Quarterly Bulletin

Winter 2005

Bank of England

Volume 45 Number 4

Foreword

Every three months, the Bank of England publishes economic research and market reports in its *Quarterly Bulletin*. This quarter, the *Bulletin* introduces the economic scoring system used by the Bank's regional Agents. It also includes new analysis of financial market reaction to Bank of England communications, and provides a review of the potential interplay between financial and monetary stability.

When the Bank's Monetary Policy Committee (MPC) makes its monthly interest rate decisions, it draws heavily on data from the Office for National Statistics (ONS). The ONS is by far the most comprehensive source of information on the UK economy, and its data play an invaluable role in the MPC process. That said, the MPC has at times found it useful to supplement ONS figures with information from other sources. In this *Bulletin*, we publish an introduction to one of those sources: the economic scoring system used by the Bank's twelve regional Agents, known as the Agents' scores.

As discussed in *Introducing the Agents' scores*, by Colin Ellis and Tim Pike, the scores are numerical measures of the intelligence that the Agents gather from month to month. They have been used internally at the Bank since the mid-1990s. From January 2006, the Bank will be publishing the scores on its website, together with the relevant back-runs of data. The scores are no substitute for ONS data: they are inevitably based on the subjective judgement of the Agents, and their coverage is much less comprehensive than official statistics. But the scores are a useful resource for the MPC. The scores are timely, offering the Committee an initial reading of economic conditions before official data are available. They provide information on economic variables for which data are limited, such as recruitment difficulties. The scores also help the MPC to track with ease changes in the intelligence provided by the Agents.

Clear communication by central banks plays an important role in explaining interest rate decisions and anchoring inflation expectations. The article *Do financial markets react to Bank of England communication?*, by Rachel Reeves and Michael Sawicki, builds on previous Bank work about communication by the MPC. The piece examines the reactions of financial markets to a wide range of Bank communications: the minutes of the monthly interest rate meetings, the quarterly *Inflation Report*, MPC speeches and testimony to parliamentary committees.

The article finds that there tends to be a significant response in financial markets to collective forms of communication — the MPC *Minutes* and the *Inflation Report*. But reactions to individual forms of communication, such as speeches and parliamentary testimony, are more difficult to discern. The article also discusses the findings of similar studies of central bank communication carried out at the European Central Bank and the US Federal Reserve.

The interplay between financial and monetary stability is a topic that has been much discussed among both central bankers and academics. Successful monetary policy tends to support the stability of the financial system, while financial stability has the

potential both to support and to complicate monetary stability. In *Financial stability, monetary stability and public policy*, Chay Fisher and Prasanna Gai provide a review of recent literature on this important issue, and also highlight a number of areas that merit further research.

Charles Bean
Chief Economist and Executive Director for Monetary Policy, Bank of England.

This edition of the *Quarterly Bulletin* also includes:

- *Markets and operations*. This article reviews developments in sterling markets, UK market structure and in the Bank's official operations since the Autumn *Bulletin*;

- *Share prices and the value of workers* (by Eran Yashiv, Bank of England Houblon-Norman Fellow). Traditionally, a company's share price is assumed to be unrelated to the value of its employees. This article sets out an alternative approach which links share price developments to both investment and hiring behaviour; and

- *Stabilising short-term interest rates* (by Seamus Mac Gorain). This article describes how the Bank's new arrangements for implementing the MPC's interest rate decisions should tie market interest rates more closely to the Committee's official rate. In particular, the article shows how volatility in sterling overnight rates should be reduced by the ability of commercial banks to vary their balances held at the Bank of England on a daily basis.

Research work published by the Bank is intended to contribute to debate, and does not necessarily reflect the views of the Bank or of MPC members.

Bank of England Quarterly Bulletin

Winter 2005

Recent economic and financial developments

Research and analysis

MPC speeches

The contents page, with links to the articles in PDF, is available at www.bankofengland.co.uk/publications/quarterlybulletin/index.htm.
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Volume 45 Number 4

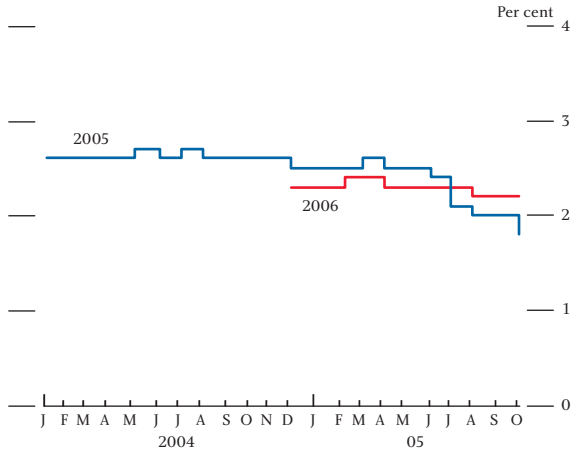
Markets and operations

This article reviews developments since the Autumn Quarterly Bulletin *in sterling markets, UK market structure and in the Bank's official operations.*(1)

- *Short-term nominal sterling interest rates rose, reversing the falls in forward rates observed earlier in the year. This was part of a global upward revision to near-term interest rate expectations.*
- *But long-term nominal and real sterling forward rates declined. Indeed, long real forward rates fell to historically low levels over the period, probably reflecting heightened UK pension fund demand for long-dated bonds.*
- *UK equity indices ended the period higher, although they had fallen sharply in October before rebounding. Alongside robust earnings growth, announcements of takeover activity may have supported share prices over recent months and helped to sustain the upward trend in UK equity prices.*
- *In effective terms, sterling depreciated, largely reflecting a fall in the value of sterling against the US dollar. Nonetheless, comparing movements over a longer window, the sterling ERI remained in a relatively narrow range.*

Economic activity data for the UK economy suggest that real GDP growth fell a little in the third quarter, reflecting erratically weak energy production. Consensus forecasts for GDP growth in 2005 have been revised down further (Chart 1). However, forecasts for 2006 have remained broadly stable, indicating that market economists continued to expect GDP growth to pick up next year. Perhaps consistent with only a temporary weakening in activity, equity prices in the United Kingdom increased over the period (Table A).

Chart 1
Expected real GDP growth for 2005 and 2006



Source: Consensus Economics.

Short-term sterling market interest rates have risen since the Autumn *Quarterly Bulletin*. By the end of the review period, the sterling futures curve was broadly flat out to the end of 2006, unwinding the downward slope that had emerged earlier in the year. These developments were part of a global upward revision to near-term interest rate expectations. With consumer price inflation having edged higher in a number of countries, market participants seem to have placed increased emphasis on the possible policy response to any signs of second-round effects on inflation of previous oil and commodity price rises.

Long-horizon sterling forward rates fell markedly. Market contacts suggest that this may have reflected increased UK pension fund demand for long-maturity index-linked

(1) This article focuses on sterling markets. The period under review is 2 September (the data cut-off for the previous *Quarterly Bulletin*) to 18 November. The reader is referred to 'Risks in the international system', Chapter 2 of the Bank of England's forthcoming *Financial Stability Review*, for a broader review of international financial markets.

Table A
Summary of changes in market prices

	2 Sep.	18 Nov.	*Change*
Sterling three-month interbank interest rates (per cent)[a]			
December 2005	4.40	4.61	*21 bp*
June 2006	4.25	4.57	*32 bp*
Sterling nominal forward rates (per cent)[b]			
Three-year	4.04	4.24	*21 bp*
Ten-year	4.19	4.17	*-3 bp*
Twenty-year	4.10	3.92	*-18 bp*
Equity indices			
FTSE 100	5327	5499	*3.2%*
FTSE All-Share	2675	2765	*3.4%*
Exchange rates			
Sterling effective exchange rate	101.0	98.8	*-2.1%*
$/£ exchange rate	1.841	1.713	*-6.9%*
€/£ exchange rate	1.468	1.464	*-0.3%*

Columns may not correspond exactly due to rounding.

Sources: Bank of England and Bloomberg.

(a) Rates implied from prices for short sterling futures contracts.
(b) Instantaneous forward rates, derived from the Bank's government liability curves. Estimates of the UK curve are published daily on the Bank of England's website at www.bankofengland.co.uk/statistics/yieldcurve/index.htm.

bonds. Long-term sterling inflation expectations appear to have remained broadly stable.

Short-term interest rates

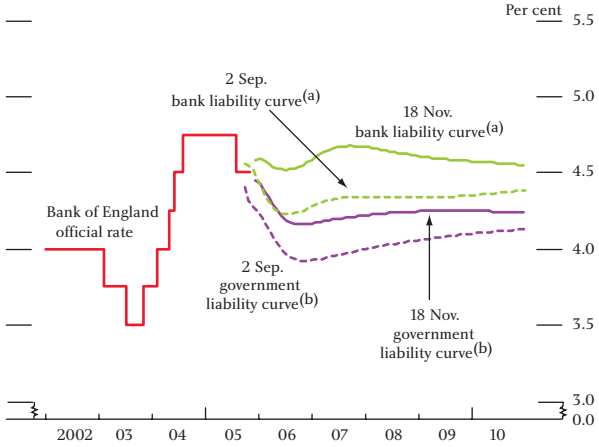
The United Kingdom's Monetary Policy Committee (MPC) maintained its official rate at 4.5% over the review period. Looking ahead, market participants revised upwards their views about the future path of sterling interest rates over the next few years, with short-term forward rates increasing by around 30 basis points.

As a result, by the end of the review period, the profile for sterling interest rates (derived from instruments that settle on Libor) was broadly consistent with market participants expecting no changes in official rates during 2006 (Chart 2).

The spread between this 'bank liability' curve and forward rates implied by general collateral (GC) repo rates and gilt yields (the 'government liability' curve) widened slightly over the period. This change appears to be linked to increased demand for short-dated gilts rather than a more general widening in the spread between secured and unsecured interest rates. As a result, the government liability curve may not currently provide a clear guide to near-term official rate expectations.(1)

In addition to nominal forward rates derived from instruments that settle on Libor, an alternative market-based measure of near-term sterling interest rate expectations can be derived from swaps linked to

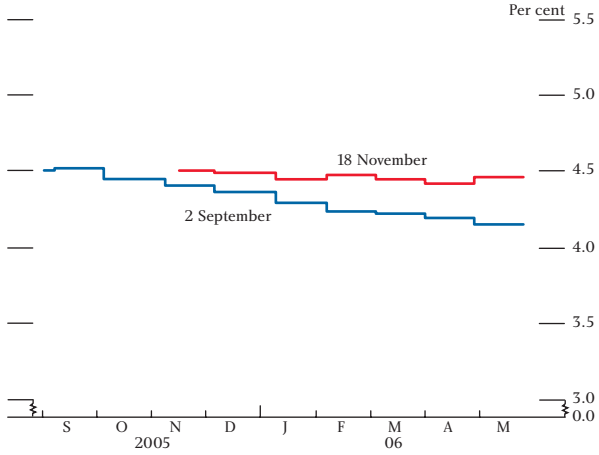
Chart 2
Sterling official and forward market interest rates



Sources: Bank of England and Bloomberg.

(a) One-day nominal forward rates implied by a curve fitted to a combination of instruments that settle on Libor.
(b) One-day nominal forward rates implied by GC repo/gilt curve.

Chart 3
Forward rates implied by sterling overnight interest rate swaps



Sources: Bank of England and Bloomberg.

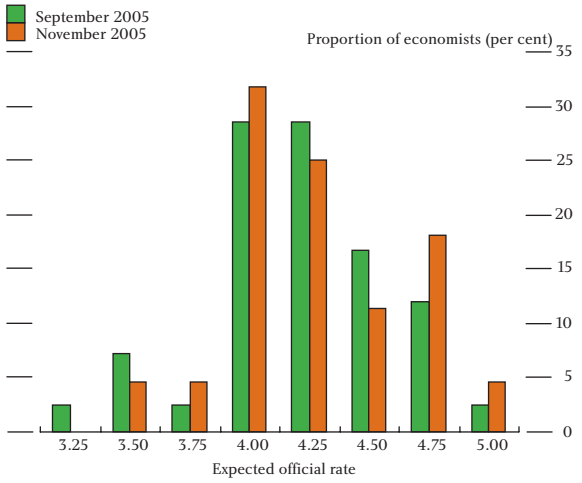
sterling overnight interest rates (SONIA). The box on pages 410–11 describes the derivation of this measure. By the end of the review period, these SONIA-based measures were also broadly consistent with little expectation of a change in official rates over the next six months (Chart 3).

In contrast, according to the survey of UK economists conducted by Reuters in November, the majority of respondents continued to expect rates to fall by the end of 2006, although there had been an increase in the proportion of economists expecting rates to rise in 2006 (Chart 4).

Implied volatility, as derived from options prices, rose somewhat, suggesting that uncertainty surrounding

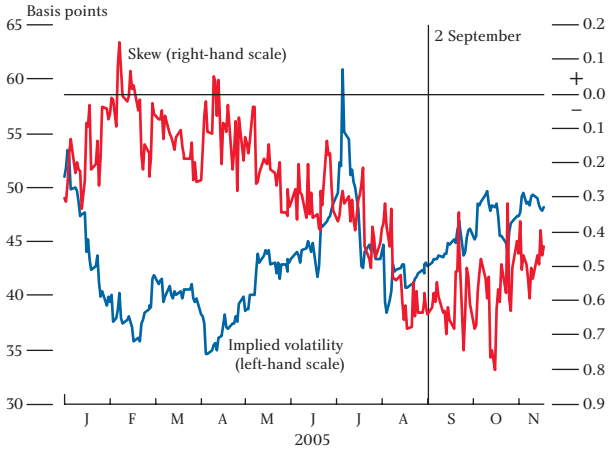
(1) See the box 'Market-based measures of interest rate expectations', on pages 404–05 of the Winter 2004 *Quarterly Bulletin*, for an explanation why short-dated gilt yields may be low relative to GC repo rates.

Chart 4
Economists' forecasts for the Bank of England official rate at end-2006



Source: Reuters.

Chart 5
Six-month implied volatility and skew from interest rate options



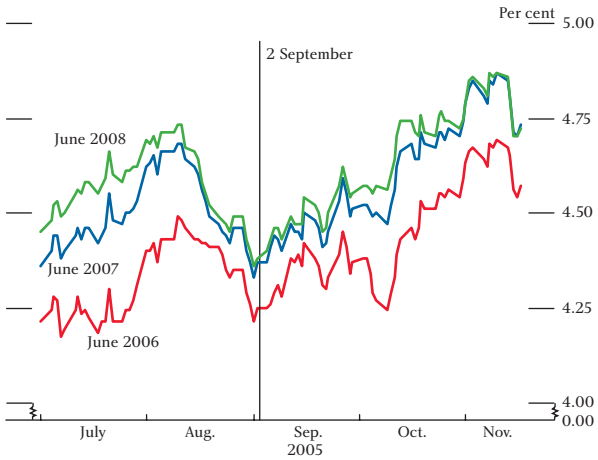
Sources: Bank of England and Euronext.liffe.

market participants' expectations for short-term interest rates increased over the review period (Chart 5). At the same time, the balance of risks to near-term sterling interest rates became a little less negatively skewed, although the risks remained to the downside.

In terms of movements through the period, sterling implied rates generally rose in October, partly in response to comments by a number of members of the MPC. But towards the end of the period, implied rates declined a little following slightly weaker-than-expected data releases and the publication of the November *Inflation Report* (Chart 6).

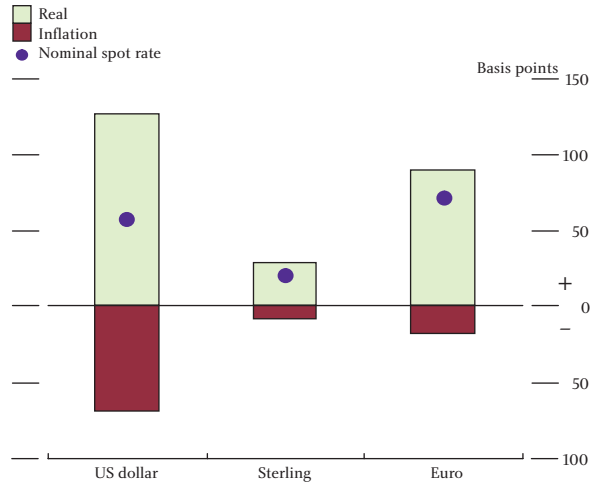
Based on the difference between nominal and index-linked gilt prices, the increase in short-term sterling nominal interest rates over the period largely

Chart 6
Implied sterling interest rates from short sterling futures contracts



Source: Euronext.liffe.

Chart 7
Changes in three-year spot rates since 2 September 2005(a)



(a) The real component of euro rates is derived by nominal government bond yields less inflation swap rates. Sterling and dollar real rates are derived from the Bank's government liability curves.

reflected an increase in short-term real rates (Chart 7). This rise may be related to global factors. Indeed, there were even larger increases in three-year real rates in the United States and euro area, consistent with expectations of increases in official interest rates in these economies.

Longer-term interest rates

Further along the yield curve, sterling forward rates fell, with the largest declines occurring at very long horizons (Chart 8). These falls reflected some quite sharp moves in nominal gilt yields towards the end of the period (Chart 9). Indeed, on 16 November, the ten-year nominal forward rate dropped by around 12 basis points, the largest one-day fall since August 2003.

Interest rate expectations from overnight swap rates

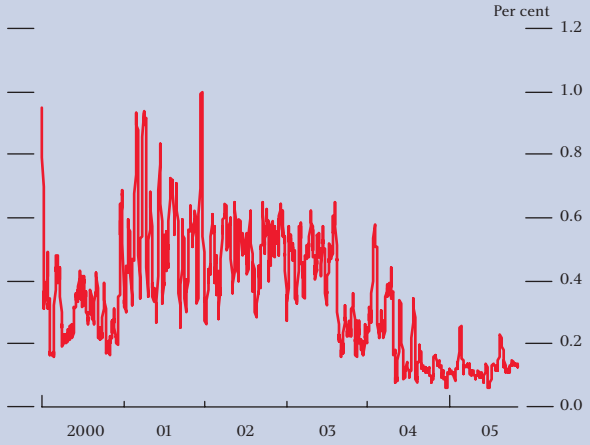
Market expectations of future official sterling interest rates can be inferred from a variety of sterling money market instruments. At short horizons, forward interest can be derived from swaps that settle on the sterling overnight index average (SONIA).(1) A SONIA interest rate swap contract (or Overnight Indexed Swap (OIS)) is an agreement between two counterparties to exchange (swap) fixed interest rate payments for floating interest rate payments. This is based on a pre-determined notional principal linked to the daily SONIA fixings compounded daily over the life of the swap.(2)

SONIA swaps are used to speculate on or hedge against the future level of overnight interest rates. Contracts vary in tenor from one week to two years, although liquidity is greatest at horizons of less than a year. SONIA swap rates should reflect market expectations of future overnight rates. As a result, forward rates derived from OISs indicate expected future interest rates at these short horizons.

Typically in the past, the spread between SONIA and the Bank's official rate has been highly volatile and, at times, fairly wide. But more recently, as has been mentioned in recent *Quarterly Bulletins*, volatility of the overnight rate relative to the policy rate has declined (Chart A). This reflects, at least in part, the interim reforms already introduced as part of the Bank's fundamental review of its official operations in the sterling money market. Indeed, the primary objective of the Bank's money market reforms is to reduce the volatility of overnight market interest rates around the MPC's official rate, so that the money market yield curve is flat until the date of the next MPC interest rate decision.(3)

The Bank envisages that there will be a material further fall in SONIA volatility with the launch of the full money market reforms.(4) Lower volatility should also encourage increased trading in instruments linked to SONIA. Indeed, market contacts report that

Chart A
Mean absolute deviation of SONIA and official interest rate(a)



(a) Based on a ten-day moving average.

turnover in SONIA swap markets has grown rapidly over the past year or so. Looking forward, therefore, forward rates derived from SONIA swaps should provide a more reliable read on market expectations of future official rates.

Inferring expectations from SONIA swap rates

One method by which it is possible to back out expectations of future policy from SONIA swap contracts of different maturities is as follows.

Step One — Assume that changes in SONIA occur only on MPC decision days.

Step Two — Take the one-month swap rate, OIS_1. This rate must be equivalent to the interest earned by compounding daily the expected SONIA rate over the next month. If the current official rate (OR) holds up until the next meeting, the one-month swap rate can be used to calculate a rate prevailing following the meeting (FR). More formally:

$$\left(1+\frac{OIS_1}{36500}*T_1\right)=\left(1+\frac{OR}{36500}\right)^{t_1}\left(1+\frac{FR}{36500}\right)^{T_1-t_1} \quad (1)$$

(1) SONIA is the average interest rate, weighted by volume, of unsecured overnight sterling deposit trades transacted between midnight and 4.15 pm on a given day between members of the Wholesale Money Brokers' Association.
(2) For additional information on interest rate swaps and other instruments used in the sterling money market, see Brooke, M, Cooper, N and Scholtes, C (2000), 'Inferring market interest rate expectations from money market rates', *Bank of England Quarterly Bulletin*, November, pages 392–402.
(3) See the consultative paper published by the Bank of England, *Reforms of the Bank of England's Operations in the Sterling Money Markets*, May 2004.
(4) The article on 'Stabilising short-term interest rates' on pages 462–70 of this *Bulletin* describes how the Bank's new framework should tie short-term interest rates more closely to the Bank's official rate.

where T_1 is the number of days to the maturity of the first swap and t_1 is the number of days to the next MPC meeting. Rearranging:

$$FR = \left[\left[\frac{\left(1 + \frac{OIS_1}{36500} * T_1\right)}{\left(1 + \frac{OR}{36500}\right)^{t_1}} \right]^{\frac{1}{T_1 - t_1}} - 1 \right] * 36500 \qquad \textbf{(2)}$$

So for example, if OIS_1 is 4.510, OR is 4.5, T_1 is 32 and t_1 is 22, using equation **(2)**, FR = 4.5044.

