long-term institutions, and some building societies. From data reported by around 70 of the main participants, we estimate that by end-August the repo market had reached at least £60 billion outstanding. The data suggest that the average turnover of the gilt repo market is about £15 billion per day. Activity is considerable out to three months and goes out to a year. It is possible to trade in size up to £400 million at 3 months, and up to £200 million further out.

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4 See Bank of England, 1994a and 1994b.

5 See Bank of England, 1995b, 1995c, 1995d, 1996a.

It is possible that the development of the gilt repo market may have also contributed to the reduction in overnight volatility – see Chart 4. This could be because institutions without large holdings of bills are finding it easier to redistribute surplus liquidity among themselves, particularly early in the day when bond inventories are typically financed. It may also be that smaller commercial banks are less constrained by their relative credit standing – so that they can deal in larger amounts and may be less concerned to tie up their daily requirement for funds early in the day; gilt repo puts them on a more equal footing with other, larger, counterparties.

With the opening of the gilt repo market it was envisaged that at some stage this instrument might be incorporated in money market dealing operations once the market was sufficiently well developed (see Plenderleith, 1996). That point may now be approaching. A number of potential advantages are already clear:

- there are £250 billion of gilts outstanding (compared to around £20 billion of commercial bank bills and around £10 billion of Treasury bills) so operations in gilt repo are much less likely to be constrained by a shortage of the underlying key instrument;
- the breadth of participation in the market to date, combined with the broad spread of holdings of gilts, suggests that a wide range of financial institutions would be able to participate in open market operations in gilt repo;
- repo would allow the Bank to use open market operations to set an official short-term interest rate at a maturity of its choice each day. With the current system relying largely on outright purchases of bills, it offers to buy bills over a range of maturities (typically up to one month), because there are insufficient bills of each maturity to restrict operations to a single maturity.

The Bank has already added to the list of instruments it will accept in its daily operations by offering to repo the government's *floating rate* gilts[6] alongside repos of bills.

5. Real-time gross settlement

The system of daily money market operations of necessity requires same-day payment and settlement arrangements. These are provided, for bills, by the Bank's Central Money Markets Office (CMO) and, for gilts, by the Bank's Central Gilts Office (CGO). At present, the payment arrangements for CMO and CGO are based on end-of-day settlement, but since April 1996, the main wholesale payments system in the United Kingdom (CHAPS) has operated on the basis of real-time gross settlement (RTGS) and we are currently studying how, in due course, to settle obligations between settlement banks in CMO and CGO in real time on a gross basis.

The move to RTGS has meant that banks now require explicit intra-day liquidity; they can no longer wait for payments to be netted off at the end of the day. One way for banks to deal with the scale and asynchronicity of their payment flows would be to hold settlement balances sufficient to cover their largest cash outflows. In practice, however, banks prefer to finance at least part of their outflows by borrowing intra-day funds. The Bank has decided to meet this additional demand for intra-day liquidity by providing fully-collateralised intra-day loans at zero cost. This ensures that the Bank is fully protected against credit risk on its intra-day lending while minimising the cost to the economy of the move to RTGS.

This development has not had any effect on the way official interest rates are set for maturities of one day or longer because the Bank insists that all intra-business day loans must be

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6 Floating rate gilts have their coupon refixed every three months, and thus behave very much like money market instruments.

repaid before the end of the business day. This makes it impossible for a bank to substitute a combination of free, or nearly free, intra-day loans for a one-day loan. If a bank wishes to borrow for a maturity that extends overnight, it has no option but to borrow for one day (or longer) at the market rate consistent with the Bank's official interest rate, or incur an unauthorised overdraft and the associated penalty interest rate.

Theoretical analysis suggests that a parallel interbank market for intra-day funds (or eligible collateral) could still emerge, given that the official facility is not open 24 hours a day and if, for example, banks were to find that there was an opportunity cost in obtaining intra-day funds from the central bank because of a shortage of the right kind of collateral. And this in turn could lead to the extension of the yield curve back beyond its current shortest maturity of one day (see Dale and Rossi, 1996). However, even in this event, the central bank's ability to control short-term interest rates should not be affected provided it maintains a rigorous segmentation between its intra-day and overnight lending, with the latter carrying the same cost regardless of how many hours the loan is actually outstanding.

6. European Monetary Union

Although many EU countries have reduced the level of reserve requirements in recent years – in part reflecting our own concern over the tax that this imposes on financial intermediation – the United Kingdom is still relatively rare in having a system with (almost) zero reserve requirements. Another important distinction in our system is the use of a daily maintenance period – i.e. there is no averaging.

In discussions on the most appropriate system for implementing monetary policy in a monetary union, it has sometimes been argued that averaging and positive reserve requirements are closely linked, essentially because a buffer stock of reserves is needed to absorb daily reserve shocks, thus reducing short-term interest rate volatility. But as we see it, this interest-rate smoothing function could also, in principle, be achieved with a buffer stock of reserves provided to banks through fully-collateralised overdrafts from the central bank. So smoothing can be separated from the size of positive reserve requirements, and would indeed be provided through averaging around a zero reserve requirement. And this would avoid the potentially distorting impact of a positive reserve requirement.

To investigate the possible implications of such an arrangement further, we have constructed a theoretical model (see Davies, 1996). In this, banks have a zero reserve requirement which they are expected to try and meet over a maintenance period which may be one day or longer. The central bank is assumed to use daily open market operations to meet the demand for funds that arises as a result of persistent money-market shortages. In conducting its operations, the central bank forecasts demand for reserves at the start of each day. On any given day, banks are subjected to reserve shocks; and these cause the central bank to make errors in its forecast since it will not observe the (net daily) shock until settlement at the end of the day. Banks have automatic access to fully collateralised overnight overdrafts at the central bank at any time within the maintenance period (except the last day). The model assumes that the central bank adjusts its target for the interest rate only at the start of the maintenance period. (This has the effect of avoiding any speculation about changes in the official rate within the maintenance period.)

Overall, the conclusion of the model is that such a system could stabilise money-market interest rates and that positive reserve requirements are not needed to confer the supposed benefits of averaging. There are three key results.

The first relates to the level of the penalty for being overdrawn at the end of the maintenance period. According to the model, the central bank should set the penalty for missing the reserve requirement at twice the market rate of interest on the last day of the maintenance period. By

doing so, the central bank will induce the banks to try to meet precisely the zero reserve requirement.[7] And the central bank should not charge for intra-period overdrafts – the whole of the penalty should be levied at the end of the maintenance period. Intuitively, the relevant consideration for a bank in deciding on a target level of reserves is the cost it still has to pay if it does not meet the reserve requirement, rather than the costs it has already paid. Only if overdrafts are free will the cost of missing the zero cumulative reserve requirement be twice the market rate of interest both before and after any shocks.