Step Three — Following the logic of step two, the two-month OIS (OIS_2) can be represented in terms of the base rate and a series of forward interest rates between meetings:

$$\left(1 + \frac{OIS_2}{36500} * T_2\right) = \left(1 + \frac{OR}{36500}\right)^{t_1} \left(1 + \frac{FR_{t_1,t_2}}{36500}\right)^{t_2 - t_1} \left(1 + \frac{FR_{t_2,t_3}}{36500}\right)^{T_2 - t_2} \qquad \textbf{(3)}$$

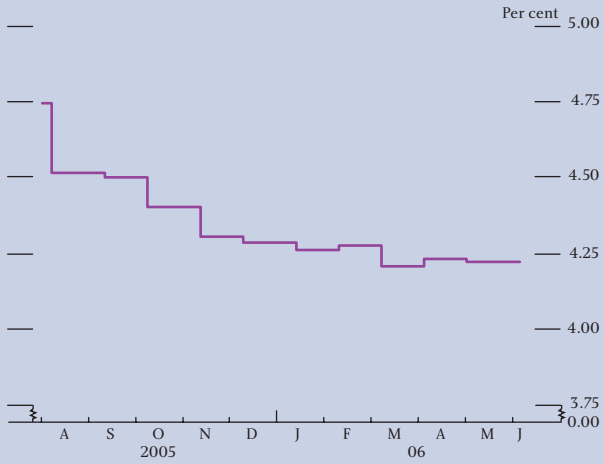
where T_2 is the maturity of the second swap, t_2 is number of days to the second meeting and FR_{t_i,t_j} is the forward rate applicable between meeting i and j.

Given the two-month swap rate, and using the policy rate up until the first meeting and the rate inferred in step two, a prevailing rate following this second MPC meeting can therefore be inferred. Thus in the example, assuming OIS_2 = 4.508 and with FR_{t_1,t_2} = 4.5044, T_2 = 61 and t_2 = 56, then FR_{t_2,t_3} = 4.3649.

Step Four — Repeat for twelve monthly OIS contracts.

Compared with other estimated curves, the OIS-inferred curve potentially allows more precise inferences regarding the timing of changes to the policy rate. One important caveat, however, is that risk premia and/or banks' specific hedging requirements may drive OIS rates away from true expectations of future overnight rates.

Chart B
Forward rates implied by SONIA swaps on 29 July 2005



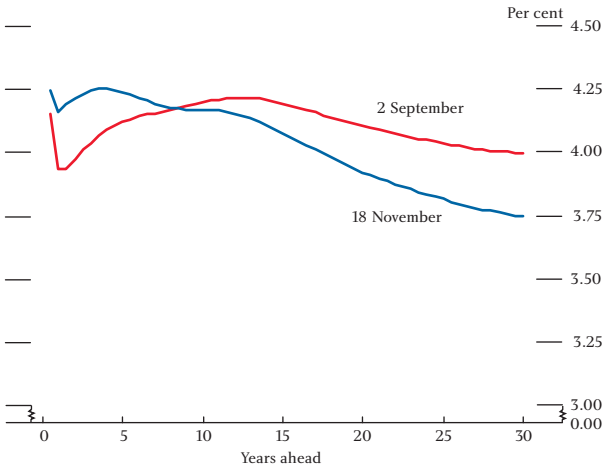
Sources: Bank of England and Bloomberg.

Chart B shows the implied path for rates implied from SONIA swaps on 29 July 2005. It shows that at that time, market interest rates indicated participants were anticipating reductions in the official rate.

Abstracting from risk premia, which are likely to be small at these short horizons, SONIA swap rates on 29 July 2005 suggested a strong expectation of a 25 basis point reduction in the official rate at the August 2005 MPC meeting and further reductions towards the end of the year.

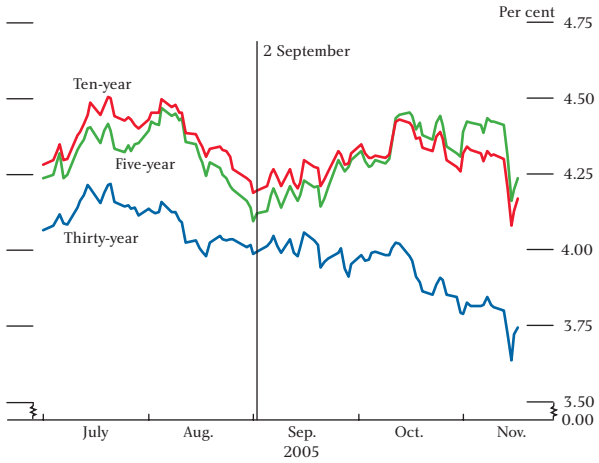
One limitation of using the OIS-based approach to infer market expectations about the timing of interest changes is that readily available data on monthly spaced contracts only extend to one year. But at horizons less than one year, this approach has some other benefits. In particular, for any given future date, derived forward rates can be cross-checked against over-the-counter forward-starting SONIA swap rates, which are now actively traded out of MPC meeting dates. These rates can give a direct read on market expectations of decisions at particular future MPC meetings.

Chart 8
Sterling nominal forward rates(a)



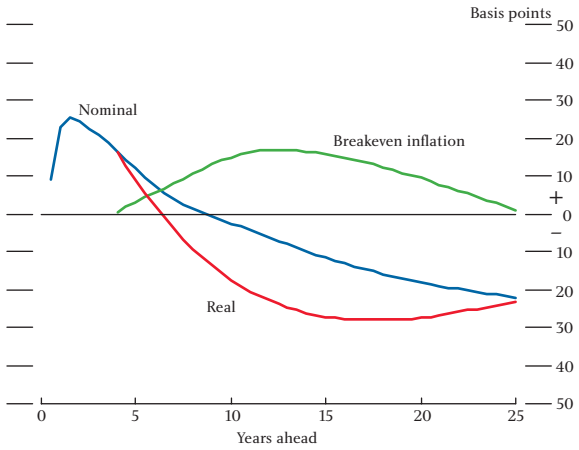
(a) Instantaneous forward rates derived from the Bank's government liability curve.

Chart 9
Sterling nominal forward rates since July 2005(a)



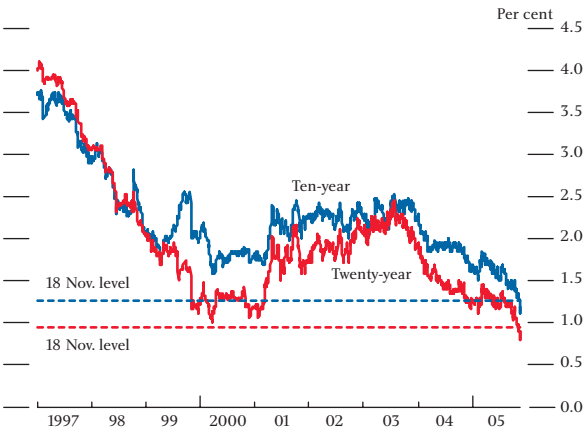
(a) Instantaneous forward rates derived from the Bank's government liability curve.

Chart 10
Changes in sterling forward rates(a)



(a) Instantaneous forward rates derived from the Bank's government liability curve.

Chart 11
Sterling real forward rates since January 1997 derived from index-linked gilts(a)



(a) Instantaneous forward rates derived from the Bank's government liability curve.

The decline in long-maturity nominal forward rates appears to have been linked to a number of factors. Purchases of long-maturity gilts by UK pension funds may have had a particularly significant effect. In addition, the fall towards the end of the period may have reflected a reaction to the November *Inflation Report*, as well as some unwinding of speculative positions involving buying euro-denominated government bonds and selling gilts ('long-bund, short-gilt' positions).

Decomposing the changes in longer nominal forward rates into their real and inflation components indicates that while breakeven inflation forward rates increased slightly at all maturities, market-based real forward rates fell at maturities beyond six years (Chart 10).

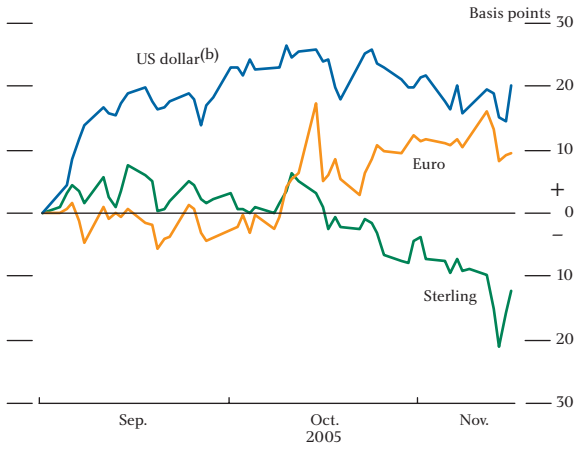
The recent fall in real sterling forward rates has continued the general downward trend in real rates over the past two years (Chart 11). Indeed, during November, long real forward rates reached the lowest levels since the UK government began to issue index-linked gilts in 1981.

The precise level of sterling real forward rates implied by index-linked gilts should be interpreted with care. Real interest rates inferred from these financial market instruments will not necessarily coincide with the 'true' underlying real rates of interest that households and firms face and that affect their economic decisions. In particular, the inflation-adjusted returns from index-linked gilts may be understated because the referenced measure of inflation is based on the RPI and is constructed as an *arithmetic* average of price changes in the basket of goods and services. Such a measure will give a large weight to prices of goods and services that have risen most rapidly, even though consumers may to

some extent have substituted away from these items towards cheaper alternatives. In contrast, the CPI measure, being a *geometric* average of individual price changes, will tend to give a relatively lower weight to such items. This 'formula effect' is estimated to add about half a percentage point a year to RPI-based measures of inflation.(1)

Generally speaking, the declines in sterling real forward rates over the past few years have coincided with the decline in international long-term real forward rates.(2) But during the current review period, real forward rates in other major currencies have risen, suggesting that the recent decline in sterling real rates reflected some sterling-specific factors (Chart 12).

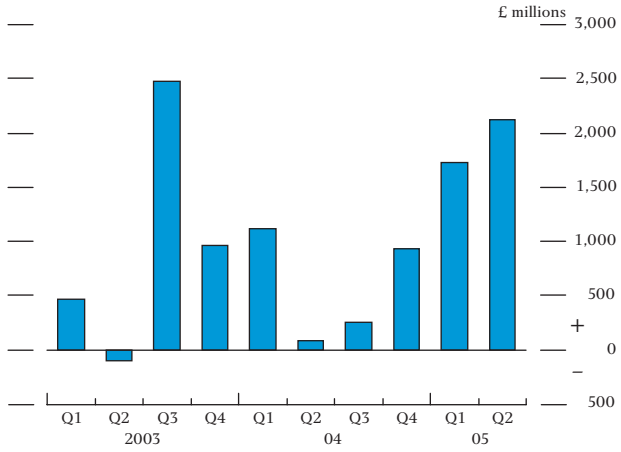
Chart 12
Cumulative changes in international ten-year real forward rates since 2 September(a)



(a) The sterling and dollar instantaneous real forward rates are derived from the Bank's government liability curve. Euro instantaneous real forward rates are calculated as nominal government bond yields less inflation swap rates.
(b) Nine-year instantaneous real forward rate.

In particular, as with implied rates on long-dated nominal gilts, some market contacts have suggested that investment by UK pension funds was a significant influence on long-term sterling real forward rates. Over the year to June 2005, there was an increase in net purchases of index-linked gilts by institutional investors (Chart 13) and this may have continued over the review period.

Chart 13
Institutional net purchases of index-linked gilts



Sources: ONS and Bank of England calculations.

In recent years, UK pension funds have increasingly focused on 'liability-driven investment' (LDI) — giving investment managers mandates to match the expected liabilities of the fund rather than, for example, a market index or a peer-group comparison. This may have been prompted, at least in part, by recent accounting and regulatory changes. In particular, the introduction of the accounting standard FRS17 required the assets of defined-benefit pension funds to be measured at market values and their liabilities to be discounted using a market rate of interest. In addition, the Pension Protection Fund (PPF), financed by levies on eligible defined-benefit pension funds, has been set up to provide compensation to pension fund members in the event that their fund becomes insolvent. Under the direction of the Board of the PPF, funds eligible for protection must undertake a regular valuation of their assets and liabilities.

Against this background, the demand for index-linked gilts from UK pension funds may have become relatively price inelastic. Trustees of funds and corporate sponsors may have become more willing to mandate purchases of these securities even though they have become increasingly expensive, in order better to match their liabilities. The liabilities of these funds typically have a long maturity(3) and, at least in part, are linked to inflation. Combined with a relatively limited supply of long-dated bonds (especially long-dated inflation-linked

(1) This 'formula effect' is discussed in the speech by the Governor on 20 January 2004 to the annual Birmingham Forward/CBI business luncheon (reprinted on pages 74–76 of the Spring 2004 *Quarterly Bulletin*) and by Stephen Nickell in his British Academy Keynes Lecture in Economics, 'Practical issues in UK monetary policy, 2000–05', on 20 September 2005.
(2) A number of explanations for low global real forward rates have been considered in previous Bank publications. See the boxes 'The fall in global long-term real interest rates' in the Spring 2005 *Quarterly Bulletin* and 'The economics of low long-term bond yields' in the May 2005 *Inflation Report*.
(3) This makes them 'long duration', ie relatively highly sensitive to changes in the interest rate used to discount such liabilities.

bonds), the increased demand may have tended to push the prices of index-linked bonds higher and their yields lower.

To the extent that returns on index-linked bonds influence the discount rates that funds employ to assess their future liabilities, the recent falls in yields could have further reduced funding ratios — the ratio of a pension fund's assets to its liabilities.(1) In turn, this may have reinforced the demand for index-linked gilts and driven their yields even lower.

Pension funds can also gain long-term inflation-linked cash flows by using the inflation swap market. Market contacts have reported significant receiving of long-dated inflation by UK pension funds in the sterling swap markets — both linked to RPI and LPI (limited price indexation(2)). Some dealers and fund managers have also been marketing pooled funds offering pension schemes long-term real returns, perhaps backed by inflation swaps. Where dealers have paid inflation in the swap market, they too may have purchased index-linked gilts to hedge this exposure, although some dealers are said to have used other hedges, including index-linked loans to finance private finance initiative (PFI) projects and property investments.

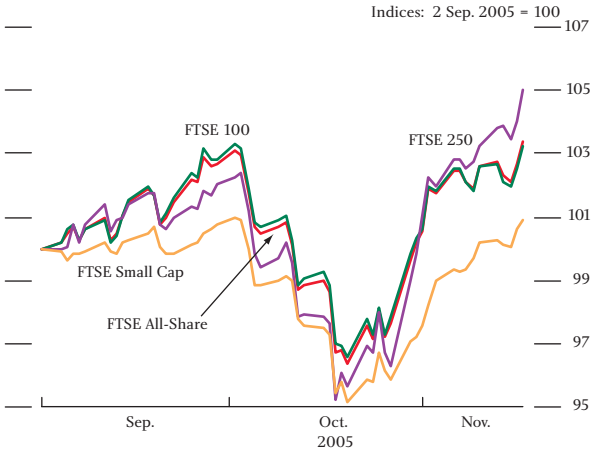
Some of the recent buying of long-dated bonds could have been associated with funds wanting to rebalance their portfolios ahead of the year-end. The high level of equity indices towards the start of the review period may also have acted as a trigger for some funds to switch from equities into bonds.

Equity markets

Other things being equal, declining long-term sterling real interest rates might have supported UK equity prices over the past year or so via lower discount rates on future cash flows. However, equity price movements through the period would suggest other factors were probably more influential. UK equity indices fell sharply in October, along with those in the euro area and, to a lesser extent, in the United States, before rising towards the end of the period. The pattern was broadly similar for large, medium-sized and small UK-quoted companies (Chart 14).

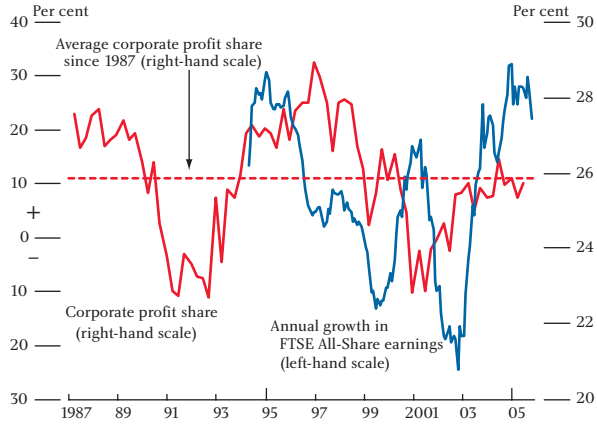
The falls in UK equity prices in the middle of the review period seemed to coincide with the increase in

Chart 14
Cumulative changes in UK equity indices



Sources: Bank of England and Bloomberg.

Chart 15
Recent developments in UK corporate earnings



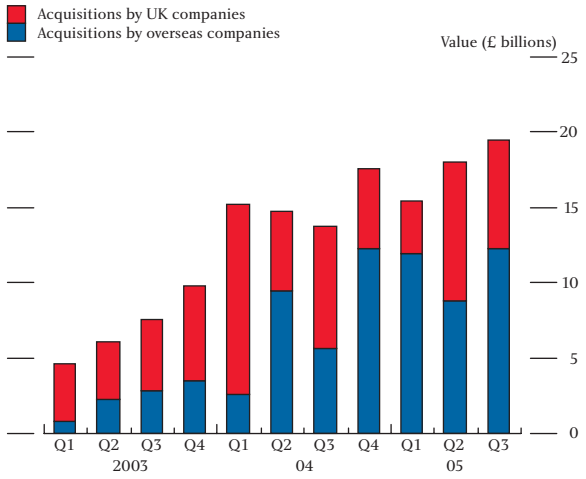
Sources: Bank of England, Bloomberg, ONS and Thomson Financial Datastream.

short-term market interest rates globally, perhaps as investors assessed the impact of tighter monetary policy on companies' earnings prospects. But with company profits having held firm despite the recent slowdown in UK domestic demand — reported earnings for quoted companies continued to grow strongly in the twelve months to the end of October (Chart 15) — any concerns about future corporate earnings seem to have been short-lived.

Some commentators have suggested that news about potential mergers and acquisitions could also have played a role, especially for the recovery in equity prices during the final few weeks of the review period. A number of prominent deals involving UK companies were announced at the beginning of November — for example, Telefonica's bid for O2 and Dubai Ports World's

(1) Under FRS17, funds are required to discount their future pension liabilities using AA-rated corporate bond rates. Under the PPF, future pension liabilities should be evaluated using rates derived from index-linked bond yields.
(2) Limited price indexation involves using an RPI-based index but with an upper bound on inflation.

Chart 16
Acquisitions of UK companies



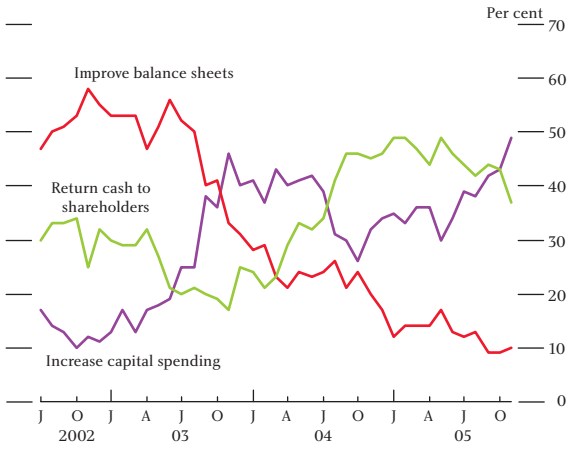
Source: ONS.

bid for P&O. More generally, takeover activity has increased over the past year, which market contacts suggest has helped to underpin the continued rise in equity prices through this year (Chart 16).

Indeed, there are some indications that the period of corporate balance sheet repair and shareholder distrust of expansion plans by company management after the 2001–02 equity market falls may be ending. For example, in the Merrill Lynch Global Fund Manager survey for November, more fund managers wanted companies to use their cash flows to increase capital spending than to return funds to shareholders through share buy-backs and dividends (Chart 17).

In principle, lower equity risk premia could also have boosted equity prices. However, uncertainty about

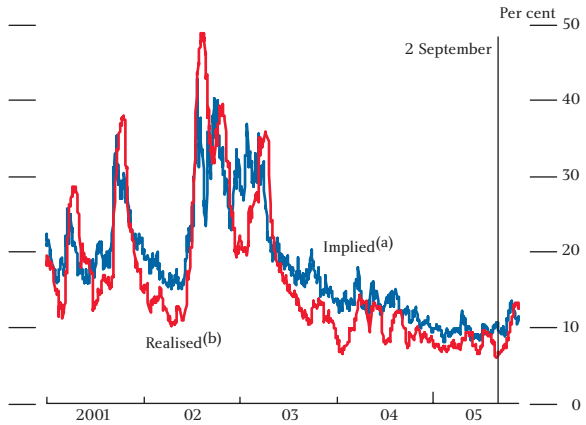
Chart 17
Survey of fund managers' views about the preferred use of corporate cash flows(a)



Source: Merrill Lynch.

(a) Survey question: 'What would you most like to see companies do with their cash flow at the current time?'.

Chart 18
FTSE 100 equity index volatilities



Sources: Bank of England and Bloomberg.

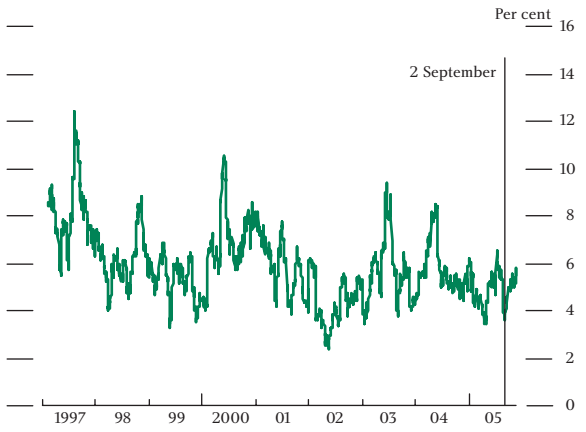
(a) Three-month constant maturity implied volatility.
(b) Annualised rolling standard deviation of log returns estimated over a 30-day window.

future equity price movements as implied from option prices rose slightly during the period. In October, implied volatility for the FTSE 100 index picked up to its highest level in 2005, echoing developments in realised equity market volatility. But both measures subsequently fell towards the end of the period and remained low by historical standards (Chart 18).

Foreign exchange markets

Volatility in foreign exchange markets also remained relatively low over the period. The standard deviation of daily changes in the sterling effective exchange rate did pick up a little, having fallen during the summer months, but it remained at a low level (Chart 19). Forward-looking measures of uncertainty implied from option prices suggested market participants expected volatility to remain broadly unchanged over the next few months (Chart 20).