The second result relates to the effectiveness of zero averaging. On all but the last day of the maintenance period, the central bank, in response to daily reserve shocks, is able to adjust its supply of reserves (with a lag) to the quantity demanded in order to maintain the short-term interest rate at the target level. The banks know this and therefore do not need to respond immediately to reserve shocks. For example, assume that a bank faces a negative reserve shock on the first day of the maintenance period; this will raise the amount that the bank needs to borrow in order to meet the zero reserve requirement. But if overdrafts are free (including no shadow cost from collateralisation), the bank only needs to be concerned with the possibility of missing the requirement for the period as a whole, and with the cost of borrowing the necessary funds to avoid this happening. If it borrows more immediately, this would drive the interest rate higher. But by postponing this borrowing until later in the maintenance period, the bank will be able to borrow at the central bank's target rate. As a result, over the maintenance period, interest rates are smoothed – errors in the central bank's forecast have no effect on the market rate (except on the final day).

The third result relates to the frequency and timing of the central bank's open market operations. The benefits of averaging can still be obtained if the central bank operates frequently, say daily (although it should not have to do so). Money-market interest rates will become volatile after the central bank has completed its last operation of the maintenance period since there will be scope for the last reserve shock to move market rates away from the target level. The central bank can minimise this volatility, however, by operating as late in the maintenance period as possible.

The simplicity of the underlying model means that these results cannot be translated directly to a real world environment, but they do provide a useful illustration of the processes at work. There are a number of ways in which the model might be extended. For example, to try and take account of the possible moral hazard concern when banks go overdrawn at the central bank (albeit on a collateralised basis), or to consider the potential trade-off between lengthening the maintenance period to reduce average volatility in overnight rates, and shortening it to give the authorities the maximum scope to change interest rates in response to news in a timely fashion. It may also be worth considering how to construct an optimal regime for allowing banks to carry forward reserve surpluses or deficiencies. A key feature of the model is that the central bank's counterparties are characterised as a single representative agent. Hence it abstracts from the accumulation of market power by individual banks. A further extension would be to relax this assumption.

7. Other research

Below we comment on two further research questions on the form of money market operations. These are also considered in the context of a one-day maintenance period with zero reserve requirements.

7.1 Maturity of official interest rates

Does the choice of maturity for the official interest rate matter? For instance, can it give the central bank more or less influence on the key rates that it wishes to influence?

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[7] This is a generalisation of the Poole's "two-times" rule, derived for a one-day maintenance period.

Intuitively, rates set by the banking system – whether longer-term market rates, such as the three-month interbank rate, or "sticky" administered rates such as base rate or the mortgage rate – will depend in the main on the market's expectations about the future course of the official rate (although other factors, such as competitive conditions in lending markets, may play a role from time to time). Provided official rates change relatively infrequently, the market will assume that when the rate changes the new level is likely to be held for some time and will set market and administered rates accordingly. In this world the choice between setting a very short official rate – such as the overnight rate – and a slightly longer-term rate – such as over a fortnight – ought to have few if any implications for the degree of influence that the authorities can exert on longer-term rates.

To check this intuition we constructed a simulation model examining the volatility in market rates at maturities ranging from overnight to three months that would arise under different assumptions about the maturity of a central bank's daily operations (see Davies and Maude, 1996). We assumed a simple policy rule to determine the central bank's response to random inflationary shocks and assumed that the market knew this with certainty. This enabled us to model the market's expected path for short rates at any point in time (abstracting from time varying risk premia). The model was then calibrated to accord with certain stylised facts about how the United Kingdom has historically managed its official rate (including the frequency of changes, the number of turning points etc.) and simulated a hundred times for each maturity of the official rate. The results confirmed that a central bank behaving broadly as the UK authorities have done in the past should be able to steer 2- and 3-month interest rates under all three of the assumed operating maturities. However, operating at a very short term rate (at the limit the overnight rate) tended to minimise volatility in very short-term rates.

There are clearly a number of caveats with such a simple model – including the assumptions about the process by which expectations are formed, the absence of time varying risk premia, and the assumption of a representative agent for the central bank's counterparty (ruling out the exercise of market power). However, the results do suggest that operating at very short-term rates does not reduce the central bank's ability to steer longer term rates consistent with monetary policy.

7.2 Penalties for unauthorised overdrafts

Central banks may wish to minimise the extent to which banks behaving optimally go into unauthorised overdraft at the end of the maintenance period because, for example, it would then be clear if a bank was not managing its liquidity properly. Is it possible to design a formula for penalising unauthorised overdrafts at the end of the maintenance period which achieves the desired outcome while relying entirely on financial means as opposed to non-financial means, such as moral suasion from the central bank?

The Poole (1968) "two-times rule" – in which the penalty rate is set at two times the market rate (equivalent to the rate in the central bank's open market operations) – gives participants the incentive *to target* a zero balance at the end of the maintenance period, but it does not guarantee that banks will meet that target – even in a world with no speculation. In a system with zero reserve requirements, and assuming symmetric shocks, this means that banks would be overdrawn on average half the time. Indeed, for an economy with a pattern of shocks like that of the United Kingdom, the penalty for unauthorised overdrafts would need to be of the order of twenty times the market rate of interest in order to ensure that banks only went overdrawn 5% of the time. Interestingly few, if any, central banks charge such steep penalties as a matter of course; indeed they prefer to rely on additional non-financial penalties. This may reflect past convention and what is perceived as acceptable by the banks.

8. Information flows

8.1 The information provided by the Bank of England

Market efficiency should in principle be served by publishing as much relevant material as possible on liquidity conditions and central bank operations. This levels the playing field between large and small participants in the market. It may also improve the quality of information, on liquidity conditions held by the market (although there is a potential incentive problem insofar as the information provided by the central bank may reduce the incentive for private banks to look for information, some of which the central bank may not have). What is relevant will vary from one system to another. In the United Kingdom the fact that banks must meet a daily balancing requirement means that the Bank publishes a lot of information on both liquidity conditions and its own operations:

- it announces all invitations to bid in open market operations – both for daily operations and for the twice-monthly gilt repo facility – through the wire services; it also publishes the amount of assistance provided on the wire services shortly after the allotment details have been calculated, and before the details of the allotment are communicated to individual counterparties;
- at around 9.45 a.m. the Bank publishes its forecast of the day's shortage and updates are published subsequently if the position deviates materially from this. It also publishes a brief summary of the main components of the daily shortage (government transactions, the maturing of previous official operations, variations in the note issue, etc.).

8.2 New sources of information

Market expectations of interest rate moves are an important ingredient in formulating monetary policy. This is partly because they provide a check against our own analysis of economic and monetary policy developments, and partly because they yield information on the credibility of any particular monetary regime. Separating out these elements may not be at all easy. The extent to which any individual central bank can extract expectational information depends on the availability of particular instruments and the depth of the markets in them.

In the United Kingdom, we have traditionally monitored a range of interest rate (price) and quantity variables for information on market expectations, as well as talking to the market directly to gauge their views. In recent years the development of the short sterling future (SSF), a future on the three month interbank rate, has added an easily read source of information on changes in the market's expectations of short-term interest rates at, currently, twelve future dates.[8]

However, at times the levels of rates signalled by the SSF have seemed implausible, and so there is generally some caution in using it as an indicator of the expected level of short-term interest rates. Possible reasons for this include the presence of liquidity premia – particularly for contracts further out – and changes in the credit risk of the underlying interbank rate. But it may also reflect the fact that the future tells us the *mean* of the market's distribution, which might be some way from the most likely (*mode*) outcome (see below).

There are also limits in the extent to which one can use the SSF to discern market expectations about near-term policy moves. This is because the clearing bank base rate is in principle an overnight rate in the sense that banks have the right to change it whenever they wish. And so a

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[8] The long gilt future has to some extent performed a similar role for near-term expectations of changes in long-term rates. However, it is more commonly used as a proxy for changes in long rates themselves.

future three-month interbank rate taken from the SSF will reflect the *average* base rate over that future three-month period. If official rates are expected to rise, a given expected interbank rate may be consistent with a lower expected base rate for the same date. Differences may also arise due to the fact that the interbank rate is a market rate which is actually charged by banks to borrowing banks, while the base rate is a reference rate for bank lending to corporate borrowers who typically pay a margin on top. The difference between the two rates will therefore be affected by changes in the credit quality of banks versus corporates, and by the degree of competition in the corporate loan market.

Recently the Bank of England – and other central banks – have developed a technique for estimating the market's complete *risk neutral probability density* (RND) function for an asset price on a particular date in the future[9] (see Bahra, 1996, and Bank of England, 1996b). This information is derived from the prices of options on short interest rate futures. Imagine an option that gives the holder the right to buy an interest rate future at a particular price – the exercise price – on a particular date in the future. Now imagine an option with a slightly higher exercise price. The difference in the price of these two options reflects the value attached to the ability to exercise the options when the price of the underlying future lies between the two exercise prices. That in turn will depend on the probability of the underlying futures price lying in the interval.

Charts 7 and 8 provide recent examples of RND functions for UK and German short-term rates in December 1996 and March 1997. Charts 9 and 10 show how certain key summary statistics – mean, mode, upper and lower quartile – for the December sterling and Deutsche mark RND functions have changed over time. And Charts 11 and 12 shows how these statistics vary looking into the future (over the currently traded range of contracts). Several features stand out. First, the standard deviation of interest rate expectations in Germany is less than that of interest rate expectations in the United Kingdom, and, as one would expect, the standard deviation for both distributions declines as the terminal date for the contract is approached. Also the distributions tend to be positively skewed, and the extent of the skewness increases the further into the future you look. This may in part reflect the range of possible outcomes in each country – for example uncertainty about the outcome of the UK general election which must be held by Spring 1997 – but it could also reflect a natural skewness arising from there being a non-negative constraint on nominal interest rates.

As an operational tool, RND functions may give authorities more information on how the market is likely to react to a change in official rates. 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 *not* change (as evidenced by a narrow and symmetric RND function) from when the mean of the probability distribution is the same, but the market already attaches non-trivial probabilities to sharply higher rates. Equally, RND functions may help in ex post analysis of the market's reaction to particular policy actions.

In both cases, the key issue is how much *incremental* information is provided by the RND functions vis-a-vis the mean of the distribution which is already visible from short-interest rate futures, and how reliable this is (taking account of variable liquidity in options contracts). Chart 13 provides a recent example of value added in the United Kingdom where, over a period of a week in September 1996, the mean of the distribution for short-term sterling interest rates in March 1997 changed little, but the probability of rates being below the present level in March 1997 fell substantially from 28 to 20%. Much of the change occurred on a day on which a monthly Monetary Meeting produced no change in official rates.

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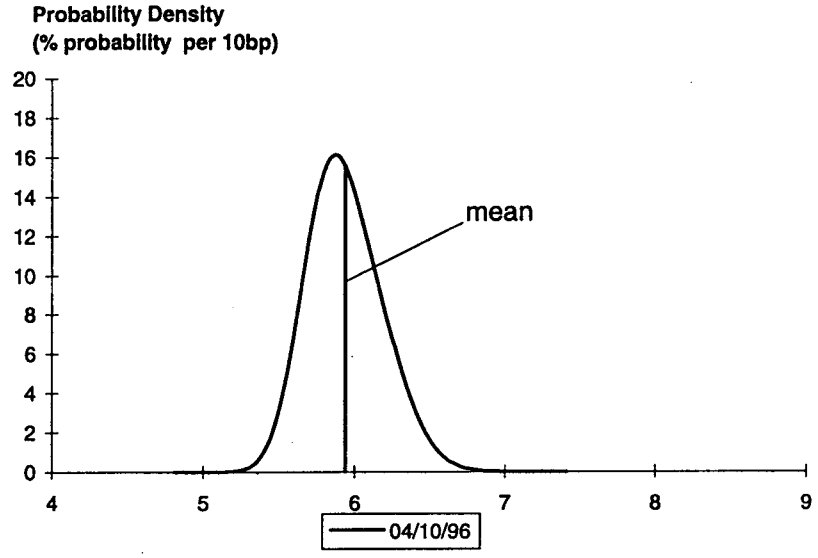
[9] The density function derived is for a risk neutral representative investor; so if market participants are risk averse the estimated distributions may differ from "true" market distributions.