Chart 19
Realised volatility of sterling exchange rate index(a)



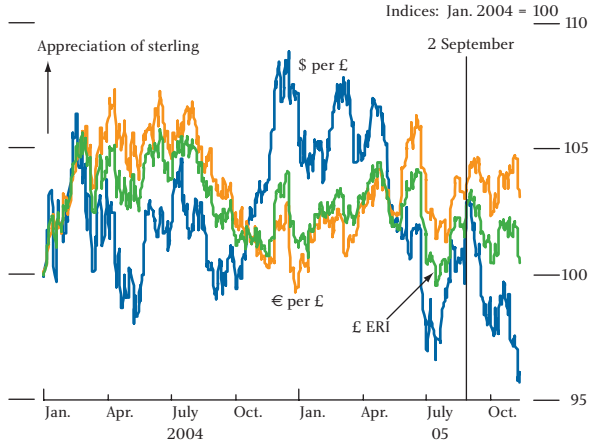
(a) Annualised rolling standard deviation of log returns estimated over a 30-day window.

The sterling exchange rate index (ERI) fell by around 2% over the period. This largely reflected a fall in the value of sterling against the US dollar which itself rose against all major currencies. Sterling depreciated by around 7% against the US dollar and 0.3% against the euro (Chart 21). The changes in these bilateral exchange rates were broadly consistent with movements in relative interest rates over the period. Comparing changes over a longer window, the sterling ERI has remained in a relatively narrow range.

Chart 20
Three-month implied sterling exchange rate volatilities

Source: Reuters.

Chart 21
Sterling exchange rate indices



Developments in market structure

'Ultra-long' gilt issuance

In September, the United Kingdom's Debt Management Office issued an 'ultra-long' 50-year index-linked gilt. This followed the issue of a 50-year conventional gilt in May. These securities enable nominal, real and breakeven inflation forward curves to be extended out to a maturity of almost 50 years. On 18 November 2005, 49-year nominal and real forward rates were around 3.3% and 0.4% respectively. The box on pages 418–19 considers the interpretation of these forward rates.

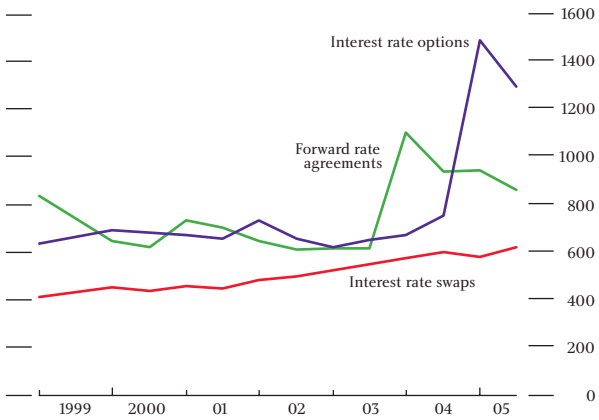
Growth in over-the-counter derivatives markets

The market for over-the-counter (OTC) derivatives continued to grow through 2005 H1, according to the most recent survey by the Bank for International Settlements (BIS). The total notional amount of OTC derivatives outstanding in all currencies increased by around 7% during 2005 H1, compared with the 14% growth rate experienced during 2004 H2.

Amounts outstanding in sterling interest rate derivatives increased by around 9%. However, amounts outstanding in sterling foreign exchange OTC options declined slightly, by around 2%.

A measure of concentration of transactions undertaken by financial institutions included in the BIS survey fell in the OTC markets for sterling forward rate agreements and interest rate options, but rose slightly in the market for sterling interest rate swaps (Chart 22).

Chart 22
Herfindahl indices of sterling transactions in exchange-traded derivatives(a)



Source: Bank for International Settlements.

(a) The Herfindahl index is a measure of market concentration. It is calculated as $H = 10{,}000 \times \sum_{i=1}^{n} S_i^2$ where S_i = share of the ith firm's transaction in total market and n = number of firms. The higher the value, the more concentrated the market is.

Bank of England official operations

Changes in the Bank of England balance sheet

The size of the Bank's balance sheet increased over the review period. This was due to an increase in sterling and foreign currency-denominated customer deposits. Notes in circulation, the largest liability on the Bank's balance sheet, fluctuated with weekly variation in

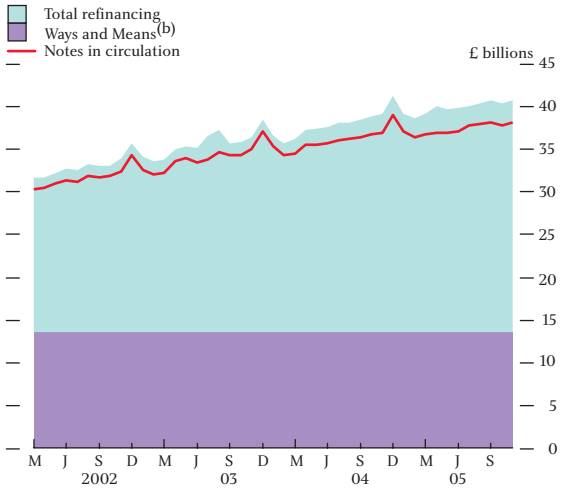
Table B
Simplified version of Bank of England consolidated[a] balance sheet[b]

£ billions

Liabilities	18 Nov.	2 Sep.	Assets	18 Nov.	2 Sep.
Banknote issue	40	41	Stock of refinancing	29	30
Settlement bank balances	<0.1	<0.1	Ways and Means advance	13	13
Other sterling deposits, cash ratio deposits and the Bank of England's capital and reserves	10	9	Other sterling-denominated assets	4	4
Foreign currency denominated liabilities	15	14	Foreign currency denominated assets	19	17
Total[c]	**65**	**64**	**Total**[c]	**65**	**64**

(a) For accounting purposes the Bank of England's balance sheet is divided into two accounting entities: Issue Department and Banking Department. See 'Components of the Bank of England's balance sheet' (2003), *Bank of England Quarterly Bulletin*, Spring, page 18.
(b) Based on published weekly Bank Returns. The Bank also uses currency, foreign exchange and interest rate swaps to hedge and manage currency and non-sterling interest rate exposures — see the Bank's 2003 *Annual Report*, pages 53 and 73–79 for a description.
(c) Figures may not sum to totals due to rounding.

Chart 23
Banknotes in circulation, the stock of OMO refinancing, and 'Ways and Means'[a]



(a) Monthly averages.
(b) An illiquid advance to HM Government. This fluctuated prior to the transfer of responsibility for UK central government cash management to the UK Debt Management Office in April 2000. The Ways and Means is now usually constant.

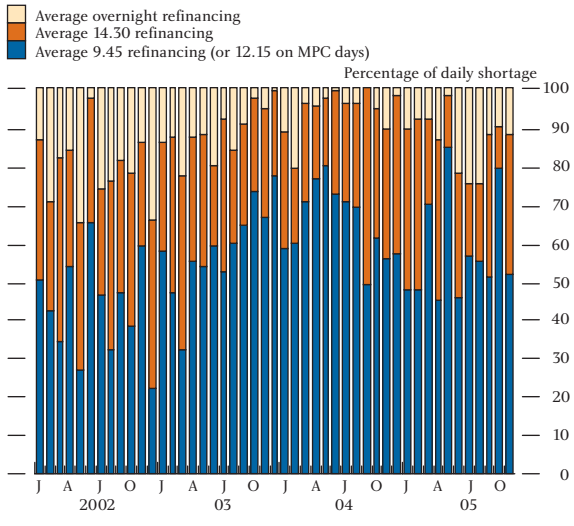
demand for banknotes and fell over the review period as a whole (Chart 23).

The Bank maintained the amount of its three and six-month euro-denominated bills outstanding at €3.6 billion, issuing new bills on a monthly basis as old bills matured. The average indicative spread to Euribor of three-month issuance narrowed to 9.0 basis points below Euribor, compared with 9.5 basis points over the previous review period; for six-month bills, the average issuance spread widened slightly to 11.0 basis points below Euribor from 10.6 basis points.

As set out in its *Annual Report and Accounts*, the Bank holds an investment portfolio of gilts (currently around £2 billion) and other high-quality sterling-denominated debt securities (currently £1.2 billion). These investments are held for a long period of time, generally to maturity. Over the current review period, gilt purchases were made in accordance with the published screen announcements; £31.4 million of 5% 2012 in August, £31.4 million of 5% 2014 in September and £31.4 million of 4.75% 2015 in October. A screen announcement on 1 December 2005 detailed the purchases to be made over the following three months.

The majority of refinancing in the Bank's open market operations (OMOs) in the sterling money market is carried out at a two-week maturity (Chart 24). As the shape of the money market yield curve steepened during the review period, counterparty participation in the Bank's two-week operations increased. The introduction of interim money market reforms on 14 March 2005, which included a narrowing of the rate 'corridor' on the Bank's deposit and late lending facilities, has led to narrower spreads between short-dated interest rates and the Bank's official rate, and therefore reduced the interest rate risk to counterparties on two-week borrowing from the Bank at the official rate.

Chart 24
Refinancing provided in the Bank's open market operations[a]



(a) Monthly averages.

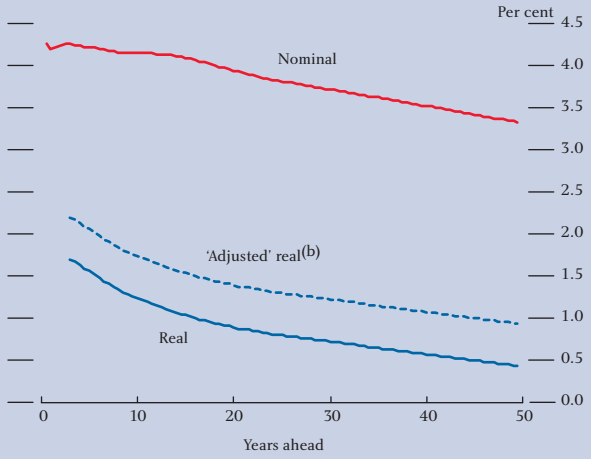
On average, the use of euro-denominated collateral by counterparties participating in the Bank's operations

Interpreting long-term forward rates

The recent issuance in the United Kingdom of 50-year conventional and index-linked gilts has made it possible to estimate sterling nominal and real forward curves out to almost 50 years.

Chart A shows these extended real and nominal inflation forward curves on 18 November 2005, estimated using the Bank of England's VRP curve fitting technique.(1) At the 49-year maturity, the estimated nominal forward rate was around 3.3%, and the real forward rate was only around 0.4%.(2)

Chart A
Sterling forward curves on 18 November 2005(a)



(a) Instantaneous forward rates derived from the Bank's government liability curves.
(b) Index-linked gilt real forward rates adjusted to allow for the 'formula effect' associated with RPI measures of inflation.

Abstracting from the level of these forward curves, it is clear that 50-year nominal and real forward rates are lower than the equivalent 10-year forward rates. In other words, the nominal and real forward curves are *downward sloping*.

A popular framework for analysing the shape of the forward curve is to assume that forward rates reflect expectations of future short-term interest rates. So one interpretation of downward sloping (or inverted) forward curves is that investors in gilts expect future sterling short-term interest rates to be lower in 50 than in 10 years' time. However, it is not obvious why market participants might have more information with which to form expectations about short-term interest rates at the 50-year horizon than they have at the 10-year horizon.

There are other, perhaps more plausible, reasons for a downward sloping forward curve. Three possible explanations are (i) risk premia, (ii) convexity, and (iii) other 'market' factors, in particular, liability matching by long-term savings institutions.

Risk premia

If market participants are risk-averse, they are likely to require a premium as compensation for uncertainty about future interest rates. In the absence of any other factors, a downward sloping forward curve would suggest this risk premium is negative and more negative with maturity.

Although this is theoretically possible,(3) the risk premium is typically thought to be positive and increasing with maturity. In this case, the risk premium would be expected to raise forward interest rates *above* underlying interest rate expectations, giving rise to an upward sloping forward curve. So risk premia alone seem unlikely to explain the downward sloping forward curves.

Convexity

Convexity arises because of two factors. First, future interest rates are uncertain and second, there is a convex relationship between bond prices and yields. The convex relationship means that bond prices rise more for a given decrease in yield than they fall for an equivalent increase. This can be seen in Chart B, where a fall in yield from Y_1 to Y_2 causes a rise in price from B_1 to B_2, whereas a rise in yield of the same magnitude (Y_1 to Y_3) causes a smaller fall in bond prices (B_1 to B_3).

Given some degree of uncertainty about future interest rates, this convex relationship has positive value to bondholders because it amplifies the positive price impact of falls in yields and dampens price falls as yields rise. In the absence of other factors, this

(1) For details of how these curves are estimated, see Anderson, N and Sleath, J (2001), 'New estimates of the UK real and nominal yield curves', *Bank of England Working Paper no. 126*.
(2) As discussed on pages 412–13, there are reasons to be cautious in attaching too much significance to the precise level of real forward rates derived from index-linked gilts due to the 'formula effect'.
(3) See the box 'Real interest rates and macroeconomic volatility', on pages 308–09 in the Autumn 2005 *Bank of England Quarterly Bulletin* which describes possible conditions under which a negative risk premium can arise.

convexity value would lower forward rates below expectations of future short-term interest rates.

To see this, consider an investor who cares only about expected pay-offs (ie is risk-neutral). Suppose this investor wishes to invest £100 for one year starting in one year's time. One option would be simply to wait until next year and purchase a one-year bond. To introduce uncertainty, assume that the investor considers it equally likely that the interest rate on the one-year bond will change from 4% today to either 2% or 6% next year. In this case, the expected yield on the one-year bond is 4% and the expected price is £96.10.(4)

Alternatively, the investor could lock-in the yield today on a one-year bond starting next year by entering into a forward contract. Clearly, the forward-implied price of the bond must also be £96.10, otherwise the investor would be able to create a position that will generate a positive expected profit for zero cost. But this means that the yield on the forward contract would be 3.98% (because £100$e^{-0.0398}$ = £96.10), which is lower than the expected interest rate of 4%. In this example, the convexity effect therefore amounts to 2 basis points at the one-year maturity.

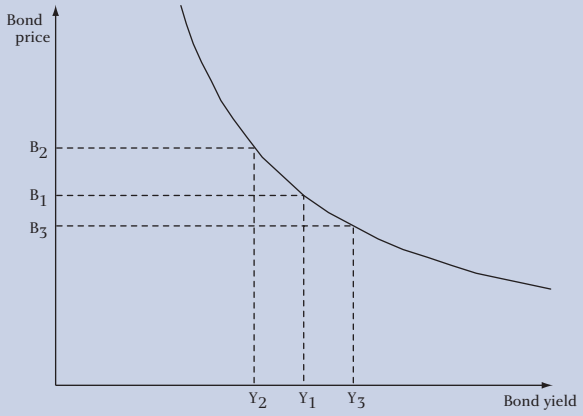
A rise in uncertainty about future interest rates increases the value of the convexity effect. For example, consider the impact of a rise in the uncertainty of the one-year yield from 2% or 6% next year, to 1% or 7%. In this case, the expected yield next year will still be 4%. But the expected price will now be higher at £96.12, corresponding to a lower forward rate of 3.96%, and therefore a higher convexity effect of 4 basis points.

In general, this convexity effect will increase with the maturity of the forward rate. So, in principle, the convexity effect could help to explain the downward sloping forward curve, although if there were a positive risk premium, convexity would have to be large enough to more than offset this premium.

Market factors

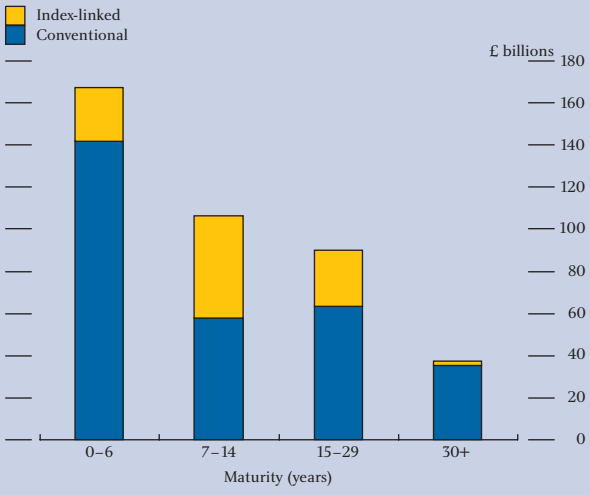
In addition to risk premia and convexity, on occasions, other non-fundamental factors in the bond market can move forward interest rates away from expected short rates. For example, if the yield curve is not perfectly arbitraged and some large investors prefer to hold bonds at particular maturities, forward rates can be determined by demand and supply factors.

Chart B
Bond price-yield relationship



As noted in the main text, demand for long-maturity gilts from institutional investors can at times become relatively price inelastic, and the value of outstanding nominal and index-linked gilts at long maturities is sometimes limited (Chart C).

Chart C
UK gilts outstanding by maturity(a)



Source: DMO.

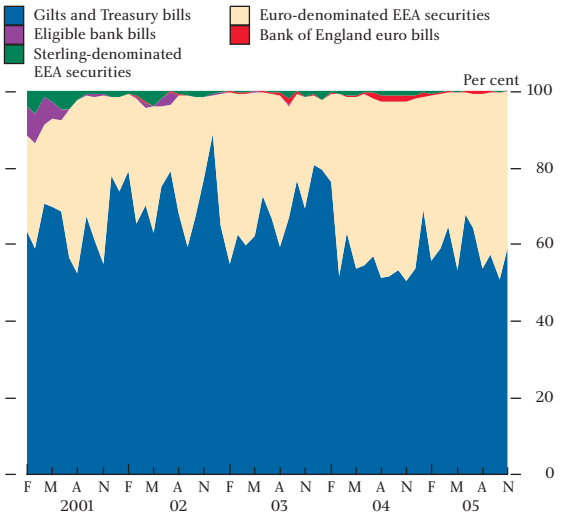
(a) Excludes the 3½% war loan and 'rump' gilts. Includes inflation uplift for index-linked gilts.

The combination of price-inelastic demand and the relative scarcity of long maturity bonds may result in investors paying a high price for long-dated gilts. This premium would tend to reduce the yield on such instruments, pushing long-maturity forward rates below the rate that would hold in the absence of these factors.

(4) This is the expected present value of £100 in one year's time, ie 0.5(100$e^{-0.02}$) + 0.5(100$e^{-0.06}$) = 96.10.

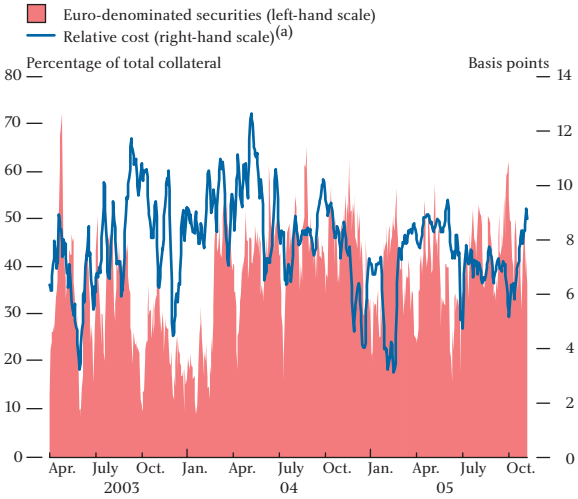
increased over the period (Chart 25), despite a small rise in its relative cost (Chart 26). This suggests that other factors can be important when a counterparty decides which collateral to pledge in the Bank's sterling operations, such as its own specific needs to finance positions in the sterling or euro bond markets.

Chart 25
Instruments used as OMO collateral(a)



(a) Monthly averages.

Chart 26
Relative cost and use in OMOs of euro-denominated EEA government securities



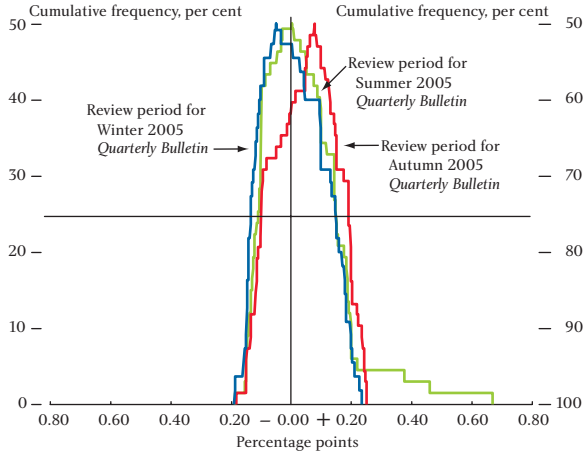
(a) The relative cost is calculated as the difference between one-month BBA repo and Libor fixing spread and one-month European Banking Federation repo and Euribor spread. A wider spread indicates a lower cost of repoing euro-denominated debt relative to repoing gilts.

The majority of OMO collateral continued to be denominated in sterling. One strategy often used by securities dealers is to give corporate or asset-backed bonds as collateral to borrow gilts from other investors, for example, UK insurance companies or pension funds. The gilts can then be used in a repo transaction with the Bank for cash, a so-called 'collateral upgrade' trade. Market contacts suggest these trades have become more popular alongside more traditional types of collateral used for borrowing gilts, such as bank's Certificates of Deposit. Until recently, commercial eligible bank bills were also accepted as collateral in the Bank's OMOs, although typically they accounted for a small proportion of total collateral pledged. As explained in the box on pages 422–23, however, in the past they were more significant.

Short-dated interest rates

The distribution of the spread between the sterling secured (gilt GC repo) overnight rate and the Bank's official rate was more symmetric during the current review period than in the period covered by the Autumn *Quarterly Bulletin* (Chart 27), in part reflecting fewer days on which the overnight rate traded above the official rate. The volatility of this spread has also remained lower than in recent years.

Chart 27
Cumulative folded distribution of sterling secured overnight rates(a)



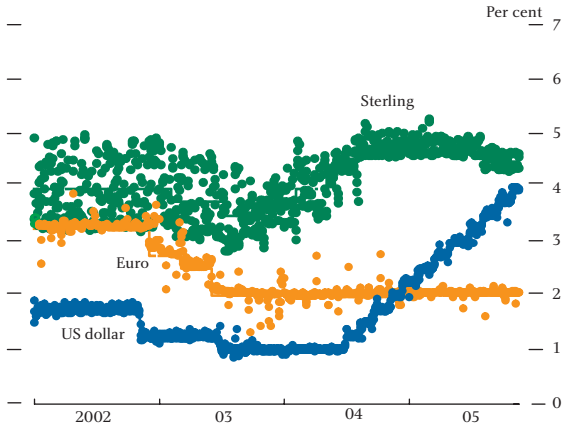
(a) Distribution of the spread between the GC repo rate and the official rate. A negative spread indicates that the market rate is less than the official rate; if more than 50% of the spread distribution is below zero, it has a negative bias.