Chart 7

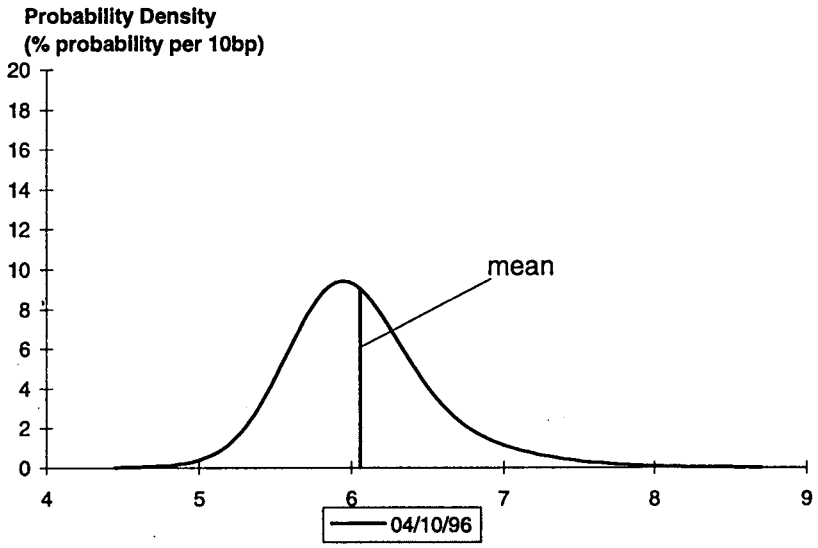
Implied probability densities for 3-month sterling interbank interest rates at futures dates, as at 4th October 1996

18 December 1996



	04/10/96
Mean	5.94
Mode	5.87
Mean - Mode	0.07
Standard Deviation	0.25
Interquartile Range	0.34
Skewness	0.34
Kurtosis	3.01

19 March 1997



	04/10/96
Mean	6.06
Mode	5.94
Mean - Mode	0.12
Standard Deviation	0.50
Interquartile Range	0.59
Skewness	0.80
Kurtosis	4.66

Notes: [1] Distributions are derived from option prices on the short sterling future. To the extent that agents are risk averse, their "true" probability distributions may differ in some degree from those shown.

[2] To avoid the problems associated with non-synchronised data, LIFFE settlement prices are used.

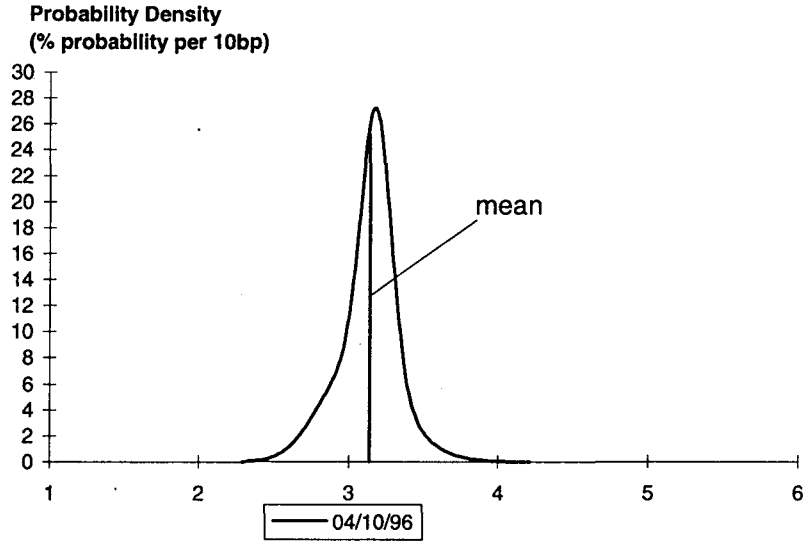
[3] The "mean" is the expected value of the distribution; this is equivalent to the value of the underlying interest rate future. The "mode" is the most likely outcome.

[4] The "probability density" indicates the likelihood of particular events occurring. Thus the probability density associated with interest rate x is approximately equal to the probability of the outcome lying in a corridor 5 basis points either side of x. Moreover, the probability of the rate lying between x% and y% at the terminal date is given by the area under the probability density curve between those two points. The area under the whole curve is always 100%.

Chart 8

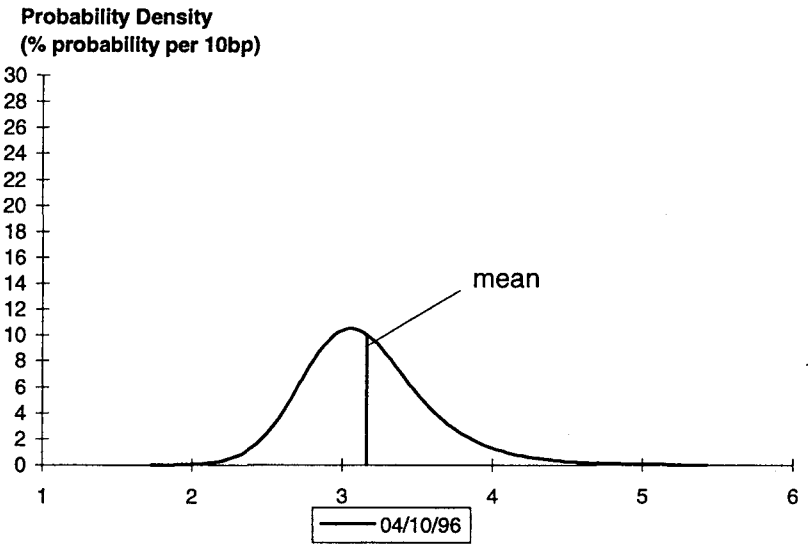
Implied probability densities for 3-month Deutsche mark interbank interest rates at futures dates, as at 4th October 1996

16 December 1996



	04/10/96
Mean	3.14
Mode	3.17
Mean - Mode	-0.04
Standard Deviation	0.20
Interquartile Range	0.21
Skewness	-0.23
Kurtosis	4.39

17 March 1997



	04/10/96
Mean	3.16
Mode	3.05
Mean - Mode	0.11
Standard Deviation	0.43
Interquartile Range	0.53
Skewness	0.71
Kurtosis	4.25

Notes:Distributions are derived from option prices on the short euromark future. For further explanation, see the notes to Chart 7.

Chart 9

Implied probability distribution summary statistics for the 3-month sterling interest rate in December 1996

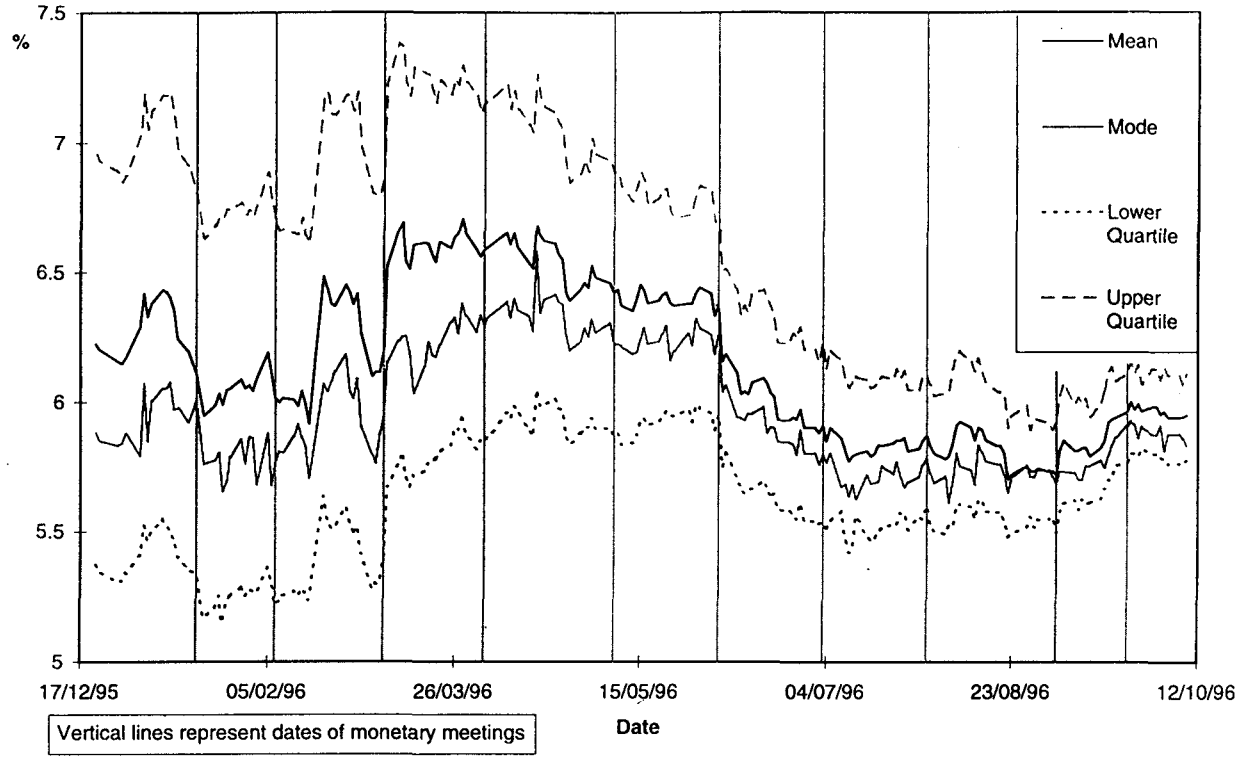


Chart 10

Implied probability distribution summary statistics for the 3-month Deutsche mark interest rate in December 1996

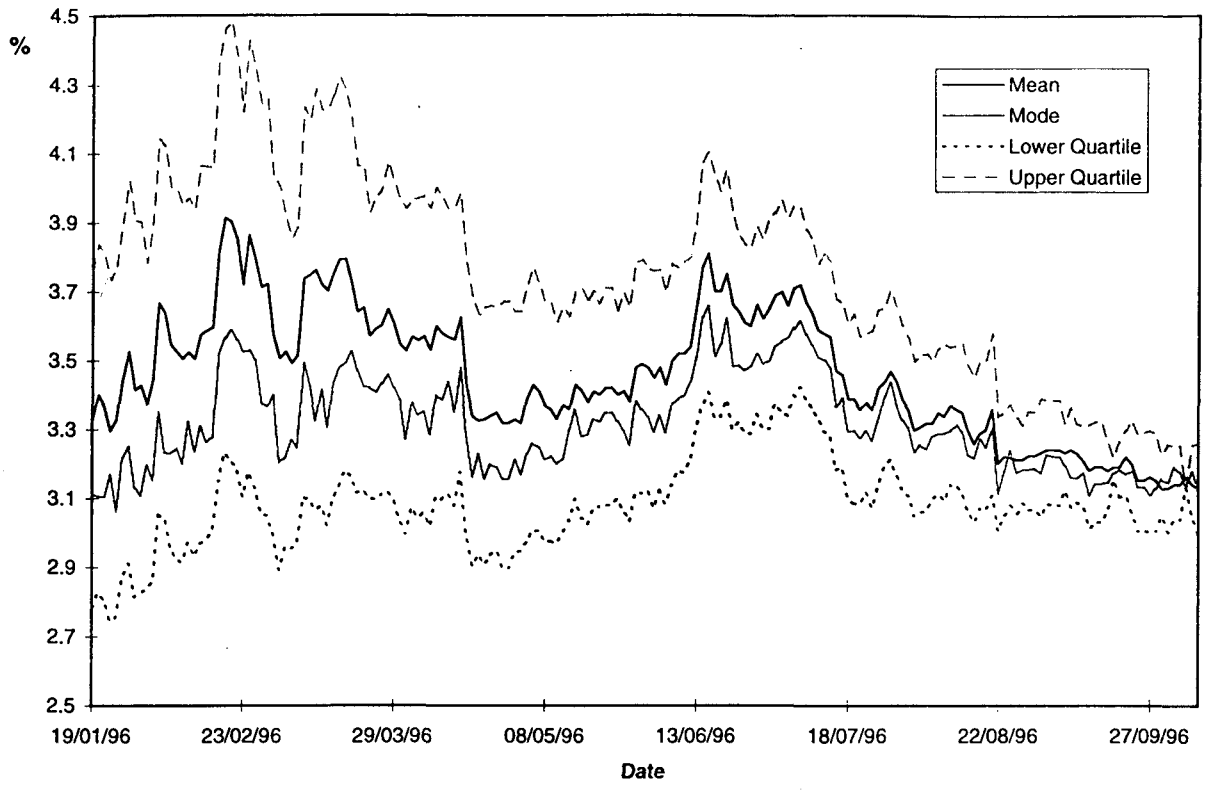


Chart 11

Three-month sterling interest rate as at 4th October 1996 and implied probability distribution summary statistics for future dates