Sterling overnight rates remained somewhat more volatile than comparable dollar and euro rates, although Charts 28 and 29 show that the difference has narrowed compared with recent years. However, volatility in sterling overnight interest rates is still undesirably large. The forthcoming money market reforms are designed to address this.

Forecasting the liquidity shortage

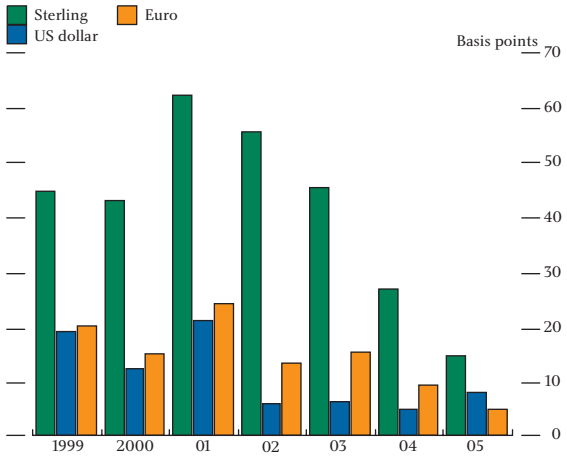
The accuracy of the Bank's liquidity forecast was better overall compared with previous quarters (Table C).

Chart 28
Overnight interest rates and policy rates



Sources: Bloomberg and Bank of England calculations.

Chart 29
Standard deviation of difference between official interest rates and overnight interest rates(a)



Sources: Bloomberg and Bank of England calculations.

(a) Overnight interest rates are SONIA for sterling, the Fed funds rate for US dollar and EONIA for euro.

A welcome development has been the low level of flows in the end-of-day schemes. Average daily payments in both the Bank of England Late Transfer Scheme (BELTS) and End-of-Day Transfer Scheme (EoDTS) have tended to be around or below £200 million, suggesting the CHAPS Sterling settlement banks are able to make more accurate forecasts of their end-of-day positions, consistent with fewer payments between banks towards the end of the trading day. The volatility of BELTS flows rose but declined for the EoDTS, although flows continued to be quite 'lumpy' (Chart 30).

Progress on money market reform

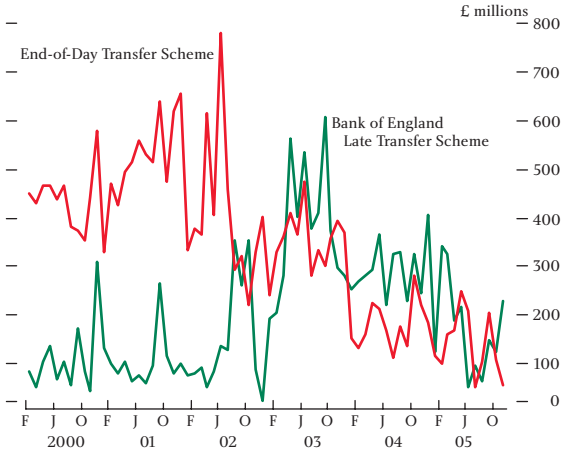
The final documentation for participants in the reformed framework was published on 31 October 2005.(1) These included the Eligibility Criteria, Terms and Conditions and Operating Procedures. The

Table C
Intraday forecasts versus actual liquidity shortages

Mean absolute difference, £ millions

	9.45 forecast	14.30 forecast	16.20 forecast
2002	83	43	30
2003	101	61	51
2004 Q1	120	79	55
2004 Q2	115	58	61
2004 Q3	89	62	52
2004 Q4	107	69	57
2005 Q1	117	87	63
2005 Q2	122	67	62
2005 Q3	199	78	52
Oct.-18 November	95	77	45

Chart 30
Bank of England Late Transfer Scheme and End-of-Day Transfer Scheme(a)



(a) Monthly averages.

documentation had previously been published, in draft form, in July and there were no substantial revisions in the final document. On 23 September, the Bank published a document entitled 'Near-term milestones and overall timetable'.(2) This aimed to provide participants with more information on the timetable for implementing the new system. The Bank still expects to launch the new system during the period March-June 2006.

The Bank's own preparations are continuing to progress well. Some of the main IT systems have completed trialling (ie for collateral management and for handling reserve balances). A number of reserve scheme banks have successfully connected to the Bank's real-time gross settlement system.

The numbers of banks and building societies expecting to participate in the reformed system has also been encouraging; prospectively between 40–50 reserve banks, 50–60 standing facility members and 20–30 open market repo operation counterparties. Trialling of standing facilities and repo operations will take place from December.

(1) www.bankofengland.co.uk/markets/moneymarketreform/051031full.pdf.
(2) www.bankofengland.co.uk/markets/moneymarketreform/smmreform050923.pdf.

Commercial bills at the Bank of England

The Bank began to discount bills in 1694, very shortly after its foundation. But from 17 August this year, commercial bills ceased to be eligible for use in the Bank's money market operations. Over the intervening 311 years the place of commercial bills in the Bank's activities had gone through many ups and downs.

Bills of exchange are negotiable instruments used particularly to finance trade. A seller of goods might draw a bill ordering the buyer of the goods to pay a sum of money at a point in the future — to the seller of the goods or to the bearer of the bill. If the buyer of the goods undertook to make that payment, by 'accepting' the bill, the seller of the goods might sell the bill in the money market, receiving payment straight away, while the buyer of the goods would have to pay up only later when the bill matured. As the bill passed from hand to hand in the market its creditworthiness might grow as successive sellers of the bill endorsed it, making themselves liable to later holders. The bill would trade more easily if it had been accepted by a bank on behalf of the buyer. It would then be a 'bank bill'. If accepted by a non-bank it would be a 'trade bill'. A bill of exchange might also be known as a commercial bill or an acceptance. A bank bill might also be called a banker's acceptance.

In the 18th century and through the Napoleonic Wars, discounting bills (buying them at a discount) was an important source of income for the Bank. In the 19th century, the 'bill on London' became the most important negotiable instrument in the world, being used to finance both inland trade and, increasingly, foreign trade. It remained significant into the early years of the 20th century. The law governing its use was codified in the Bills of Exchange Act 1882. The Treasury bill, a government liability and not a bill of exchange, had been introduced with the Treasury Bills Act 1877.

The scale of the Bank's bill discounting varied during this period, depending on the rate it applied and whether it was prepared to discount bills for bill brokers or only for ordinary Bank customers. Discounts did however peak at times of financial crisis. Only in 1890 did the Bank establish a discount mechanism as a means of controlling the market in normal times, when it granted discount facilities to the discount houses, the market-makers in bills.

The relationship with the discount houses continued, but the First World War (and indeed the Second War) saw such an increase in outstanding Treasury bills that from the 1920s to the early 1980s the Bank's use of commercial bills was very limited.(1) Low interest rates in the 1930s eroded the profitability of market-making in bills and the market was disrupted by wartime dislocation of trade. The Radcliffe Committee in its 1959 Report wrote of the 'irreversible shrinkage' in the relative supply of commercial bills. But as it turned out, the market revived to an extent during the 1960s, partly because bill finance was subject to less official restraint than other forms of lending.(2)

A more significant revival began in the early 1980s, when the Bank once again made extensive purchases of commercial bills. At that time the central government was draining cash from the money market by borrowing long-term to fund the Public Sector Borrowing Requirement which was then much greater than the central government's own needs.(3) Some of the cash was put back into the market when central government repaid most of its outstanding Treasury bills. But that still left the Bank needing to provide the market with a

(1) As noted in an article published in the December 1982 issue of the *Bank of England Quarterly Bulletin*, on the centenary of the 1882 Act, Coleby, A L, 'Bills of exchange: current issues in a historical perspective'.
(2) See 'The London discount market: some historical notes', *Bank of England Quarterly Bulletin*, June 1967, pages 144–56.
(3) The difference being sizable local authority and public corporation borrowing, other than from central government.

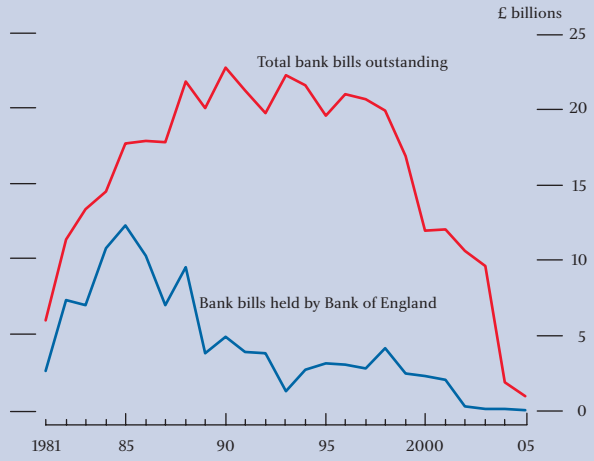
considerable amount of liquidity and to do so with an instrument other than the Treasury bill. A major part of the solution was to buy commercial bills — on such a scale that the Bank's holdings became known as 'the bill mountain'.

Initially the growth in outstanding bills went largely into the Bank's hands but then market holdings grew also (Chart A). The market was, however, still very much less significant than it had been in its heyday. It has been estimated that in the peak years of the 1860s, the value of bills drawn amounted to about 170% of net national income.(4) With an average maturity of around three months this would make the outstanding stock of bills equivalent to over 40% of annual net national income. In the 1980s and 1990s, the equivalent figure was 3%. By that stage the stock of bills in the market corresponded to only about 1½% of UK banks' sterling assets.

Official operations in such a small market were at times problematic. The market was easily cornered and partly for this reason the Bank encouraged the establishment of a gilt repo market and from March 1997 began to use gilt repo in its daily operations. Although bills could still be used alongside gilt repo, in practice their use began to fall as did the size of the bill market.

The decline slowed temporarily when the Bank allowed a wider range of bills to be used. The Bank had long had a list of requirements that a bill had to meet to be eligible for use in the Bank's operations. Some of these related to the maturity of the bill and to the accepting bank. But one was that the bill should identify the underlying transaction being financed, which was to be short-term, self-liquidating and not for

Chart A
Bills issued by UK resident banks



capital purposes. By 2000 the Bank had concluded that this 'clausing' did not add to the creditworthiness of the bill and dropped the requirement. One unintended effect of this was to make it easier for banks to draw bills on each other. Such 'bank-on-bank' bills came to form a significant part of the bill market. Because these bills were usable at the Bank they also counted towards banks' supervisory stock liquidity requirement.(5) However, the Bank prefers to provide liquidity to the banking sector against high-quality collateral in the form of claims outside the banking sector. Accordingly 'bank-on-bank' bills were made ineligible in 2003, and the decline in the bill market accelerated once more.

Although the change made this year is in a sense historic, experience suggests that central bank operations are best carried out using instruments that have a life and a market of their own. It is evident that the revival of the commercial bill in the 1980s and 1990s was not of this kind, but very dependent on the evolution of the Bank's own operations.

(4) Nishimura, S, *The decline of inland bills of exchange in the London money market 1855–1913*, Table 18.
(5) On the requirement see Chaplin, G, Emblow, A and Michael, I, 'Banking system liquidity: developments and issues', Bank of England *Financial Stability Review*, December 2000, especially Box 4 on page 101.

Introducing the Agents' scores

By Colin Ellis of the Bank's Inflation Report and Bulletin Division and Tim Pike of the Bank's Agency for the South East and East Anglia.

Each month, the Bank's twelve Agents make quantitative assessments of economic conditions as seen from their respective countries and regions. These scores provide numerical measures of the intelligence that the Agents gather from month to month, and cover some areas of the economy where there are no official statistics. The scores are also timely and some have a high correlation with subsequently published ONS data. As such, they can be useful indicators of the current economic conjuncture. This article examines the scores that have been used in the regular MPC process since 1997. From January 2006, the scores will be published on the Bank's internet site.

Introduction

The Bank of England has twelve regional offices, or Agencies. Their main function is to provide economic intelligence to the Monetary Policy Committee (MPC) ahead of its interest rate decision.(1) The Agencies have around 8,000 contacts drawn from the business community. Each month they talk to around 700 contacts, or about 60 per Agency, with a cross-section of companies in terms of sector, location and size, in order to get a reasonably balanced view of the latest economic developments. The specific details of the individual meetings and companies are confidential; the Agencies report inferences about the broader economy based on their discussions. The information has the advantage of being both timely and relevant to the current economic conjuncture. And because the Agents hold fairly lengthy discussions with their contacts, they can provide some real-world insight into recent developments. They also gather information on future prospects.

How the Agents inform monetary policy

There are two main channels by which information from the Agencies is passed on to the MPC. The first is through the Agents' regular presentations to the Committee at the monthly pre-MPC meeting with Bank staff. This meeting discusses the latest economic data ahead of the MPC's interest rate meeting: Lambert (2005) discusses the policy process in more detail. There are often two presentations from the Agency network: one giving a regular update on the economy over the past month; and the other on a topic of special interest, commissioned previously by the MPC.

The second channel is via a regular monthly economic report (MER) for each region. The MERs include assessments of the latest trends in output, demand, employment and costs and prices in the economy as seen from the respective regions. The twelve regional reports are distilled into a national summary, the *Agents' Summary of Business Conditions*, which is subsequently published alongside the MPC *Minutes*.(2)

The Agencies' MERs also include a statistical annex. This is made up of a series of scores, or quantitative judgements, for various economic factors. The scores have three main benefits. First, they are an attempt to quantify the intelligence that the Agencies gather from month to month in a systematic way. For example, the scores show whether the Agents believe that employment intentions have picked up or fallen over recent months. Second, they cover some areas of the economy where there are no official data. And finally, like the accompanying Agents' reports the scores are very timely — the MPC receives them ahead of official data and most business surveys.

From time to time, the number and definition of scores has changed as the Bank has reviewed their usefulness.

(1) See Eckersley and Webber (2003).
(2) These summaries are available on the Bank's website at www.bankofengland.co.uk/publications/agentssummary/index.htm.

At the time of writing, the Agencies provided 25 different scores each month on the following:

- Retail sales values
- Consumer services, professional and financial services, and other business services turnover (one score for each of the three categories)
- Manufacturing output for domestic and export markets (one score each)
- Construction output
- Investment intentions of manufacturers and service sector companies (one score each)
- Materials costs
- Costs of imported finished goods
- Total labour costs per employee in manufacturing and services (one score each)
- Manufacturers' domestic prices
- Retail goods prices
- Retail services prices
- Business to business services prices
- Pre-tax profitability in the manufacturing and service sectors (one score each)
- Recruitment difficulties
- Employment intentions in the manufacturing, business services, and consumer services sectors (one score for each category)
- Capacity constraints in the manufacturing and service sectors (one score each)

Most of the scores are based on an annual comparison of the most recent three months compared with the same period a year earlier. The exceptions are investment intentions, employment intentions, and capacity constraints, which are forward looking. However, all of the scores reflect the Agents' views over a few months, rather than a single month's meetings with contacts. So the scores try to track the underlying trend in economic factors, rather than more volatile movements from month to month. Some of the scores' definitions have changed slightly over time: for example, the 'recruitment difficulties' score was previously defined in terms of 'skill shortages'. But by and large, where the precise definitions have changed, there is normally some overlap between the old and new classifications.

The score for each economic indicator ranges from -5 to +5, with -5 typically denoting a rapidly falling level and +5 representing rapid growth. So a score of +5 for retail services prices would indicate rapid price inflation for those services. And a zero score for retail sales would indicate that the value of retail sales was thought to be broadly unchanged over the past three months compared with a year ago.

How the scores are created

Each month, the Agents and Deputy Agents in each region review the information they have gathered on economic conditions, and take a view on whether conditions have changed to an extent that warrants changing one of their scores. The individual judgements on what value to score are ultimately subjective ones, rather than being based on scientific models or methods. Instead, the scores are a simple way of translating the information from Agents' contacts into a quantitative assessment of the economy over time, as seen through the eyes of the Agents. Unlike data produced by the Office for National Statistics (ONS), the whole sample of companies on which the scores are based changes each month. In addition, the scores are not based on a mechanical method for taking into account the business size of the Agents' contacts, although the Agents do try to make the sample representative, and place more weight on larger firms.

It is important to note that the scores are not designed to be self-standing. Rather, they should be interpreted alongside the more detailed qualitative analysis of economic events, published each month in the *Agents' Summary of Business Conditions*.

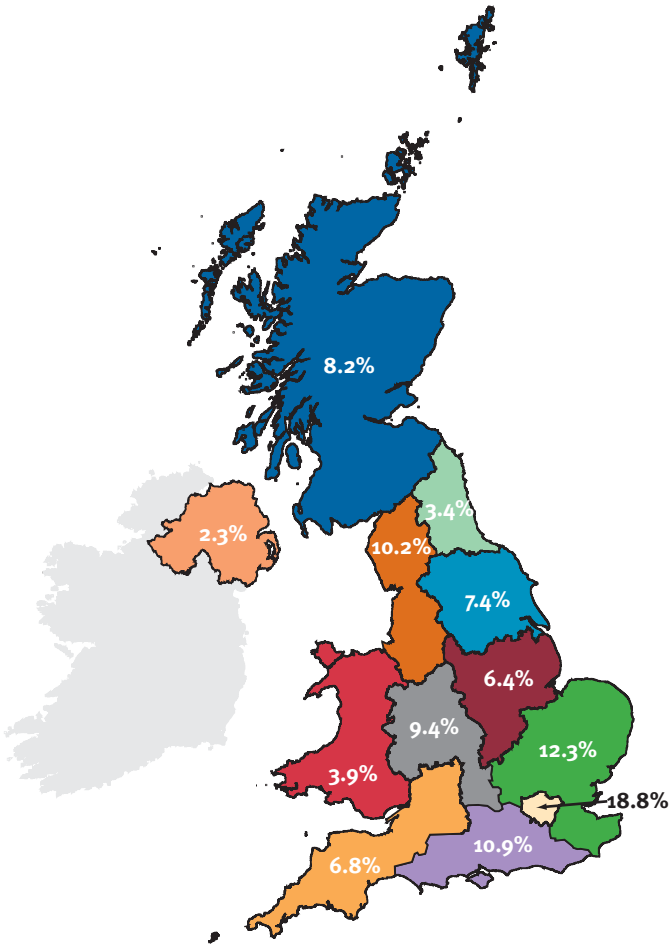
Aggregating the individual scores

In total, the Agencies send 300 scores to the Bank's head office each month. The individual scores from each Agency are then weighted together to produce a set of aggregate scores for the UK economy. The weights are based on the nominal share of Gross Value Added (GVA) in each country and region: these data are published annually by the ONS, so the weights can change from year to year.(1) Chart 1 shows the weights for 2002, the latest available at the time this article was finalised. So developments in Greater London (19% of GVA) have a much larger impact on the aggregate scores than those in Northern Ireland (2%). The analysis in this article is based on these aggregate scores for the economy as a whole.

The Agents' scores were introduced in the mid-1990s. But the data were first introduced into the regular MPC

(1) The Agents' regions do not match the broad ONS regional definitions, so county-level GVA data are required to construct the weights. These data are available on the internet at www.statistics.gov.uk/StatBase/Product.asp?vlnk=10904.

Chart 1
GDP weights in 2002 by Agency region



process in September 1997, soon after the MPC was given responsibility for monetary policy. Some of the scores, including those for capacity constraints, were introduced during 1998 and a few others, including the retail prices of goods and services, began in 2000. And in January 2005, a further set of changes were made, with the introduction of several new scores. So the back-run of data is shorter than for most surveys, particularly for some series. This limits the usefulness of any statistical analysis, as at most there are around eight years of data. From January 2006, each month the Bank will publish the aggregated Agents' scores, together with the back data for the series, on its website alongside the regular *Agents' Summary of Business Conditions*.(1)

Correlations with ONS data

How can we judge the accuracy of the Agents' scores? One way is to compare them to official data published by the ONS. However, this will not be a perfect test; for example, some ONS series may currently be mismeasured, and could be subsequently revised over time.(2) Furthermore, the match between some scores and ONS data is not perfect: they do not measure exactly the same thing. But comparing scores with ONS data can offer guidance on whether the scores are picking up the same broad trends in the economy.

Most of the scores are based on the Agencies' assessment of economic conditions over the past three months compared with those prevailing a year ago. So when comparing the scores to ONS data, it is sensible to look at both on a comparable basis.(3) In some instances, the Agents' scores appear to lead official data, for example in the case of investment intentions.

Table A shows the correlations for some of the Agents' scores with comparable ONS data.(4) The correlation coefficients show how closely together the scores and the ONS data move over time. A correlation of +1 indicates the series move in perfect lockstep together; a correlation of 0 indicates that movements in the series appear to be unrelated. The table also shows whether the Agents' scores 'lead' ONS data, based on the timing between the two series that yielded the highest correlation. For example, the highest correlation between ONS data on consumer services output and the Agents' score for consumer services turnover occurs between ONS data in the latest quarter and the Agents' score in the previous period: so on this basis the Agents' score 'leads' the official data by one quarter.

A number of the scores in Table A are highly correlated with official data, particularly those for material costs and retail sales values.(5) Yet while correlations summarise the relationship between the two series, it is also important simply to look at the data. Charts 2 and 3 show the Agents' scores for retail sales and materials costs, alongside the corresponding ONS series in Table A. Chart 2 shows that, while there is a relationship between the scores and the official data, the

(1) More detail on the definitions of the scores will also be available on the Bank's internet site.
(2) For example, see Castle and Ellis (2002). Note that the Agents' scores are not typically revised.
(3) By construction, the ONS series will be serially correlated, as discussed in Barnes and Ellis (2005). This must be borne in mind when interpreting the results presented in this article and the Agents' scores themselves.
(4) At the time this article was finalised, quarterly ONS data were generally only available to 2005 Q3, while some monthly data were published for October 2005.
(5) Note that several scores exhibit 'bias', so that a zero score from the Agencies does not correspond exactly to zero growth in official estimates. But positively correlated scores can still shed light on whether growth is rising or falling.