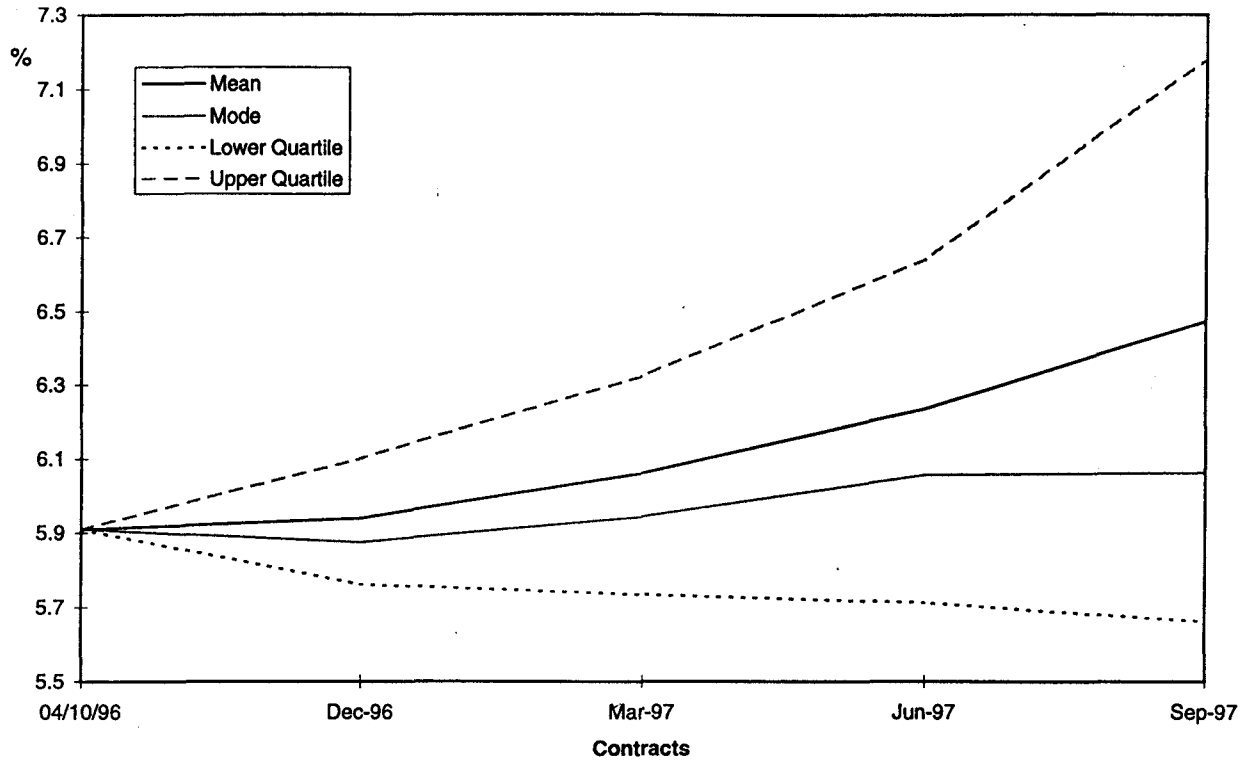


Chart 12

Three-month Deutsche mark interest rate as at 4th October 1996 and implied probability distribution summary statistics for future dates

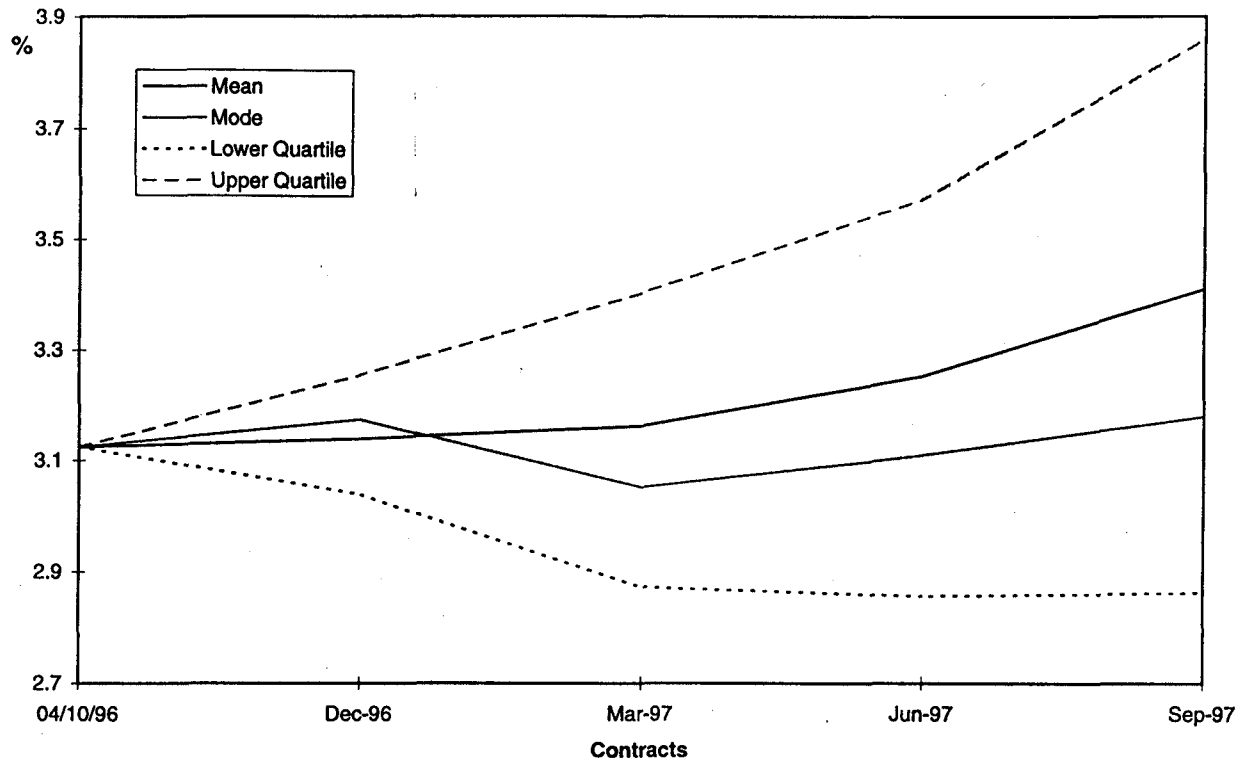
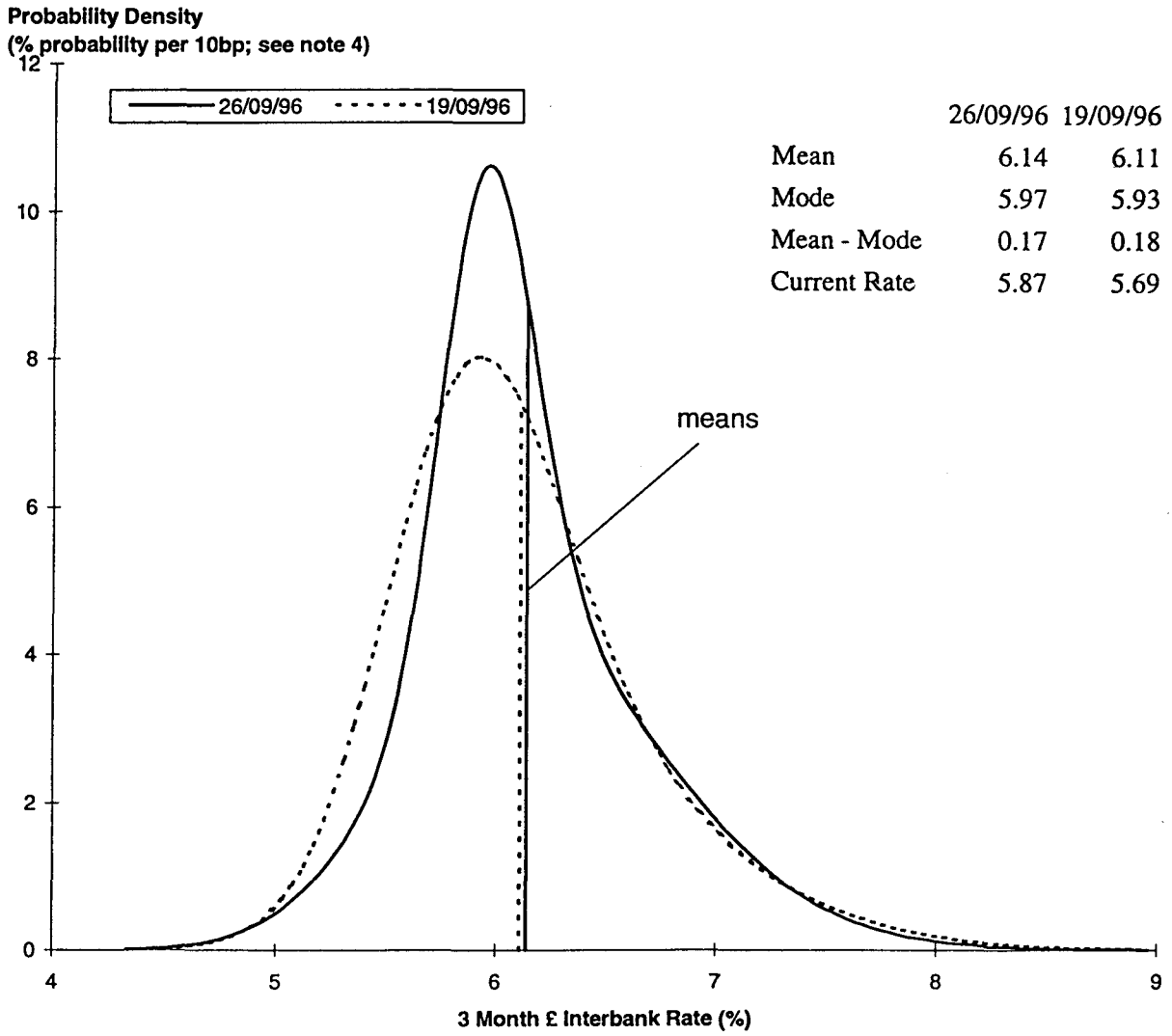


Chart 13

Sterling interest rate distribution for 19th March 1997 as at 19th and 26th September 1996



	26/09/96	19/09/96
Mean	6.14	6.11
Mode	5.97	5.93
Mean - Mode	0.17	0.18
Current Rate	5.87	5.69

We are currently investigating the value added in, and reliability of, RND functions. One approach is to consider the *change* in probability of the three-month interbank rate being at or below the current level as a result of a particular event. Table 3 shows this change for the nearest and next but one contract dates for each of the past 46 monetary meetings (comparing the distribution at close of business on the day before the meeting with that at close of business on the day after the meeting). It illustrates how, on a number of occasions, there appears to be more "news" in the outcome of monetary meetings – including those where there is no change in official rates – when measured by this probability measure, than when measured by the accompanying change in the futures rate (equivalent to the mean value of the RND function). Estimated RND functions appear to be sensitive to the choice of optimisation routine, particularly for contracts close to expiry. So, until we have done further work on this and developed a confidence band for the derived distributions, this evidence of value added should be seen as tentative.

Table 3

Value added in implied probability distributions for three-month sterling interest rates

Meeting date	Nearest contract		Next nearest contract		Base rate
	Change in prob.* (%)	Change in mean (b.p.)	Change in prob.* (%)	Change in mean (b.p.)	Change (p.p.)
10/12/1992	3.12	2.00	-13.92	0.04	
13/01/1993	1.94	-17.65	5.09	-11.52	-1.00
03/02/1993	1.00	0.00	-0.10	-4.06	
03/03/1993	2.37	4.46	-16.83	-2.92	
07/04/1993	2.27	-4.97	11.24	-4.45	
06/05/1993	6.50	-10.14	19.40	-12.20	
09/06/1993	-5.98	1.07	-17.80	7.91	
27/07/1993	6.92	-20.85	16.41	-18.75	
08/09/1993	-4.25	4.02	10.90	10.07	
12/10/1993	8.07	-10.02	3.99	-14.01	
03/11/1993	2.32	-5.00	2.59	-6.86	-0.50
08/12/1993	0.73	-1.12	2.77	-3.03	
06/01/1994	6.35	-4.01	3.48	-6.99	
03/02/1994	-1.97	2.83	-5.15	5.96	-0.25
02/03/1994	0.62	-2.94	7.58	0.12	
30/03/1994	4.33	3.13	1.21	1.84	
04/05/1994	1.25	-0.18	-1.30	-1.03	
08/06/1994	0.63	-4.96	10.04	-0.99	
06/07/1994	-3.14	5.02	1.15	10.10	
28/07/1994	-0.90	45.92	-3.90	39.95	
07/09/1994	0.50	-14.08	1.80	-27.98	
26/09/1994	-0.12	0.00	-0.23	2.05	0.50
02/11/1994	0.12	-6.98	-0.13	-7.00	
07/12/1994	0.09	-2.92	-0.21	-9.10	
28/12/1994	-0.68	15.93	0.08	16.07	0.50
02/02/1995	-0.58	-1.90	-0.45	4.93	0.50
08/03/1995	0.30	-3.06	-1.51	-0.02	
05/04/1995	-1.18	-1.99	-1.26	-0.14	
05/05/1995	5.16	-16.19	16.25	-13.05	
07/06/1995	-7.59	0.02	9.13	10.01	
05/07/1995	3.24	-9.84	2.37	-12.60	
25/07/1995	5.26	-3.93	3.37	-10.00	
07/09/1995	2.53	-1.24	35.50	-1.80	
28/09/1995	9.47	-9.98	10.55	-18.57	
01/11/1995	2.13	-1.04	2.77	-1.19	
13/12/1995	4.58	0.93	9.12	-2.94	-0.25
17/01/1996	11.09	-18.99	12.92	-21.95	-0.25
07/02/1996	2.32	1.09	3.61	-4.12	
07/03/1996	-16.74	6.02	-1.76	22.96	-0.25
03/04/1996	-2.54	-0.95	2.53	1.85	
08/05/1996	-4.09	5.95	-12.74	1.86	
05/06/1996	26.20	-15.14	65.21	-20.86	-0.25
03/07/1996	1.21	-0.12	-4.01	-3.19	
31/07/1996	2.75	-2.05	-2.02	-2.00	
04/09/1996	-9.79	7.18	-43.47	7.97	
23/09/1996	1.58	6.04	-5.61	5.23	