Table A
Correlations between ONS data and the Agents' scores

Agents' scores	ONS series[a]	Sample period[b]	Correlation	Leads
Manufacturing output				
Domestic	Manufacturing output, 3-on-12	July 1997–Sep. 2005	0.66	*0*
Export	Goods export volumes, 3-on-12	July 1997–Sep. 2005	0.52	*1*
Services turnover				
Consumer	Customer services output,[c] 4Q	1997 Q3–2005 Q3	0.51	*1*
Business	Business services output,[d] 4Q	1997 Q3–2005 Q3	0.66	*2*
Retail sales values	Retail sales values, 3-on-12	July 1997–Oct. 2005	0.76	*0*
Investment intentions[e]	Business investment, Q4	1997 Q3–2005 Q3	0.73	*2*
Employment intentions[f]	Private sector jobs,[g] 4Q	1997 Q3–2005 Q2	0.71	*0*
Materials costs	Manufacturing input prices, 3-on-12	July 1997–Oct. 2005	0.90	*0*
Manufacturers' output prices				
Domestic	Manufacturing output prices, 3-on-12	July 1997–Oct. 2005	0.72	*0*

(a) '3-on-12' denotes the percentage change over the past three months compared with a year ago, and '4Q' denotes the four-quarter percentage change. Where the correlations are based on quarterly data, the end-month score in each quarter has been used.
(b) The sample was adjusted for leads (quarters or months) where applicable.
(c) Defined here as the sum of distribution, hotels and catering and recreational and other personal services.
(d) Defined here as the transport and communications and business services and finance sectors.
(e) Weighted average of manufacturing and services scores, where the weights are based on business investment shares.
(f) Weighted average of sectoral scores, where the weights are based on Workforce Jobs data. Note that before 2005 this score reflected actual employment, rather than intentions.
(g) Defined here as whole-economy jobs excluding the public administration, health and education sectors.

series are more closely related in terms of turning points rather than the precise size of any pickup in sales growth. However, the relationship for materials costs is closer (Chart 3) — although, again, a 'no change' reading on the score does not appear to correspond to zero growth in the official data. There have been occasions when the material costs score has picked up more rapidly than ONS data, notably in 2002 and 2004. In part, this could reflect the fact that — unlike the ONS input price series — the score covers more than just the manufacturing sector. For example, it will also include the construction sector, where the CIPS survey suggests that input costs have risen rapidly in recent years.

Chart 2
Measures of retail sales values

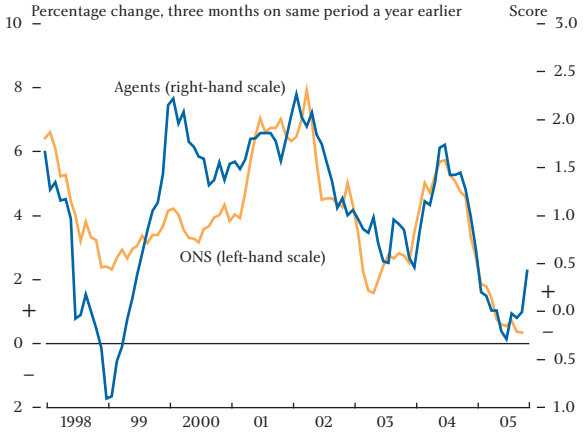
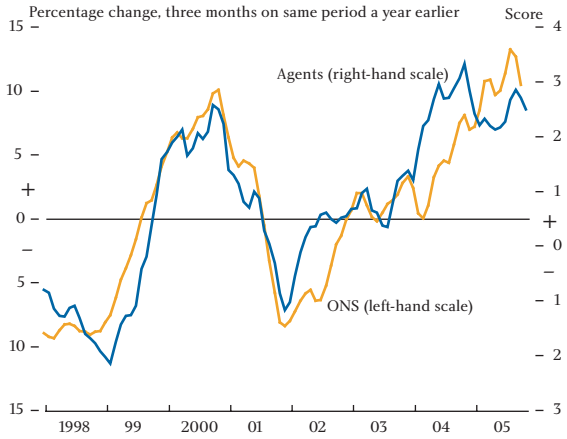


Chart 3
Measures of materials costs



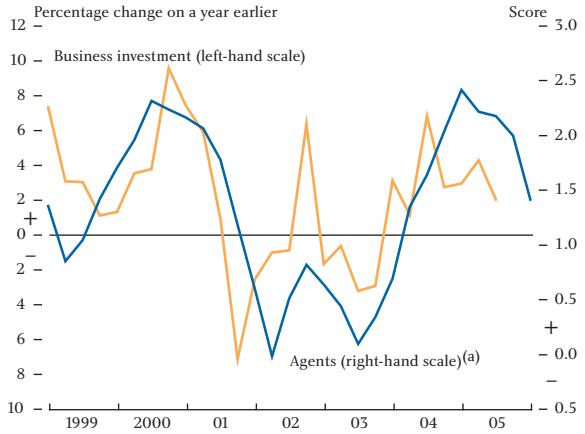
A few of the scores are most highly correlated when they lead the official data by one or two periods. In the case of business investment (Chart 4), that is unsurprising, given that the score should reflect investment intentions.(1) However, in other instances the lead between the score and ONS data is more puzzling — such as for business services output — though some business surveys also appear to lead ONS data.(2)

Chart 5 plots a combined score for the services, manufacturing and construction sectors against a measure of private sector output. This aggregated score is reasonably well correlated with the output data — the

(1) The manufacturing and services scores have been weighted together by sectoral investment shares.
(2) See Ashley *et al* (2005).

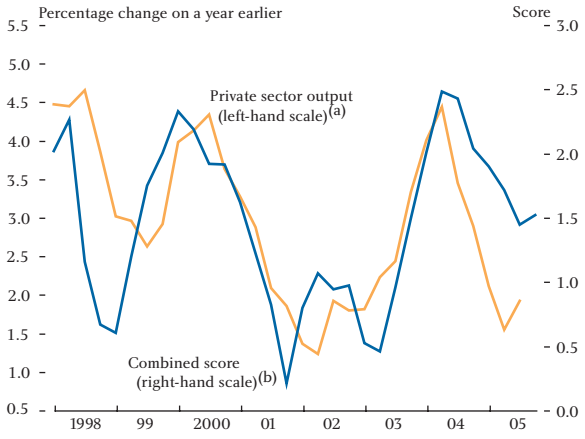
correlation is 0.60 over the sample shown. Given that the scores are available before the ONS data, this suggests they can generally be a useful guide to activity. In the recent past, the scores have suggested a less marked slowing in growth than ONS data.

Chart 4
Business investment and intentions



(a) Weighted average of manufacturing and services intentions, moved forward two quarters. The end-month score in each quarter is plotted, apart from the last observation, which is the score for November 2005.

Chart 5
Measures of private sector activity



(a) Defined as the sum of the manufacturing, construction and private services sectors.
(b) Services, manufacturing and construction scores, weighted by GDP shares. The end-month score in each quarter is plotted, apart from the last observation, which is the score for November 2005.

So far, we have examined those scores that are reasonably well correlated with ONS data. But it is worth noting that other scores are less well correlated with ONS data, as shown in Table B. In particular, the Agents' score on construction output is uncorrelated with official ONS data. And the scores for retail goods prices and retail services prices are negatively correlated with official estimates of inflation rates. These scores are therefore less likely to provide an accurate read on the corresponding official data. So far, we have been unable to explain these weak or contrary relationships.

Table B
More correlations between ONS data and the Agents' scores

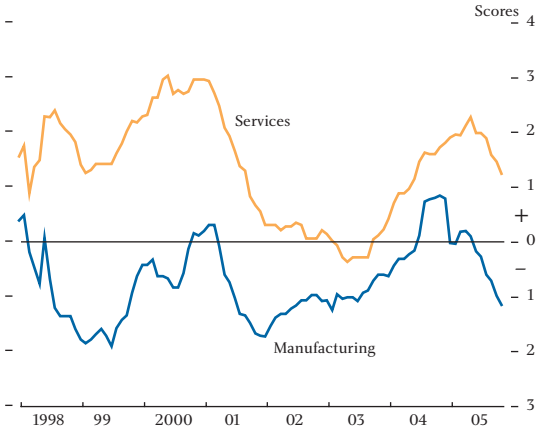
Agents' score	ONS series[a]	Sample period	Correlation
Construction output	Construction output, 4Q	1997 Q3–2005 Q3	–0.02
Retail goods prices	CPI goods prices, 3-on-12	May 2000–Oct. 2005	–0.29
Retail services prices	CPI services prices 3-on-12	May 2000–Oct. 2005	–0.15

(a) '3-on-12' denotes the percentage change over the past three months compared with a year ago, and '4Q' denotes the four-quarter percentage change. For construction, where the correlations are based on quarterly data, the end-month score in each quarter has been used.

Recruitment difficulties and capacity utilisation

Some of the scores relate to economic factors that are not measured by the ONS, such as recruitment difficulties and capacity utilisation. These two variables are of interest to the MPC, as they are the guides to the pressure of demand on potential supply, and hence underlying inflationary pressure, in the economy.(1) Charts 6 and 7 show the scores for capacity utilisation and recruitment difficulties.

Chart 6
Agents' scores for capacity constraints over the next six months(a)



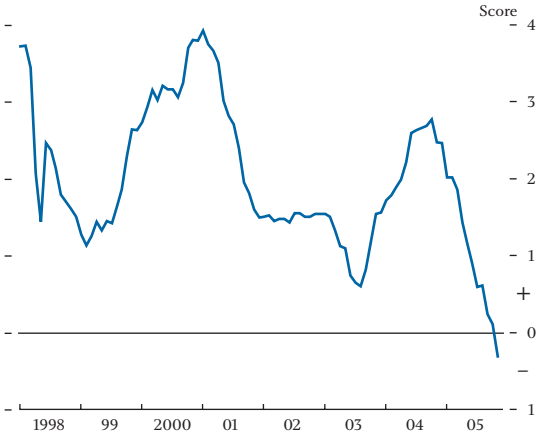
(a) Capacity utilisation relative to normal before January 2005.

However, we must be careful when interpreting these scores. The Agents themselves often comment that capacity pressures can be hard to judge, especially given that many firms are increasingly able to 'flex' capacity by changing shift patterns or using temporary workers. In recent months, the MERs have reported that many service sector firms face little or no capacity pressure. By and large, the exceptions are in one subsector,

(1) See the box on pages 24–25 of the February 2005 *Inflation Report* and the box on pages 28–29 of the May 2005 *Inflation Report*.

namely professional and financial services. The main capacity constraint for these companies is the lack of enough skilled workers to meet demand. And over the course of this year, the Agents' reports have noted that professional and financial service companies have found it hard to recruit suitable staff in the face of strong demand growth. So the positive capacity score for the service sector partly reflects developments in one component of the service sector, rather than more widespread capacity pressures. This illustrates that the scores should always be interpreted in the light of reading the *Agents' Summary of Business Conditions*.

Chart 7
Agents' score for recruitment difficulties(a)



(a) Skill shortages before January 2005.

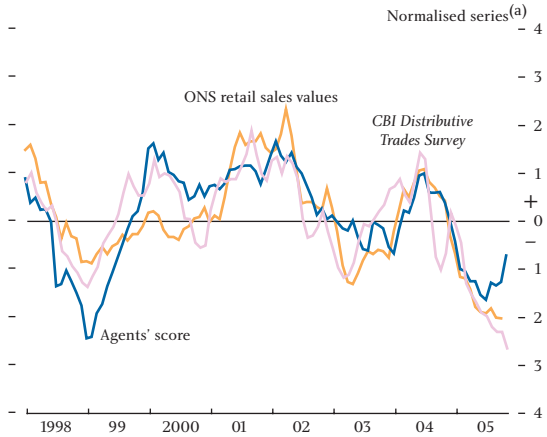
Further work on the scores

The scores provide additional information about the economy on top of official data. But in some instances, they track similar variables to some of the key economic surveys, such as the *CBI Distributive Trades Survey*. Do the scores perform as well as these surveys against ONS data?

Chart 8 shows official data on retail sales values, together with the aggregate Agents' score and the CBI survey. All three series have been adjusted to fit on one axis.(1) The chart suggests that the Agents' scores are as closely related to ONS data as the CBI survey.

We could replicate this analysis for other scores. But a better test would be to see if a combination of the Agents' score and survey data perform better than either the score or the surveys by themselves (see for example Ashley *et al* (2005)). That is an avenue for future work.

Chart 8
Measures of retail sales



(a) The average value of each actual series over the sample shown has been subtracted, and the result divided by the standard deviation of each actual series.

Conclusion

The Bank's twelve regional Agencies play an important role in informing monetary policy. Each month the Agencies report on economic conditions ahead of the MPC's interest rate decision, based on confidential visits with companies. As part of these regular monthly reports, the Agencies produce a set of 'scores'. These are numerical measures based on the intelligence the Agencies have gathered — they are the Agents' subjective judgements about economic conditions, based on meetings with contacts in their region. The scores try to track the underlying trend in factors such as output or employment intentions, rather than more volatile movements from month to month. Some of the scores correlate well with official data, such as materials costs and investment intentions, though others, such as those for the prices of retail goods and services, are less well correlated. Other scores cover areas of the economy where there are no official data. But the main advantage of the scores is that they are very timely. So they offer the MPC an early gauge on conditions in the economy before official data and most surveys are available. From January 2006, the Bank will publish the scores each month on its website, alongside the regular publication of the *Agents' Summary of Business Conditions*.

(1) This process is called 'normalisation': the average value of each series is subtracted from the observed data, and the resulting numbers are divided by the standard deviation of the (observed) series.

References

Ashley, J, Driver, R, Hayes, S and Jeffery, C (2005), 'Dealing with data uncertainty', *Bank of England Quarterly Bulletin*, Spring, pages 23–29.

Barnes, S and Ellis, C (2005), 'Indicators of short-term movements in business investment', *Bank of England Quarterly Bulletin*, Spring, pages 30–38.

Castle, J and Ellis, C (2002), 'Building a real-time database for GDP(E)', *Bank of England Quarterly Bulletin*, Spring, pages 42–49.

Eckersley, P and Webber, P (2003), 'The Bank's regional Agencies', *Bank of England Quarterly Bulletin*, Spring, pages 92–96.

Lambert, R (2005), 'Inside the MPC', *Bank of England Quarterly Bulletin*, Spring, pages 56–65.

Do financial markets react to Bank of England communication?

By Rachel Reeves of the Bank's Structural Economic Analysis Division and Michael Sawicki of the Bank's External Monetary Policy Committee Unit.

Communication by the Bank of England's Monetary Policy Committee (MPC) can convey information to market participants about the economic and policy outlook. In an inflation-targeting framework, clear communication by the central bank has an important role in explaining interest rate decisions and in helping to anchor inflation expectations. This article explores how financial markets react to different forms of communication by the MPC. The article finds that markets react to collective forms of communication such as the MPC Minutes *and* Inflation Report. *But reactions to what might be called individual forms of communication — speeches and testimony to parliamentary committees — are more difficult to discern. Compared with a similar study for the United States, the results for the United Kingdom are less pronounced.*

Introduction

In his speech 'Boring bankers: should we listen?' Richard Lambert (2004) highlighted the shift in recent years among modern central banks towards greater openness. And as Mervyn King (2000) notes, 'mystery and mystique has given way to transparency and openness'. Effective communication is important because it can help to anchor expectations around the inflation target and so help a central bank to achieve its objectives. Although central banks only set a short-term policy rate, policymakers want to shape expectations along the yield curve.

Previous Bank of England studies have investigated whether the move to inflation targeting in the United Kingdom has affected the reaction of financial markets to macroeconomic data releases and Bank of England policy announcements.(1) In this article, we investigate in more depth the extent to which financial markets respond to a wide range of communication tools used by the Monetary Policy Committee (MPC).

Specifically we look at:

- the *Minutes* of the monthly MPC meetings, published each month 13 days after the MPC interest rate meeting;
- the *Inflation Report*, published each quarter six days after an MPC meeting and which includes the MPC's projections for inflation and growth up to three years ahead;
- speeches given by MPC members; and
- evidence given to parliamentary committees (mainly the Treasury Committee).

We find that markets react to the publication of the MPC *Minutes* and the *Inflation Report*, suggesting that these forms of communication provide important information to market participants. We find that these two forms of collective communication typically provide more information to financial markets than individual forms of communication, such as speeches and evidence to parliamentary committees.

We focus on the reaction of financial markets not only on the days of communication, but also on periods as short as five minutes after communications, so as to capture their impact more clearly. We also control for other 'news' that affects financial markets — data releases and interest rate decisions. Again, this allows us to capture more effectively the reaction to communication.

(1) See, for example, Lasaosa (2005), Clare and Courtenay (2001), Haldane and Read (2000), Moessner, Gravelle and Sinclair (2005). More recently, Bell and Windle (2005) looked at market reactions to MPC policy decisions, as well as to the publication of the MPC *Minutes* and the *Inflation Report*.

Assessing the impact of communications

To test whether financial markets systematically react to MPC communication, we need to identify the part of the communication that is 'news' to market participants. We take two steps to extract this information:

- First, we isolate the impact of MPC communication on market prices from the impact of other news released on the same day. We do this by controlling for the impact of macroeconomic data releases and monetary policy decisions on asset prices. This is achieved by measuring the outturn relative to the market expectations for data releases and policy decisions implied by surveys.(1)

- Second, we relate the unexplained variance of market prices to communication. If MPC communication has an effect on financial market prices then the variance of those variables should be higher following communication than it would be at times without communication. We test for the impact of communication on financial market prices across different days by looking at the measured variance of asset prices on communication compared with non-communication days.(2)

To capture the impact of communication we look at daily data and also at short time periods following communication. Formally, we would expect the coefficients on communication events to be positive and significant in a regression of the form below:

$$\varepsilon_{jt}^{2} = \alpha_{j0} + \alpha_{j1}\, communication + \eta_{jt} \qquad \textbf{(1)}$$

where ε_{jt}^{2} are the squared residuals from the regression of yield changes of asset price j after controlling for monetary and macroeconomic surprises; *communication* captures individual communication events, such as the publication of *Minutes*, the *Report* and so on. The *communication* variables are set to one on the days of communication and zero otherwise. We compare the variance of asset prices on communication and non-communication days, both over the whole day and also for 5, 15 and 60-minute periods following communications.(3) We use data from June 1997 to December 2004 to test the impact of communication.

On some occasions, it is clear that MPC communications have moved market interest rates quite markedly. Two such examples were the publication of the February 1999 *Report*, and the *Minutes* of the October 2003 MPC meeting.

In February 1999, the MPC cut interest rates by a larger-than-expected 50 basis points. The February *Report* was published shortly after that policy decision and before the February *Minutes*. Publication appeared to have a large impact, as market participants updated their outlook for the path of interest rates. In October 2003, the split vote revealed by the MPC *Minutes* was seemingly interpreted by market participants as a trailer for the first rate increase in that tightening cycle. That increase materialised at the November 2003 meeting.

Charts 1 and 2 show a marked reaction to both of these communications. These charts plot the squared residuals from our regressions of changes in three-month interest rates implied by short sterling futures, described above.

The results are most striking with the intraday data, where few other spikes of a similar size are observed in the month around the communications. The results are less pronounced for daily data. This reflects other news — outside of the variables we are able to control for — also having an impact on market prices. Intraday data help us to isolate the impact of communication on financial markets more clearly.

The rest of this section discusses the results of our analysis in more detail. We look at four forms of communication: the MPC *Minutes*, the *Inflation Report*, speeches given by MPC members, and parliamentary testimony given by MPC members. Table A shows that the variance of three-month short sterling futures, a measure of volatility in the market, is higher on average on days when the *Minutes* and *Inflation Report* are published. It suggests that the variance does not increase on days of speeches and parliamentary

(1) We describe the macroeconomic data releases we control for, our methodology for controlling for them and the financial market prices we look at in Annex 1. We focus on our results for measures of three-month interest rate expectations, as this is where we would most directly observe a reaction to Bank of England communication.
(2) This follows the methodology of Kohn and Sack (2003) and has the advantage of not requiring any priors about whether particular communications will push interest rate expectations up or down.
(3) Note that for our intraday analysis we have one observation per day in our sample. We compare the 5 (or 15 or 60) minute interval following the communication with the same 5 (15 or 60) minute interval on non-communication days. For the *Minutes*, for example, we compare the 9.30–9.35 window on days of the *Minutes* publication compared to the 9.30–9.35 window on the other days in the sample.

Variance of three-month interest rates implied by short sterling futures on specific communication days

Chart 1
February 1999 *Inflation Report*

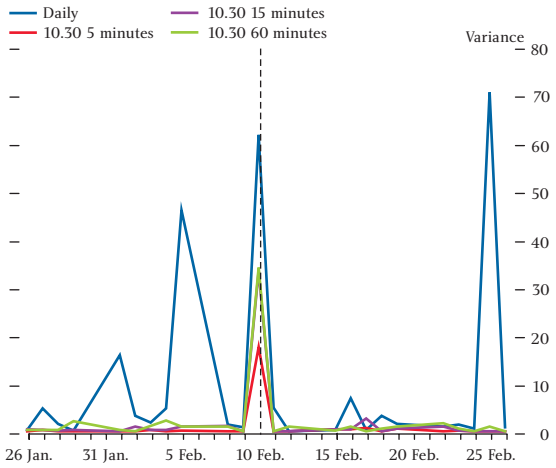
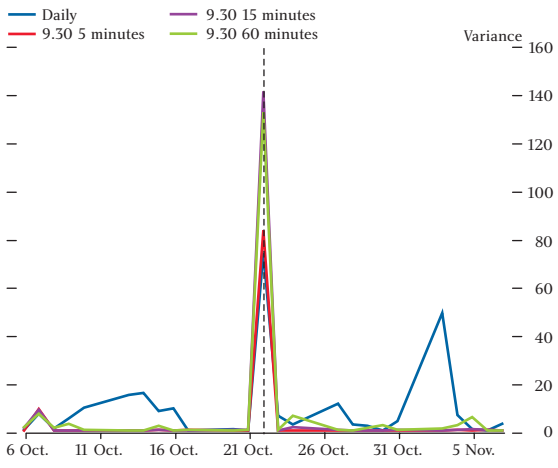


Chart 2
October 2003 *Minutes*



testimony. More detailed results are available in Annex 2.