* Probability of 3-month LIBOR on the maturity date of the option being less than the base rate prevailing on the day before the respective monetary meeting. (Change computed as the probability on the day after the meeting less the probability on the day before the meeting.)

We are currently investigating the value added in, and reliability of, RND functions. One approach is to consider the *change* in probability of the three-month interbank rate being at or below the current level as a result of a particular event. Table 3 shows this change for the nearest and next but one contract dates for each of the past 46 monetary meetings (comparing the distribution at close of business on the day before the meeting with that at close of business on the day after the meeting). It illustrates how, on a number of occasions, there appears to be more "news" in the outcome of monetary meetings – including those where there is no change in official rates – when measured by this probability measure, than when measured by the accompanying change in the futures rate (equivalent to the mean value of the RND function). Estimated RND functions appear to be sensitive to the choice of optimisation routine, particularly for contracts close to expiry. So, until we have done further work on this and developed a confidence band for the derived distributions, this evidence of value added should be seen as tentative.

Conclusion

This paper has described a number of developments that have already had an impact on UK money market operations over the past few years, and a number of issues that are likely to arise in the future, particularly as we take advantage of the development of the open gilt repo market and new financial instruments. It is clear that any system for setting official interest rates has to be ready to evolve in response to changes in market structure and changes in the framework in which monetary decisions are made.

Addendum

The Bank of England's operations in the sterling money markets: proposals for change

On 4th December 1996, the Bank of England published a consultative paper outlining proposals for changes in its daily money market operations. The key proposals were:

- **Gilt repo.** The Bank would extend its daily open market operations to include operations in gilt repo (repo of UK government bonds) alongside existing operations in Treasury bills and eligible local authority and bank bills;
- **Counterparties.** The Bank would broaden the range of counterparties able to participate in these operations, to include market participants active in the gilt repo and/or bill markets. Up to then, as the main paper explains, the main counterparties had been the specialist discount houses;
- **Late lending.** The Bank would also take the opportunity to simplify the arrangements for providing finance at the end of the trading day to adjust for any remaining imbalance in the market.

After a period of consultation, the Bank proposed to put the changes into effect in the early months of 1997, if possible.

The paper presented to the BIS meeting sets out the strains to which existing arrangements had been subject, and some of the advantages which operating in gilt repo might offer. By December the Bank judged that the new gilt repo market had indeed developed to the point where daily official gilt repo operations should be undertaken. In reaching this judgment the Bank took into account both the size of the market (already larger than the bill markets, and with the potential to grow further, given the stock of the underlying instrument – gilts) and the range of players active in the new market (wider than in the bill market, where the main settlement banks and the discount houses had predominated).

The proposed relationship with participants in the Bank's operations is seen as purely functional. The Bank will be prepared to deal with any supervised banks (including discount houses) building societies and securities firms which meet four functional criteria:

- they must have the technical capacity to respond quickly and efficiently in the Bank's operations;
- they must be active in the gilt repo and/or bill markets, thus contributing to the distribution of liquidity around the system (but there will be no formal market-making obligation);
- they will be expected to participate regularly in the operations;
- they will be expected to provide useful information to the Bank on market conditions and developments.

There will be no published list of those with whom the Bank has agreed to deal, and no need for counterparties to be separately capitalised. Nor will there be any special supervisory regime for counterparties as such. In all these ways the new arrangements will differ from existing arrangements for the discount houses. Until the new arrangements are in place the number of actual counterparties cannot be known. But the Bank intends that the business of being a counterparty should be fully contestable.

Gilt repo is a new form of secured money. By dealing in this market alongside the bill market the Bank intends to smooth the flow of liquidity to the market and the flow of eligible paper to the Bank. The wider availability of eligible paper and the wider range of counterparties make is less likely that operations will be dominated by a small number of institutions.

The Bank expects that its repo rate will become the "headline" UK official interest rate. Whenever it undertakes fixed rate repos, the Bank will state the rate in advance. (No rate is currently set in advance on days when the Bank is undertaking only outright operations.)

Some aspects of the Bank's operations will not change. There will be no reserve requirements (apart from the small Cash Ratio Deposits) and no averaging. The Bank will thus need to operate in the markets on most days. The average maturity of its current operations is about two weeks; in future it will generally offer three repos each day, at a maturity of two weeks and one working day shorter and longer than two weeks. In future, as now, only the settlement banks have a daily maintenance requirement at the central bank. In future only the settlement banks will have access to central bank funds late in the day to deal with unexpected liquidity developments (although there will be transitional arrangements available to the discount houses).

The Bank believes the proposed changes are consistent with the direction and spirit of the plans being drawn up in the EMI for monetary operations in euro. The emphasis on the use of repo in open market operations is clearly congruent with EMI plans. And the criteria proposed for participants in the Bank's operations are likely to resemble closely those proposed for the ECB in its choice of counterparties for high frequency ("fine-tuning") operations.

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