MPC *Minutes*

The *Minutes* are the MPC's key vehicle for explaining the monthly policy decision. The *Minutes* set out the range of views of the Committee about the monetary policy stance, the risks surrounding that stance and the arguments underpinning the decision. They also reveal the individual votes by the MPC members. The *Minutes* are published at 9.30 am on the Wednesday 13 days after the interest rate decision.(1)

Our results suggest that markets react to the publication of the *Minutes*. Of the different forms of MPC communication the *Minutes* seem to have the greatest information content for financial market participants. Using daily data to compare days on which the MPC *Minutes* are published with all other days we find that publication increases the variance of three-month interest rates implied by short sterling futures. This result is statistically significant at the 5% level (Table A).

Using intraday data, we find much stronger results. Five, 15 and 60-minute price responses for interest rates implied by short sterling futures (at all maturities) suggest that the MPC *Minutes* increase the variance of market prices (Table A).(2) This increase remains significant when the largest ten responses are excluded (an indication of robustness). This provides further confirmation that the MPC *Minutes* systematically contain important information for market participants.

Financial market volatility varies over time. To reflect this we also look at a comparison of communication days against the previous five working days — thus potentially capturing the importance of trends in market volatility. Using this comparison, we find that the impact of the *Minutes* release becomes stronger and more significant for a number of measures of interest rate expectations extending along the yield curve

Table A
Impact of official communications on three-month interest rates implied by short sterling futures

Comparison of variance on communication and non-communication days (basis points squared)

	MPC *Minutes*		*Inflation Report*		Speeches		Parliamentary testimonies	
	Non-*Minutes* days	Increase in variance on *Minutes* days	Non-*IR* days	Increase in variance on *IR* days	Non-speech days	Increase in variance on speech days	Non-testimony days	Increase in variance on testimony days
Daily response	13.959	8.470**	14.280	2.007	14.308	0.051	14.407	-5.592
5-minute response	0.859	6.413***	0.170	6.502***	–	–	–	–
15-minute response	1.103	8.122***	0.384	10.424***	–	–	–	–
60-minute response	1.771	9.995***	1.033	14.785***	–	–	–	–

Table shows changes in the variance of the error term relative to the average for the entire sample. *** indicates significance at the 1% level; ** at the 5% level; and * at the 10% level.
Speeches are those given by Governors George and King, including speeches by Mervyn King when he was Deputy Governor.

(1) Before October 1998 the *Minutes* were published after a six-week lag.
(2) The results for long gilt futures are in Annex 2.

(Table A1 in Annex 2). This result confirms the importance of the *Minutes* in influencing market participants' near-term policy expectations. The impact at longer horizons suggests that the *Minutes* may also help market participants understand how policymakers interpret and react to information.

The move to a faster timetable for publication in 1998 has increased the impact of the *Minutes* on financial markets. In October 1998 the MPC began to publish the *Minutes* within two weeks of the policy meeting, as opposed to the previous delay of six weeks from when the meeting took place. This change means that the *Minutes* are now available ahead of the next MPC meeting. We find that the response to publication only becomes systematically significant after the timetable was shortened. This suggests that timeliness of communication is important for market participants.(1)

Inflation Report

The *Inflation Report* is the MPC's key quarterly publication. The *Report* contains projections for output growth and inflation, depicted as fan charts that portray the uncertainties around the Committee's central view. The publication of the *Report* is accompanied by an hour-long press conference with three senior Bank of England officials: the Governor, the Chief Economist, and the Executive Director for Markets.

As with the reaction to the *Minutes*, we find that the variance of implied rates from short sterling futures reacts positively and significantly in the 5, 15 and 60-minute intervals after the release. Again, this result is robust to excluding the largest individual responses. However, the market reaction tends to be less clear when looking at daily data. This reflects the volume of other 'news' that becomes available during the day. Overall, these results suggest that interest rate expectations respond to the publication of the *Report*, but that the response occurs in a short period around the time of communication. It is subsequently harder to detect the response using daily data (Table A).

The results for the MPC *Minutes* and *Report* are also illustrated in a stylised way in Charts 3 and 4. The blue bars show the average variance of three-month interest rates implied by short sterling futures on days without the release of either MPC *Minutes* or *Reports* respectively. The red bars show the positive incremental impact on the variance that we attribute to these communications.

Speeches

MPC members give speeches to set out their views of the economic outlook and to explain policy decisions. These potentially provide information for market participants. Since many speeches occur after the close of markets in the United Kingdom and market participants will react to wire service headlines which appear at other times, we only analyse the reaction to speeches using daily data. We find very little evidence of a market reaction to speeches (Table A). Narrowing down the set of speeches covered to those most directly related to monetary policy and the economic conjuncture has no material impact on the results. And

Variance of three-month interest rates implied by short sterling futures on communication days, compared to non-communication days

Chart 3
Minutes

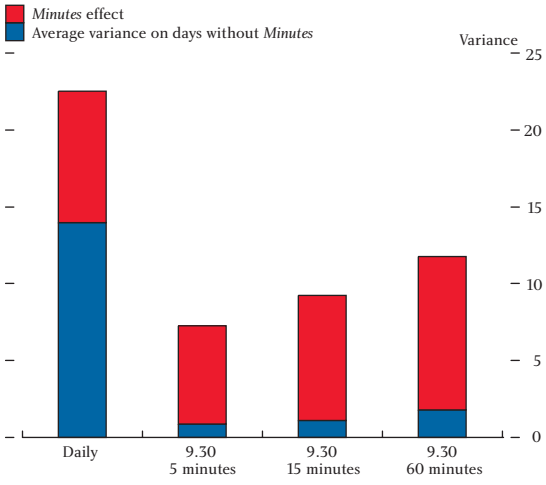
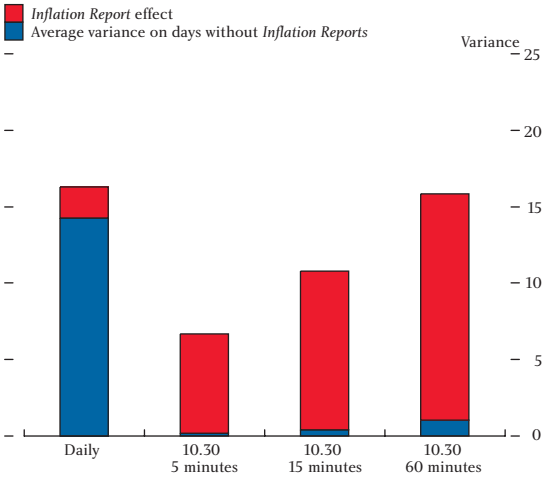


Chart 4
Inflation Report



(1) The results are available in Table A3 in Annex 2.

it makes little difference as to whether we consider the entire set of speeches by MPC members, or just those by the Governors.(1)

Testimony to parliamentary committees

The MPC regularly gives testimony to the House of Commons Treasury Committee after the publication of the *Inflation Report*. Evidence is also given to the Treasury Committee and to the House of Lords Economic Affairs/Monetary Policy Committee on other occasions.

Although an important part of the accountability of the MPC, the communications were not significant in terms of financial market reaction (Table A). The results for testimonies relating to the *Report* seemed weaker than for testimonies relating to other topics. This may not be surprising as the Treasury Committee hearings following the *Report* may not contain much incremental news relative to the *Report* itself. Overall the results suggest that the collective forms of communication — the *Minutes* and *Inflation Report* convey the most important information to financial markets.

Do market participants focus on particular summary statistics in the *Minutes* and *Inflation Report*?

In trying to form a view about the future direction of monetary policy, MPC watchers sometimes focus on the balance of votes on the MPC and on the shape of the inflation and growth projections presented in the *Report*. It could be that financial markets react to summary information contained in the MPC *Minutes* and *Inflation Report*, which act as a proxy for their news content. Does the voting record or the fan charts have any news content on top of what we have already observed?

A vote split among MPC members could be taken to represent greater uncertainty about the prospects for inflation or output growth. However, on occasions when the Committee was split, we could not systematically identify any greater variance in asset prices above that usually associated with publication. That might reflect market participants paying close attention to the *Minutes* as a whole, rather than a crude proxy for news. It might also reflect vote splits being non-trivial to interpret. As suggested by Lambert (2004), the voting record without the supporting paragraphs for the policy decision does little to explain the reasons for the decision.

For the *Report*, we tested summary statistics describing the shape of the inflation fan chart — the MPC's central projection for inflation and the balance of risks around that projection.(2) Again, we found no strong systematic impact on the market reaction over and above the usual reaction to the publication of the *Report*. Market participants may attach more significance to the supporting analysis in the *Report* and to the comments given during the press conference. No single crude proxy tells the story.

International comparisons

Our key finding is that there is a significant response of financial market prices to the publication of the MPC *Minutes* and the *Inflation Report*. These collective forms of communications appear systematically to contain news of interest to market participants. Our strongest results come from our intraday data; by contrast, in the daily data, it is harder to find evidence of the importance of communication. This suggests that set against the day-to-day volatility of financial market prices, official announcements account for relatively little of those movements.

Compared with international evidence, our results suggest that the response to Bank of England communication is less pronounced than the response to communication from the Federal Reserve. In their analysis of Federal Reserve communication, Kohn and Sack (2003) find a significant response of interest rate expectations to Federal Open Market Committee (FOMC) statements accompanying interest rate decisions and to FOMC Chairman Greenspan's testimony to Congress. Specifically, using daily data, Kohn and Sack find large increases in the variance of asset prices in response to communications. These increases are statistically significant at the 5% level, and extend out to two-year forward rates. Greenspan's testimony to Congress is found to be significant at the 1% level out to four years ahead. There are several possible explanations for the more significant results for the United States compared with the United Kingdom.

(1) By this, we mean speeches by Governors George and King, including speeches by Mervyn King when he was Deputy Governor.
(2) Specifically we tested whether there was any additional variance relating to the deviation of the modal inflation projection from target using constant and market interest rates; the width of the fan chart; the 'balance of risks' as evidenced by the skew in the fan chart; and the gradient of the inflation projection at the two-year horizon.

- First, all central banks have their own communication strategies, and so cross-country comparisons are difficult. Forms of communication that look similar might in fact serve different purposes. For example, there is no obvious US equivalent to the *Inflation Report*, which is one of the MPC's most important vehicles for communication. Similarly, the FOMC statements, which Kohn and Sack find have a significant impact on market prices above and beyond the policy decision itself, do not have a regular equivalent in the United Kingdom. Moreover, the biannual Congressional testimony in the United States is a more high profile news event than seemingly similar testimony in the United Kingdom, and so might receive more market attention. Our results for speeches — arguably the most comparable form of communication across countries — are in line with those of Kohn and Sack, where we, and they, do not find a significant response.

- Second, the Bank of England has an explicit and symmetric inflation target — the MPC only decides the manner in which the inflation target is met. By contrast, the Federal Reserve has more freedom to set its objectives as well as having control over the instruments of monetary policy. The volatility of US long bond yields, reacting to both data and communications, may be a reflection of investors revising their estimate of the implicit Federal Reserve inflation objective, as suggested by Gürkaynak, Sack and Swanson (2003). Correspondingly, our results for the United Kingdom suggest a more limited impact of communication on interest rate expectations beyond a one-year horizon.

- Third, MPC members are individually accountable for their votes, whereas the FOMC is more collegiate in style, with fewer dissenting voices. Therefore financial market participants could react more to communications from the FOMC, if they are taken to be more representative of a single prevailing view. The particularly strong US result for Congressional testimonies — which we do not pick up in the equivalent UK parliamentary hearings — might reflect a belief that the opinion of the Federal Reserve Chairman is particularly significant.

Ehrmann and Fratzscher (2005) compare the reaction of financial markets to communication from the Bank of England, European Central Bank and the Federal Reserve. They conclude that markets appear to react less to Bank of England communication than to communication from the other two central banks. However, their analysis exaggerates the difference between the impact of communication across countries. They focus on communication by individual members — speeches, interviews and testimonies — rather than the publication of collective communication, such as the *Minutes* and *Inflation Report*. For the Bank of England these latter publications are the most important forms of communication, as confirmed by our results. Further, because the vote at the policy meeting is revealed in the *Minutes*, market participants may gain a good understanding of the thinking of individual MPC members. Any subsequent speeches or interviews by MPC members may only expand slightly on known information.

Conclusions

Communication provides central banks with a means of explaining their decisions and thinking. This can be used to inform financial market participants about the economic and policy outlook. As such, communication offers an important avenue for policymakers to help investors understand their thinking. Communication complements the MPC's policy actions, by allowing some influence over expectations of interest rates beyond the immediate policy meeting.

Our analysis enables us to compare the impact of collective and individual forms of communication. Our use of intraday data also enables us to identify more accurately the impact of communication on financial markets than is possible with daily data.

Our strongest results are for the collective forms of communication — the *Minutes* and *Inflation Report*. The relatively strong impact on financial markets in response to these communications suggests that they contain significant information about the policy and economic outlook. By contrast, more individual forms of communication, such as speeches and parliamentary testimony, seem to convey rather less information to market participants.

Annex 1
Data processing and data description

Controlling for macroeconomic data releases and interest rate decisions

We control for data releases and interest rate decisions when measuring the impact of communication on financial markets to better identify the impact of communication. Market participants form expectations in advance for what they expect the data release or interest rate decision to be, and we would expect the surprise in the data relative to agents' expectations to move market prices. Controlling for data releases is particularly important because the publication of the *Minutes* and *Report* very often occur on the same day as UK labour market data are published. We label the surprise component of the *i*th macroeconomic release $mac^u_{i,t}$. To make the regression coefficients comparable across indicators, we standardise the surprises by their sample standard deviation for each macroeconomic series:

$$mac^u_{i,t} = (A_i - E_i)/\Omega_i \qquad \textbf{(A1)}$$

where A_i is the announcement value of the data, E_i is the expectation of the announcement and Ω_i is the sample standard deviation of surprises. Each $mac^u_{i,t}$ is set to zero on days where there is no data release for that macroeconomic indicator. Similarly, $baserate^u_t$ is our standardised monetary policy surprise variable.

We allow the change in each of the asset prices j under investigation — labelled Δy_{jt} — to respond to the unexpected component of the monetary policy decision and macroeconomic data surprises i, as per regression **(A2)** below:

$$\Delta y_{jt} = \beta_{j0} + \beta_{j1} baserate^u_t + \sum_{i=2} \beta_{ji} mac^u_{i,t} + \varepsilon_{jt} \qquad \textbf{(A2)}$$

For both our daily and intraday data, each regression contains one observation per working day over the sample. Correspondingly the intraday series, Δy_{jt} measures the x-minute reaction in yields or prices starting from the communication time. We estimate our regressions by OLS.

In controlling for UK and US macroeconomic surprises in daily data, we chose the subset of surprise variables that were significant at the 10% level in either the three-month short sterling regression, or the one to two-year forward rate regression. From UK data, this included releases of: average earnings/unemployment, first and second releases of GDP, industrial production, retail sales, RPI/RPIX; from US data, this comprises: consumer confidence, the first release of GDP, the Institute for Supply Management (ISM) index, non-farm payrolls and retail sales.

For intraday windows around 9.30, we also include trade data, the third release of GDP, provisional M0, provisional M4, PSBR, and producer prices — all significant at least at the 10% level in explaining the price response of short sterling or long gilt futures. As none of these data releases occur at 10.30, we do not include any surprise variables for intraday windows around the 10.30 release time.

Our macroeconomic surprise variables are constructed using data for expectations as calculated by Money Market Services International; and from September 2003 to December 2004, from Bloomberg.(1) For monetary policy surprises we use mean survey expectations derived from Reuters economists' polls.

Financial markets data

Our daily data consists of:

- three-month forward interest rates at constant three, six and twelve-month maturities implied by short sterling futures contracts;(2)
- ten-year spot yields from a yield curve fitted to risk-free government securities;

(1) We switch surveys owing to data limitations: Money Market Services (MMS) data for survey expectations are not consistently available after September 2003, but typically have longer historic backruns. However, the Bloomberg poll surveys a similar group of economists, and is similar in the available back data.
(2) These are calculated from intraday short sterling data provided by Euronext.liffe.

- implied forward interest rates: respectively one to two, two to three, three to four, and four to five-year forwards; and
- the ten-year instantaneous forward rate.

Our intraday data covers the prices of implied three-month forward interest rates at three, six and twelve-month constant maturities.

Annex 2
Results tables

Table A1
Impact of official communication in daily data

		Increase in Var(ε) due to: MPC *Minutes*		*Inflation Report*		Parliamentary testimonies (all)		Speeches (EG & MK)	
	Var(ε) on non-communication days:	Relative to full sample	Relative to week before	Relative to full sample	Relative to week before	Relative to full sample	Relative to week before	Relative to full sample	Relative to week before
Short sterling futures:									
Three-month	13.984	8.470**	10.574**	2.007	5.252	-5.592	-6.088	0.051	0.073
Six-month	24.754	9.687	11.853**	3.216	10.211	-4.095	-4.526	1.608	3.036
Twelve-month	36.578	13.209	15.772*	-3.834	2.135	0.491	4.594	3.786	7.084
Government forward rates:									
One to two-year	29.585	10.342	14.896*	-6.238	-2.674	3.753	7.207	5.183	5.984
Two to three-year	28.783	4.657	9.806*	-6.590	-4.316	-4.050	-1.273	2.698	1.780
Three to four-year	28.791	2.885	8.277	-5.163	-5.009	-6.003	-1.618	-0.702	-3.978
Four to five-year	29.473	4.282	9.710*	-2.119	-3.588	-4.927	0.358	-3.361	-7.236
Instantaneous ten-year	23.966	10.062*	12.506**	10.412	12.127	10.231	16.072*	-4.313	-2.553

Table shows changes in the variance of the error term relative to the average for the entire sample, or the variance in the five days preceding the official announcement. *** indicates significance at the 1% level; ** at the 5% level; and * at the 10% level based on a t-statistic of the single restriction for the significance of the dummy regression. Full set of test statistics available from the authors on request.

Table A2
Impact of official communication in intraday data

		Increase in Var(ε) due to MPC *Minutes* (9.30 am)			Increase in Var(ε) due to *Inflation Report* (10.30 am)	
	Var(ε) on non-*Minutes* days:	Relative to full sample	Relative to week before	Var(ε) on non-*IR* days:	Relative to full sample	Relative to week before
Three-month short sterling futures:						
5-minute response	0.859	6.413***	6.450***	0.170	6.502***	6.523***
15-minute response	1.103	8.122***	8.090***	0.384	10.424***	10.458***
60-minute response	1.771	9.995***	9.893***	1.033	14.785***	14.995**
Six-month short sterling futures:						
5-minute response	1.166	8.632***	8.500***	0.302	9.593***	9.668***
15-minute response	1.689	11.637***	11.504***	0.632	14.366***	14.544***
60-minute response	2.942	14.449***	14.410***	1.675	23.405***	23.753***
Twelve-month short sterling futures:						
5-minute response	1.104	6.749***	6.723***	0.234	8.878***	8.845***
15-minute response	1.846	13.270***	13.348***	0.631	18.310***	18.396***
60-minute response	3.778	15.895***	16.214***	2.330	28.152***	28.558***

Table shows changes in the variance of the error term relative to the average for the entire sample, or the variance in the five days preceding the official announcement. *** indicates significance at the 1% level; ** at the 5% level; and * at the 10% level based on a t-statistic of the single restriction for the significance of the dummy regression. Full set of test statistics available from the authors on request.

Table A3
Impact of shortened publication schedule on the response to MPC *Minutes*

Increase in Var(ε) due to the publication of the MPC *Minutes* published with a lag of:

	Six weeks (June 1997 – September 1998)	Two weeks (October 1998 – December 2004)
Three-month short sterling futures:		
5-minute response	10.559	5.513***
15-minute response	9.336	7.851***
60-minute response	14.212	9.077***
Six-month short sterling futures:		
5-minute response	12.810	7.687***
15-minute response	11.625	11.617***
60-minute response	17.004	13.892***
Twelve-month short sterling futures:		
5-minute response	5.579**	6.958***
15-minute response	12.572	13.366***
60-minute response	18.733	15.273***

Table shows changes in the variance of the error term relative to the average for the entire sample. *** indicates significance at the 1% level; ** at the 5% level; and * at the 10% level.

References

Bell, J and Windle, R (2005), 'Monetary policy news and market reaction to the *Inflation Report* and MPC *Minutes*', *Bank of England Quarterly Bulletin*, Summer, pages 169–78.

Clare, A and Courtenay, R (2001), 'Assessing the impact of macroeconomic news announcements on securities prices under different monetary policy regimes', *Bank of England Working Paper no. 125*.

Ehrmann, M and Fratzscher, M (2005), 'Central bank communication: different strategies, same effectiveness?', *European Central Bank Working Paper no. 05-488*.

Gürkaynak, R S, Sack, B and Swanson, E (2003), 'The excess sensitivity of long-term interest rates: evidence and implications for macroeconomic models', *Federal Reserve Board Finance and Economics Discussion Series 2003-50*.

Haldane, A and Read, V (2000), 'Monetary policy surprises and the yield curve', *Bank of England Working Paper no. 106*.

King, M (1997), 'The inflation target five years on', lecture delivered at the London School of Economics, 29 October 1997.

King, M (2000), 'Monetary policy: theory in practice', address to the American Economic Association and the American Finance Association, 7 January 2000.

Kohn, D and Sack, B (2003), 'Central bank talk: does it matter and why?', *Federal Reserve Board Finance and Economics Discussion Series 2003-55*.

Lambert, R (2004), 'Boring bankers — should we listen?', *Bank of England Quarterly Bulletin*, Summer, pages 241–49.

Lasaosa, A (2005), 'Learning the rules of the new game? Comparing the reactions in financial markets to announcements before and after the Bank of England's operational independence', *Bank of England Working Paper no. 255*.

Moessner, R, Gravelle, T and Sinclair, P (2005), 'Measures of monetary policy transparency and the transmission mechanism', in Mahadeva, L and Sinclair, P (eds), *How monetary policy works*, Routledge.

Financial stability, monetary stability and public policy

By Chay Fisher, System Stability Department, Reserve Bank of Australia[1] and Prasanna Gai of the Bank's Systemic Risk Assessment Division.

The interplay between financial and monetary stability has received considerable attention in recent times, from policymakers and academics alike. This article reviews the broad themes that have emerged in the recent literature and highlights several key issues that merit attention by researchers. In particular, the optimal combination of instruments designed to achieve these twin goals of policy simultaneously remains a relatively underexplored area of research.

Introduction

Maintaining financial and monetary stability are two key concerns of public policy, and it is recognised that significant welfare costs can arise from a failure to do so. But are these twin goals — and the policies used to pursue them — mutually reinforcing? And under what circumstances, if any, might they conflict? What does this imply for the conduct of public policy, both within and outside central banks?

Such questions have received increased attention over recent years, partly because of a perception that the potential of financial instability has increased at a time when many countries appear to have secured monetary stability.[2] The debate has also been reinforced by institutional changes within central banks, where the long-standing concern for overall financial stability has, in many cases, become more explicit.

One view of the relationship between monetary and financial stability is that policymakers in each sphere should concentrate on achieving their individual goals, treating developments in the other merely as an input into the decision-making process. An alternative view, however, is that a combination of initiatives, encompassing both monetary policy and financial stability instruments, may be able to achieve better outcomes in both and, as such, would be welfare enhancing.[3]

But understanding the complex interplay between the twin goals of central bank policy is by no means an easy task. A key problem is the difficulty in defining the concept of and instruments used to achieve financial stability. Haldane *et al* (2004) propose that financial instability introduces deviations from the optimal saving and investment plan of an economy due to imperfections in the financial sector.[4] On this broad definition, a wide range of instruments might be considered by policymakers, not all of which lie in the compass of the central bank.

In contrast, the central tenet of monetary stability — to maintain a low and stable (positive) rate of goods and services price inflation — is more widely agreed, as are the instruments with which to achieve it.[5]

This article proceeds by considering the potential influence — both positive and negative — of monetary policy on financial stability, and *vice versa*. We then highlight some alternative policy options for dealing with financial imbalances put forward in the literature, and a final section concludes.

Monetary policy and financial imbalances

Successful monetary policy tends to support financial stability, in part, by helping remove the distortions in price signals associated with high and volatile inflation. These distortions can lead to an intertemporal

(1) This article was written while Chay Fisher was on secondment at the Bank of England.
(2) For example, see the discussion in Crockett (2003).
(3) See, in particular, Borio and White (2004).
(4) Although this article proceeds with that definition in mind, a number of alternatives exist. See Houben *et al* (2004) for a survey.
(5) The precise institutional frameworks differ across countries, however, and debate continues on various aspects. For example, Cecchetti and Kim (2003) examine the case for targeting the path of the price level, rather than the rate of inflation.

misallocation of resources and a build-up of imbalances in financial balance sheets that can sow the seeds of crisis.(1) Price stability has, therefore, often been thought of as a necessary (but not sufficient) condition for promoting financial stability.

Conversely, the failure to maintain low and stable inflation — or otherwise conducting monetary policy that is in hindsight too loose — can conflict with the aims of financial stability policy. One example is the Nordic banking crises in the late 1980s and early 1990s, where Drees and Pazarbasioglu (1998) argue that monetary conditions were not tightened either by enough or in a timely manner and, thus, contributed to the build-up of financial imbalances.(2)

In an environment of high inflation, it is also possible that a rise in real interest rates designed to lower inflation could act as the *trigger* for an unwinding of financial imbalances and, as borrowers' balance sheets come under pressure, a period of financial distress.(3) The transition may prove particularly difficult for banks that have adapted their businesses to a high inflation environment, especially if it exposes previous shortcomings in risk management.(4)

But perhaps of more interest in the current low inflation environment is a situation where monetary policy is successful in achieving its aims (ie price stability), yet still might conflict with (future) financial stability by facilitating the conditions for financial imbalances to develop.(5) Recently, some commentators — including Borio and Lowe (2002), Borio and White (2004) and Goodfriend (2003) — have suggested that such a situation could arise because of a so-called 'paradox of credibility'. The paradox is that the success of central banks in reducing inflation expectations may have introduced stickiness in prices, which might mask the build-up of imbalances in the real economy. If the signal from consumer prices is weakened, monetary policy may be slower to respond to emerging imbalances and unwittingly contribute to the conditions for financial instability.

Amato and Shin (2004) present a theoretical analysis of the interaction between inflation expectations and firms' price-setting behaviour that highlights conditions under which aggregate prices may not be a reliable indicator of imbalances in the real economy. They show how, in a competitive environment, public information 'crowds out' private information so prices might not respond to underlying fundamentals, as reflected in firms' marginal cost. Moreover, if the central bank is credible, beliefs may become centred around the inflation target so, again, prices may not respond to marginal cost pressures. But while the potential for a paradox makes intuitive sense, the circumstances under which it compromises the signals from goods and services inflation have yet to be established empirically.

The accumulation of financial imbalances in an environment of low and stable inflation — whether or not because of a paradox of credibility — raises questions about whether public policy can do more to prevent their build-up.(6) A series of recent papers highlights the benefits and potential costs of using monetary policy in such a proactive manner. Broadly speaking, the protagonists are often characterised as split into two camps, though the distinction is often blurred and the differences in policy prescriptions are sometimes subtle.

On one side of the fence are those who argue that an explicit proactive response to financial imbalances is neither desirable nor feasible. There are a number of practical concerns that have been raised — and well documented elsewhere — including the following five issues.

First, intertemporal distortions cannot be identified with enough accuracy to guide a monetary policy response. For example, asset price misalignment and the financial imbalances it engenders are inherently difficult to identify at the time and their existence is often only clear with the benefit of hindsight.(7) Gruen *et al* (2005) argue that formulating an appropriate policy response to an asset price bubble

(1) Such episodes, which include so-called 'asset price bubbles' and periods of excessive lending by banks are documented in Borio and Lowe (2002).
(2) Posen (2003), however, questions the causal link between asset price misalignments and indicators of loose monetary policy across a number of OECD countries.
(3) On the other hand, if the central bank adopts a more expansionary stance of monetary policy than justified by the inflation outlook, for fear of triggering a financial crisis, it might facilitate the conditions that could lead to a worse crisis in the future.
(4) Lindgren *et al* (1996) identify a significant reduction in inflation as a factor in 21 of 36 episodes of financial instability they examine.
(5) Notwithstanding Posen's findings, it seems reasonable to suggest that monetary policy mistakes are more likely to conflict with financial stability.
(6) Although many papers focus on asset prices more narrowly.
(7) Greenspan (2002) is often cited in support of such an argument, with reference to the US share market bubble of the late 1990s.

depends on knowledge of the stochastic properties of the bubble, and the associated information requirements may be prohibitive.

Second, it is likely to be very difficult to calibrate the size of a proactive monetary policy reaction. Bean (2003) and Greenspan (2002), among others, argue that the size of an interest rate rise needed to burst an asset price bubble may be so large that it could lead to a significant economic downturn.

Third, the appropriate timing of a proactive monetary response is difficult to determine. In their asset price bubble example, Gruen *et al* (2005) suggest that a condition under which a proactive response is plausible includes a situation where the bubble is unlikely to burst of its own accord over the monetary policy horizon, otherwise the policy prescription would be to lower rates to offset the impact of the predicted downturn. But, given the lags in the impact of monetary policy, a proactive response to a bubble is unlikely to be plausible.

Fourth, political economy constraints would need to be overcome if the central bank were to raise interest rates in the absence of obvious near-term inflationary pressures. Although, Borio and White (2004) argue that these 'while serious, …are not immovable'.

The fifth concern is the potential moral hazard risk of a systematic proactive response of monetary policy to financial imbalances. For example, Ferguson (2003) argues that investors may undervalue the risks they take on if they expect that the central bank will invariably act to offset future financial stability concerns.(1)

The policy prescription that often flows from these concerns is that central banks should only react to asset prices and financial imbalances to the extent that these affect the outlook for future inflation and output.(2) Therefore, monetary policy should instead be directed at alleviating the fallout of financial imbalances and instability — notwithstanding the moral hazard implications of such an approach.

In the other broad camp are those who argue that the potential costs of financial instability are large enough to warrant a more proactive approach to monetary policy.(3) Prominent advocates of early monetary policy action include Borio and Lowe (2002), Bordo and Jeanne (2002), Dupor (2002), and Cecchetti *et al* (2000),(4) who argue that central banks should 'lean against the wind' of emerging financial imbalances by raising interest rates to reduce the probability of costly financial instability in the future. Such a strategy can be likened to taking out insurance, with the insurance premium being slower output growth in the near term (Bordo and Jeanne (2002)).

Those in favour of a proactive monetary policy response typically acknowledge the difficulties noted above but, naturally, offer counter-arguments. In particular, on measurement and identification — perhaps the key objections to proactive monetary policy — there are at least two retorts. First, measurement difficulties ought not to stand in the way of attempting to incorporate the information in the monetary policy decision, especially since many other common inputs — such as the output gap — are also very difficult to measure (Cecchetti *et al* (2000)).(5) Second, there have been some recent advances in techniques aimed at predicting financial vulnerability. Borio and Lowe (2002) and (2004), using a 'signalling' framework, suggest that cumulative processes of credit, asset prices and investment provide 'reasonably strong circumstantial evidence that useful *ex-ante* indicators of financial vulnerability can be constructed'.(6) But, as the authors themselves acknowledge, much remains to be done in this area.

In terms of the monetary policy framework, some in the 'proactive camp' argue that a flexible inflation-targeting framework is sufficient, emphasising the importance of greater flexibility in the forecast horizon. Bean (2003) makes a similar point. An additional explicit reference to financial imbalances is not necessary because a sufficiently flexible, forward-looking inflation-targeting framework is able to take into account the impact of potential financial instability on future inflation and output.

(1) Filardo (2004) notes the potential trade-off between the moral hazard cost and the potential macroeconomic cost of central bank inaction.
(2) See, for example, Bernanke and Gertler (1999) and Ferguson (2003). But, even so, the predictive power of asset price changes is not clear. See Stock and Watson (2003) and Clews (2002) for a UK perspective.
(3) See Hoggarth and Saporta (2001) for estimates of the cost of financial instability.
(4) See also Kent and Lowe (1997).
(5) Others disagree — Gertler (2003), for one, suggests that the analogy is 'dead wrong'.
(6) Borio and Lowe (2002). Gertler (2003) offers a critique of their techniques. And see Bell and Pain (2000) for a general review of leading indicator models of financial distress.

Although proposals for the underlying policy *framework* appear similar, where opinion seems to differ is on the relative weight that should be given to potential financial instability within that framework. That, in turn, is likely to be influenced by judgements of the relative costs of policy mistakes and attitudes to policymaking in the presence of uncertainty. On the former, there is an argument that the impact of policy mistakes may be asymmetric and that the cost — in terms of lost output — of tightening policy under the mistaken belief that unsustainable financial imbalances are developing may be lower than not acting and letting a boom-bust cycle run its course (Borio and Lowe (2002)). Possible changes in the dynamics of the economy — brought about by financial liberalisation and (credible) monetary policy focused on price stability — may also warrant greater attention to financial imbalances (Borio and White (2004)).

While there is general acceptance that financial instability is costly, there is little evidence against which to assess the costs and benefits of alternative policy actions. This is because of the absence of counterfactual episodes and appropriate models with which to assess the welfare effects; an important area of further research effort.(1)

A more formal way of analysing the relative weight that should be given to financial imbalances is beginning to emerge in the literature on monetary policy and 'extreme events'. This work aims to shed light on the optimal monetary policy response to low-probability, high-impact events, of which the bursting of an asset price bubble can be seen as an example.(2) Svensson (2003) shows how the optimal policy response to extreme events depends on the precise specification of the policymaker's loss function. At one end of the spectrum, if the central bank operates according to certainty equivalence (as with a quadratic loss function) it will act to offset the (probability-weighted) average size of the shock, implying a high probability that actual inflation will undershoot the inflation target. At the other end of the spectrum, if the central bank operates according to a 'perfectionist' loss function (hitting the target exactly), it will completely ignore low-probability shocks.

In the absence of more formal models, researchers often appeal to case studies. The problems in Japan following the share market and property price cycle in the late 1980s are sometimes cited as an example of both a situation where asset price bubbles can develop in a low inflation environment, and where policymakers should have paid more attention to developments in asset markets. Cecchetti *et al* (2000), for example, note that '…Japan's experience suggests that a single-minded focus on narrowly defined inflation may not always provide the best guide to monetary policy'. But Goodfriend (2003) and Posen (2003) take an alternative view, arguing that, although Japanese monetary policy should have indeed been tighter in the late 1980s, higher interest rates were justified by reference to more traditional indicators of inflationary pressure alone, so the policy mistake was not caused by lack of attention to asset prices.(3)

Bergman and Hansen (2002) attempt to assess empirically the interaction between financial stability and monetary policy in Sweden. They incorporate indices of financial distress into a vector autoregressive (VAR) framework with output, prices and interest rates (and further extended to include the ratio of credit to GDP). In the four-variable VAR, the authors find that price shocks have a more pervasive impact than interest rate shocks on financial instability, but suggest that 'monetary policy has contributed to aggregate financial instability throughout our sample'.(4) In their analysis, contractionary monetary policy acts as a shock that motivates financial instability, but it is also possible that previously loose monetary policy helped sow the seeds for future distress (see Drees and Pazarbasioglu (1998)).

Influence of financial stability policy on monetary stability

Financial stability policy has the potential both to support and to complicate monetary stability through its interaction with both the goals of monetary policy and the capacity to implement a policy change. Unlike monetary policy, financial stability policy in many countries involves the financial regulator, the central bank and the fiscal authority. Each authority can have different objectives and different instruments with which to meet them. Ensuring financial stability —

(1) See Haldane *et al* (2004) for a discussion and application of some models aimed at tackling this issue.
(2) Filardo (2004) offers an alternative perspective that explicitly recognises model uncertainty and in which policymakers use a mini-max criterion, ie they seek to minimise the maximum possible loss to society.
(3) Okina *et al* (2000) suggest, however, that the spurt of inflation may have been due to a tax-induced one-off adjustment in the price level.
(4) Their results are sensitive to both the measure of financial distress and inclusion of the credit to GDP ratio.

promoting the optimal savings-investment plan for the economy as a *whole* — therefore requires considerable co-ordination between agencies.

On the positive side of the ledger, financial stability policy supports monetary policy. One of the ways it can do so is by providing the foundation for a stable monetary transmission mechanism. The financial system is important to the transmission of monetary policy because of its role in facilitating the pass-through of interest rate changes to loan demand — the 'interest rate channel'. In this respect, a well-functioning financial system that is robust to shocks — for example by holding sufficient capital and liquidity — is a key input to the effective operation of monetary policy.

The efficient resolution of financial crises is another important means by which financial stability policy can support monetary policy. A key objective of crisis resolution is to minimise the disruption to financial intermediation and consequences for the macroeconomy (Hoggarth *et al* (2003)). Policymakers have a range of resolution strategies at their disposal, from liquidity support to guarantees of liabilities and nationalisation of parts of the financial system. Hoggarth *et al* (2003) conclude that the potential costs — both direct (fiscal) and indirect (eg moral hazard) — and benefits of crisis resolution strategies depend crucially on the nature of the shock to the financial system.

Claessens *et al* (2003) consider how the cost of financial crises is affected by three types of official policy — liquidity support, (explicit) government guarantees on liabilities, and regulatory forbearance — and by structural and institutional factors. Their results suggest that limited liquidity support may prove more helpful than open-ended commitments. Using a cross-section of 35 banking crises, they find that the three policies not only add to the fiscal cost of crises, but 'extensive' liquidity support and regulatory forbearance actually contribute to lower GDP growth and delay the economic recovery, rather than the reverse as intended. Improving institutional arrangements, such as the legal framework, lowers both fiscal and economic costs.(1) Hoggarth *et al* (2003) also find that, after controlling for other factors affecting the output loss (eg the credit to GDP ratio), open-ended liquidity support is associated with large falls in output.

Conditions in the financial system and financial stability policies, can also, however, complicate the operation and goals of monetary policy.(2)

Banks may have a more prominent role in the transmission mechanism than implied by the interest rate channel alone, through a so-called 'bank lending channel'. In the presence of imperfections, or frictions, in capital markets (eg information asymmetries) a shock to banks' balance sheets (eg tighter monetary policy) may translate into a reduced supply of funding to customers who are unable to switch their source of funds.(3) These borrowers may face a 'credit crunch' if the cost of bank loans increases more than proportionately to the monetary policy tightening, or is associated with some form of non-price restriction on loan supply (Hall (2001)). Small to medium-sized firms, in particular, may find it difficult to access capital markets if bank funding dries up, and may therefore have to curtail their investment plans. The initial health of banks is likely to influence the strength of the bank lending channel.(4)

Recent studies have focused on the specific role of banks' capital in the bank lending channel — that is, loan supply could be restricted as a bank attempts to restore its capital ratio following a shock. For example, Aikman and Vlieghe's (2004) simulation results show that shocks to the economy are amplified and become more persistent in the presence of capital market frictions, especially when the shock is directly to banks' net worth.(5)

It also, however, raises the possibility that financial stability policy could act as the shock as well. For example, regulatory capital could be a binding constraint on banks' behaviour if they are forced to raise new capital to meet minimum requirements. One implication for monetary policy is that, if capital ratios are close to the regulatory minimum, the effectiveness of

(1) The focus is, however, on techniques aimed at resolving crises once they are in motion or have reached a near-critical stage, rather than where support to otherwise healthy institutions heads off potential problems (Goodhart (2003a)).
(2) Tucker (2004) explores the important role played by the liquidity management of banks in the implementation of monetary and financial stability policy.
(3) The other element of the overall 'credit channel' is the 'balance sheet' channel which focuses on the health of borrowers' balance sheets, rather than those of lenders. Hall (2001) provides a good summary of both.
(4) Empirical evidence on the strength, and main determinants of, a possible bank lending channel is mixed and varies across countries. For recent evidence see Angeloni *et al* (2002) (euro-area countries); Driscoll (2004) (United States); Huang (2003), Atanasova and Wilson (2004) (both United Kingdom).
(5) See Haldane *et al* (2004) for an alternative calibration of the model.

an easing in monetary policy in stimulating aggregate demand may be weakened as banks are forced to raise additional capital before they can expand lending in response to increased demand for loans. This would have the effect of delaying the monetary stimulus. These so-called 'financial headwinds' may have delayed the recovery in the US economy in the early 1990s.(1)

Such a process can act as a shock if there is a *change* in regulatory requirements and/or tougher enforcement by regulators. A number of papers have analysed the latter proposition by considering whether regulators make qualitatively tougher assessments of banks' financial conditions or more vigorously enforce regulations during periods of banking sector fragility. Peek and Rosengren (1995) find that in New England in the early 1990s, banks subject to regulatory enforcement actions reduced their lending to a greater extent than other banks, after controlling for other characteristics.

Berger *et al* (2001) attempt to quantify the extent of US bank supervisors' 'toughness' and its impact on US bank lending during the early 1990s and the 'boom' period of the mid-to-late 1990s. Controlling for indicators of banks' health and their operating environment, they find evidence supporting the hypotheses that supervisory assessments were tougher in the earlier period and weaker in the latter, and that in turn had an effect on banks' lending behaviour. However, the economic significance was found to be small.

The interaction between financial stability policies, such as capital regulation, and the real economy raises the further issue that the underlying design of regulatory policy may change bank behaviour in a way that complicates the pursuit of monetary stability. One way in which it might do so is by exacerbating the so-called procyclicality that some suggest is inherent in the financial system.(2) For example, it has been argued that the risk assessments embodied in the new Basel II capital accord might induce banks to reduce their capital during good times and increase it in the bad times. By doing so, the behaviour of banks could amplify the economic cycle, thereby complicating the task of monetary policy.(3)

Interaction between financial stability policy and monetary policy

So far we have described the role of financial stability policy largely in terms of supporting the underlying health of the financial system. In this respect, it tends to support monetary policy in a passive sense. But can financial stability policy also be used proactively? And might there be a combination of policies that can achieve better outcomes from a social welfare perspective?

One of the arguments against using monetary policy proactively to combat the emergence of financial imbalances is that it is a blunt instrument that may have undesirable consequences for some sectors in the economy not directly affected by financial imbalances. By itself, this implies that a more targeted approach to policy, focused on the source of the friction underpinning the financial imbalance, may be preferable. In this vein, financial stability authorities have a number of policy options at their disposal, including (but not limited to) prudential regulation and disclosure policy.(4)

Proactive prudential policy?

As noted above, the tendency of the financial system to act in a procyclical manner and amplify economic cycles has received increased attention in recent times. This procyclicality, it has been argued, is due to a 'financial accelerator'(5) caused by information asymmetries and the interaction between credit growth and collateral values. Difficulties in measuring how risk is evolving over time and the fact that market participants have incentives to react to risk in ways that are socially sub-optimal (Borio *et al* (2001) may also contribute to the amplification of economic cycles.(6)

These links between the financial system and the economic cycle raise at least two, closely related, issues in the context of this article. First, can prudential policy be used in a proactive manner to help prevent the build-up of financial imbalances? And second, can prudential policy do more to limit the cost of financial instability than at present.

(1) In reviewing evidence on the influence of bank capital on real activity, BCBS (1999) note that the distribution of capital among banks as well as the aggregate capital ratio is potentially important.
(2) See, in particular, Borio *et al* (2001) for a comprehensive analysis of procyclical behaviour.
(3) Kashyap and Stein (2004) discuss the point in detail.
(4) Discretionary tax policies may also be an option, but a discussion of tax instruments is beyond the scope of this essay. See the findings of the G-10 Contact Group (2002) for more detail.
(5) See Bernanke *et al* (1999).
(6) For a formal model of the procyclicality of the financial system and its attendant welfare costs, see Gai *et al* (2005a). Gai and Vause (2005) present a measure of investors' risk perceptions over the economic cycle.

There appears to have been little policy research explicitly addressing the first question, with Carmichael and Esho (2003) a recent exception. Overall, they find scant support for using prudential regulation such as portfolio restrictions and adjustments to minimum capital ratios to control the emergence of asset price bubbles.(1) This conclusion is based largely on the practical difficulties of implementation, the potential efficiency costs of overly restrictive regulation and (to the extent banks' judgement is supplanted by that of the regulators) the view that such policies would be contrary to the move towards encouraging internal risk management.

More generally, it would appear that using discretionary changes in prudential policy over the course of an economic cycle to deal with emerging financial instability is beset by similar problems to using monetary policy — namely identification, calibration and timeliness.(2) Implementation would also require a high degree of co-operation between policymakers.

In contrast, there seems to be more support for considering adjustments to the prudential framework designed to help limit the impact of financial instability. This may be partly achieved by specifying rules that require changes in prudential variable(s) — eg loan to valuation ratios, capital ratios — over the cycle, though the rule itself may be fixed.(3)

Goodhart (2003b), for example, proposes a number of ideas for consideration, including linking loan to valuation ratios to the real percentage change in the underlying asset's price, and conditioning capital adequacy requirements on the rate of growth of bank lending relative to its trend. Kaufman (1998) also suggests that raising capital ratios in an environment of rising asset price inflation may help insulate banks from the fallout of a subsequent unwinding. Schwartz (2002) reaches a similar conclusion, arguing in favour of capital requirements that increase along with the amount of new credit backed by the collateral of the asset class that is growing most strongly.(4) It is also possible that such policies could help slow the development of financial imbalances, at the margin. As noted, however, Carmichael and Esho (2003) argue that countercyclical adjustments to capital adequacy standards may be costly in terms of economic efficiency.

One example of counter-cyclical prudential policy is the statistical, or 'dynamic', provisioning method pioneered by Spanish regulators, where banks make provisions against expected losses over the term of the loan, rather than actual losses in the event of default.(5) Arguably, this could help adjust for banks holding relatively low buffers during an economic upswing (when risks are materialising), if they misperceive the extent of the underlying risks (Borio *et al* (2001)).

While there is little historical precedent against which to assess these propositions, anecdotal evidence suggests that they have some merit. Hong Kong introduced maximum limits on loan to valuation ratios in the early 1990s in response to developments in the property market, in addition to recommending that banks restrict the share of property in their loan portfolios to 40%, which was around the average at the time.(6) Property prices subsequently peaked in 1997, before falling by over 65%, making it difficult to argue that the prudential measures prevented a bubble emerging. But, as Gerlach and Peng (2002) suggest, the response of credit to property prices seems to have been more muted and helped the banking system emerge in relatively good health.(7)

Overall, the proposals to adjust prudential frameworks to help insulate the financial system from the impact of financial imbalances have typically been general in nature. Statistical provisioning aside, there has been little in the way of precise proposals. In part, this may reflect practical constraints to their implementation.

Communication and disclosure

A third alternative available to policymakers is to make more effective use of communication strategies with

(1) They are, however, in favour of stress testing and dynamic provisioning.
(2) Borio *et al* (2001) note other difficulties such as avoidance by banks and the potential for regulatory forbearance.
(3) Borio *et al* (2001) make the distinction between these types of rules and purely discretionary changes in prudential requirements in response to specific developments, which they find support for but argue should only be used in extreme circumstances.
(4) Schwartz (2002) emphasises that shifting portfolio compositions by financial institutions may be the crux of the problem.
(5) See Fernandez de Lis *et al* (2001), Carmichael and Esho (2003) and Borio *et al* (2001) for discussions. We sidestep the potential tension between accounting and financial stability raised by this issue. See Michael (2004) for a discussion of accounting standards and financial stability.
(6) See Yue (2001). The Hong Kong experience is more an example of a discretionary change in prudential policy, rather than a type of evolving 'rules'.
(7) Another possible example is the introduction of restrictions on credit card lending in Thailand in April 2004 (see BIS (2004)).

market participants. The aim would be to attempt to counteract the market failure induced by the types of information asymmetries that could be driving asset prices out of line with fundamental values. Gai and Shin (2003) argue that this is best achieved by improving 'common knowledge' of fundamental valuations and the systemic aspect of risk through regular publications such as financial stability reviews. An increasing number of central banks are now publishing stand-alone financial stability reports.

Gai *et al* (2005a) argue the information requirements expected of a central bank in dealing with asset price misalignment and financial imbalances are formidable. Nevertheless, central bank disclosures can guide market expectations, particularly to the extent that public disclosures of fundamental variables driving asset prices are less noisy than the private signals of investors. Central bank disclosure policy may therefore help ease the task of policymakers using interest rates to achieve financial stability ends. But the effectiveness of enhanced communication in influencing outcomes is difficult to gauge, particularly if it is battling against a tide of buoyant sentiment.

A related issue is that enhanced disclosure by private sector participants could help alleviate the burden on other policy instruments by facilitating market discipline on risk-taking by financial institutions. Recent policy initiatives — including pillar three of Basel II and the push towards improved international accounting standards — have sought to support such an outcome. Enhanced disclosure may also play a role in alleviating the types of information asymmetries, such as monitoring costs implicit in financial intermediation, described by Haldane *et al* (2004).(1) And empirical evidence over a range of countries provides broad support for such policies (Baumann and Nier (2003)).

Concluding remarks

There has been considerable research and discussion on the relationship between monetary policy and financial stability in recent times. While considerable progress has been made on certain aspects, many issues at the heart of the relationship remain unresolved.

Our article suggests two areas where there is scope for further work. First, the early identification of risks to financial stability. If incipient financial imbalances are easier to detect and the reasons for their emergence well understood, then appropriate policy prescriptions can be implemented.

Second, alternative policy tools to complement monetary policy deserve more careful consideration. Relatively little analysis has been undertaken to explore how prudential design and disclosure policy by public authorities can best be implemented in a co-ordinated fashion so as to address issues of systemic stability.

(1) However, as Haldane *et al* (2004) note, identifying the underlying friction and its impact on banks' behaviour is an area that requires further research.

References

Aikman, D and Vlieghe, G (2004), 'How much does bank capital matter?', *Bank of England Quarterly Bulletin*, Spring, pages 48–58.

Amato, J and Shin, H S (2004), 'Imperfect common knowledge and the information value of asset prices', *mimeo*, London School of Economics.

Angeloni, I, Kashyap, A, Mojon, B and Terlizzese, D (2002), 'Monetary transmission in the euro area: where do we stand?', *ECB Working Paper no. 114*.

Atanasova, C and Wilson, N (2004), 'Disequilibrium in the UK corporate loan market', *Journal of Banking and Finance*, Vol. 28, Issue 3, pages 595–614.

Bank for International Settlements (2004), *Annual Report*, Basel, June.

Basel Committee on Banking Supervision (BCBS) (1999), 'Capital requirements and bank behaviour: the impact of the Basel Accord', *Working Paper no. 1*, April.

Baumann, U and Nier, E (2003), 'Market discipline and financial stability: some empirical evidence', Bank of England *Financial Stability Review*, June, pages 134–41.

Bean, C (2003), 'Asset prices, financial imbalances and monetary policy: are inflation targets enough?', in Richards, A and Robinson, T (eds), *Asset prices and monetary policy*, Reserve Bank of Australia Conference, Sydney, 18–19 August, pages 48–76.

Bell, J and Pain, D (2000), 'Leading indicator models of banking crises — a critical review', Bank of England *Financial Stability Review*, December, pages 113–29.

Berger, A, Kyle, M and Scalise, J (2001), 'Did US bank supervisors get tougher during the credit crunch? Did they get easier during the banking boom? Did it matter to bank lending?', in Mishkin, F (ed), *Prudential supervision: what works and what doesn't*, University of Chicago Press, Chicago.

Bergman, U and Hansen, J (2002), 'Financial instability and monetary policy: the Swedish evidence', *Sveriges Riksbank Working Paper no. 137*.

Bernanke, B and Gertler, M (1999), 'Monetary policy and asset price volatility', *Federal Reserve Bank of Kansas City Economic Review*, Vol. 84, Issue 4, pages 17–51.

Bernanke, B, Gertler, M and Gilchrist, S (1999), 'The financial accelerator in a quantitative business cycle framework', in Taylor, J and Woodford, M (eds), *Handbook of macroeconomics*, Vol. 1C, North Holland, Amsterdam.

Bordo, M and Jeanne, O (2002), 'Monetary policy and asset prices: does 'benign neglect' make sense?', *IMF Working Paper no. 02/225*.

Borio, C, Furfine, C and Lowe, P (2001), 'Procyclicality of the financial system and financial stability: issues and policy options', *BIS Paper no. 1*.

Borio, C and Lowe, P (2002), 'Asset prices, financial stability and monetary stability: exploring the nexus', *BIS Working Paper no. 114*.

Borio, C and Lowe, P (2004), 'Securing sustainable price stability: should credit come back from the wilderness?', *BIS Working Paper no. 157*.

Borio, C and White, W (2004), 'Whither monetary and financial stability? The implications of evolving nature of policy regimes', *BIS Working Paper no. 147*.

Carmichael, J and Esho, N (2003), 'Asset price bubbles and prudential regulation', in Hunter, W, Kaufman, G and Pomerleano, M (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*, MIT Press.

Cecchetti, S, Genberg, H, Lipsky, J and Wadhwani, S (2000), 'Asset prices and central bank policy', *Geneva Reports on the World Economy no. 2*: International Centre for Monetary and Banking Studies.

Cecchetti, S and Kim, J (2003), 'Inflation targeting, price-path targeting and output variability', *NBER Working Paper no. 9672*.

Claessens, S, Klingebiel, D and Laeven, L (2003), 'Resolving systemic financial crises: policies and institutions', prepared for World Bank conference on 'Systemic financial distress: containment and resolution', 8–9 October.

Clews, R (2002), 'Asset prices and inflation', *Bank of England Quarterly Bulletin*, Summer, pages 178–85.

Crockett, A (2003), 'Central banking under test?', in 'Monetary stability, financial stability and the business cycle: five views', *BIS Paper no. 18*.

Drees, B and Pazarbasioglu, C (1998), 'The Nordic banking crises: pitfalls in financial liberalisation?', *IMF Occasional Paper no. 161*.

Driscoll, J (2004), 'Does bank lending affect output? Evidence from the US states', *Journal of Monetary Economics*, Vol. 51(3), pages 451–71.

Dupor, W (2002), 'Nominal price versus asset price stabilization', *mimeo*, Wharton School, University of Pennsylvania.

Ferguson, R (2003), 'Should financial stability be an explicit central bank objective?', in 'Monetary stability, financial stability and the business cycle: five views', *BIS Paper no. 18*.

Fernandez de Lis, S, Martinez Pages, J and Saurina, J (2001), 'Credit growth, problem loans and credit risk provisioning Spain', *BIS Paper no. 1*.

Filardo, A (2004), 'Monetary policy and asset price bubbles: calibrating the monetary policy trade-offs', *BIS Working Paper no. 155*.

G-10 Contact Group on Asset Prices (2002), 'Turbulence in asset markets: the role of micro policies', Basel.

Gai, P, Lester, B and Millard, S (2005a), 'Asset prices, financial imbalances and central bank policy', paper presented at the World Congress of the Econometric Society, 22 August 2005, London.

Gai, P and Shin, H S (2003), 'Transparency and financial stability', Bank of England *Financial Stability Review*, December, pages 101–08.

Gai, P and Vause, N (2005), 'Investors' risk appetite', *Bank of England Working Paper no. 283*.

Gerlach, S and Peng, W (2002), 'Bank lending and property prices in Hong Kong', *Hong Kong Monetary Authority Quarterly Bulletin*, August, pages 1–10.

Gertler, M (2003), 'Commentary: whither monetary and financial stability', in *Monetary policy and uncertainty: adapting to a changing economy*, Federal Reserve Bank of Kansas City, Symposium, Jackson Hole, 29–30 August.

Goodfriend, M (2003), 'Interest rate policy should not react directly to asset prices', in Hunter, W, Kaufman, G and Pomerleano, M (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*, MIT Press.

Goodhart, C (2003a), 'Comments at panel session at the World Bank conference on 'Systemic financial distress: containment and resolution', 9 October.

Goodhart, C (2003b), 'The historical pattern of economic cycles and their interaction with asset prices and financial regulation', in Hunter, W, Kaufman, G and Pomerleano, M (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*, MIT Press.

Greenspan, A (2002), 'Economic volatility', in *Monetary policy and uncertainty: adapting to a changing environment*, Federal Reserve Bank of Kansas City Symposium, Jackson Hole, 29–30 August.

Gruen, D, Plumb, M and Stone, A (2005), 'How should monetary policy respond to asset-price bubbles?', *International Journal of Central Banking*, forthcoming.

Haldane, A, Saporta, V, Hall, S and Tanaka, M (2004), 'Financial stability and macroeconomic models', Bank of England *Financial Stability Review*, June, pages 80–88.

Hall, S (2001), 'Credit channel effects in the monetary transmission mechanism', *Bank of England Quarterly Bulletin*, Winter, pages 442–48.

Hoggarth, G, Reidhill, J and Sinclair, P (2003), 'Resolution of banking crises: a review', Bank of England *Financial Stability Review*, December, pages 109–23.

Hoggarth, G and Saporta, V (2001), 'Costs of banking system instability: some empirical evidence', Bank of England *Financial Stability Review*, June, pages 148–65.

Houben, A, Kakes, J and Schinasi, G (2004), 'Toward a framework for safeguarding financial stability', *IMF Working Paper no. 04/101*.

Huang, Z (2003), 'Evidence of a bank lending channel in the UK', *Journal of Banking and Finance*, Vol. 27, Issue 3, pages 491–510.

Kashyap, A and Stein, J (2004), 'Cyclical implications of the Basel II capital standards', *Economic Perspectives*, Federal Reserve Bank of Chicago, Quarter One, pages 18–31.

Kaufman, G G (1998), 'Central banks, asset bubbles, and financial stability', *Federal Reserve Bank of Chicago Working Paper no. 98–12*.

Kent, C and Lowe, P (1997), 'Asset price bubbles and monetary policy', *Reserve Bank of Australia Research Discussion Paper no. 9709*.

Lindgren, C, Garcia, G and Saal, M (1996), *Bank soundness and macroeconomic policy*, IMF, Washington.

Michael, I (2004), 'Accounting and financial stability', Bank of England *Financial Stability Review*, June, pages 118–28.

Okina, K, Shirakawa, M and Shiratsuka, S (2000), 'Asset price bubbles and monetary policy: Japan's experience in the late 1980s and the lessons', *Institute for Monetary and Economic Studies, Discussion Paper 2000-E-12*, Bank of Japan.

Peek, J and Rosengren, E (1995), 'Bank regulation and the credit crunch', *Journal of Banking and Finance*, Vol. 19, Issues 3–4, pages 679–92.

Posen, A (2003), 'It takes more than a bubble to become Japan', in Richards, A and Robinson, T (eds), *Asset prices and monetary policy*, Reserve Bank of Australia Conference, Sydney, 18–19 August, pages 203–49.

Schwartz, A (2002), 'Asset price inflation and monetary policy', *NBER Working Paper no. 9321*.

Stock, J and Watson, M (2003), 'Forecasting output and inflation: the role of asset prices', *Journal of Economic Literature*, Vol. 41, Issue 3, pages 788–829.

Svensson, L (2003), 'Optimal policy with low-probability extreme events', *NBER Working Paper no. 10196*.

Tucker, P (2004), 'Managing the central bank's balance sheet — where monetary policy meets financial stability', speech to mark the 15th anniversary of Lombard Street Research, 28 July.

Yue, E (2001), 'Marrying the micro- and macro-prudential dimensions of financial stability — the Hong Kong experience', *BIS Paper no. 1*.

Share prices and the value of workers

By Eran Yashiv, Bank of England Houblon-Norman Fellow.[1]

Is the value of workers in a company reflected in its share price? Traditional approaches suggest not. This article proposes an alternative: the workforce of the company can be seen as a collection of matches between workers and jobs. The company decides on forming matches, as well as on investment in physical capital, on the basis of its expectations of future profits, which also determine the share price. So there is a link between investment and hiring on the one hand and share prices on the other. This approach has implications for the analysis of share price movements, employment and investment.

Introduction

Traditional economic theory struggles to explain the behaviour of share prices. The standard model in economics and finance states that the value of the company, as reflected in the share price, should equal the value of its capital stock. But typically that model matches the data poorly. The lack of a direct role for labour in the standard model of (perfectly) competitive markets is also puzzling. Workers are assumed to be paid their marginal products in wages. So with labour therefore 'capturing' its contribution to the company, it is only the value of capital that is left for the owners of the company, ie its shareholders. Hence owning shares is akin to owning capital.

This article presents an alternative way of thinking about these issues. The relationship of the company with its workers can be viewed as a collection of matches of workers to jobs. The cost of the match is any cost in forming the match, such as recruitment costs, and any expense incurred in operating production processes, such as training. The job-worker match generates production and hence revenue for the company. These returns accrue over time, as long as the job-worker match lasts, and generate a stream of profits for the company. The expected present value of these profits should be reflected in the share price. So the behaviour of share prices can be explained by studying the present value of job-worker matches, and of the associated capital stock. That is the aim of this article, using tests of macroeconomic data.

The rest of the article proceeds as follows. The next section outlines a model that relates a company's share price to the value of both its workers and its capital. The model is then tested against US data, and the implications of the results for explanations of share price behaviour are discussed.

The value of the company

This section describes a model that formalises the broad concepts outlined above. The model assumes that a company makes optimal decisions on hiring workers, and on investing in physical capital, with the aim of maximising its expected profits, discounted over time. These decisions are then related to the share price. As such there is a link between share prices, labour and capital.

The company has to choose the rates of hiring and investment that maximise expected discounted profits.[2] In doing so it takes into account how productive labour

(1) The Bank of England awards Houblon-Norman and George fellowships to economists engaged in full-time research on an economic or financial topic of interest. Eran Yashiv was a Houblon-Norman fellow in 2005, and would like to thank the Bank of England for funding and hospitality. He would also like to thank Hoyt Bleakley, Ann Ferris, Jeff Fuhrer and Elizabeth Walat for their worker flows series, Bob Hall for market value data, Darina Waisman for able research assistance, and Colin Ellis for excellent editorial work.

(2) When discussing future values, such as future profits, we often need to express them in common terms relevant for today. This is done by converting future values to current or present values by discounting. The latter term refers to the idea that £1 in the future is worth less than £1 in the present, as we must take into account the accrual of interest on any sum invested today. Hence discounting uses the rate of interest to convert values from the future to the present. For example: £$(1 + R)$ in a year from now will be worth £1 today (in present value) when the interest rate is R. The term 'expected' refers to the notion that future values are not known with certainty but can only be evaluated taking into account the probabilities of future events.

and capital are, as well as how costly they are. This is done with a forward-looking perspective: firms take into account not only production in this period, but also in all future periods.

The share price of the company, or more generally its economic value, is the expected discounted stream of future profits, ie revenues less costs. The link of the share price with hiring and investment on the one hand and with labour and capital on the other is established by splitting this present value into different components.

Under certain assumptions,(1) the value of the company is equal to the sum of two components:

(i) the value of the capital stock, which is equivalent to the present value of future capital productivity; and

(ii) the value of the labour stock (the company's workforce), which is equivalent to the present value of future labour productivity, minus wage costs.

This decomposition implies that the company decides on hiring and investment based on its expectations of the future productivity of capital and labour. But these expected productivities also determine future profits, which are reflected in the current share price. So the rate of investment and the rate of hiring relate to the same expectations that drive the share price. Thus there is a link between hiring and investment flows and labour and capital stocks on the one hand, and the share price on the other. The innovation of this approach is that firms partly derive profits (and hence extra market value as reflected in its share price) by successfully matching workers to jobs, in addition to employing capital and using it productively. And the former channel is likely to be increasingly important, compared with the latter, in an economy where production becomes more labour-intensive (and less capital-intensive): for example, this may happen if the balance of the economy moves towards the service sector and away from manufacturing. The box on page 454 discusses the model in more detail.

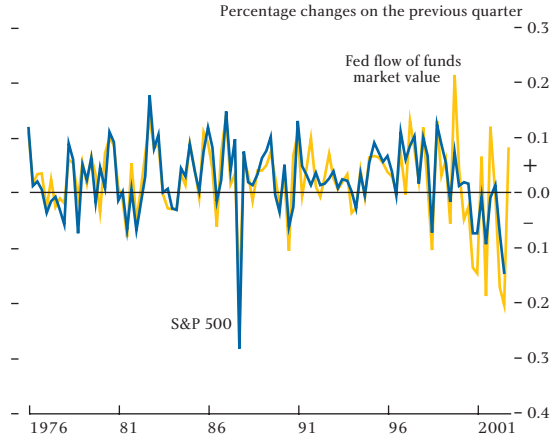
Taking the model to the data

In this section, the model set out above is applied to US data. First, the relevant data are presented, and then the performance of the model is examined.

Ideally, we would apply the model to UK data. But unfortunately, the existing data are either too short and/or not comprehensive enough. For example, UK data on gross hiring (from both unemployment and inactivity) are only available on a quarterly basis from the 1990s. So instead, the model is tested against US data for the private non-farm non-financial sector.

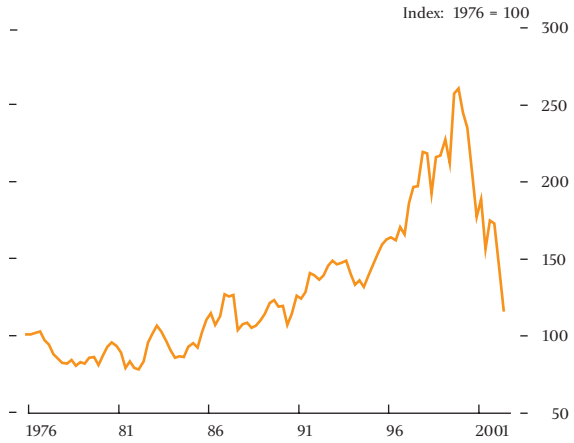
The key data we require are company values. These are based on the Fed flow of funds database for the United States.(2) The data are the sum of financial liabilities and equity less financial assets, adjusted for the difference between market and book values for bonds. This is a broad measure, intended to capture the private sector as a whole. This series is close to the more familiar, but narrower, S&P 500 index. Chart 1 shows the two series over the sample period 1976–2002; there is a clear positive correlation.

Chart 1
Fed flow of funds market value and the S&P 500



Sources: Based on Hall (2001) and Thomson Financial Datastream.

Chart 2
US market value to GDP ratio



Sources: Based on Hall (2001) and Bureau of Economic Analysis.

(1) Namely a so-called constant returns to scale (CRS) class of production function, and CRS adjustment costs. For example, with a CRS production function, when capital and labour (the inputs) double, output also doubles.
(2) These data are available on the internet at: www.federalreserve.gov/Releases/Z1/. The precise data used were supplied by Bob Hall (based on Hall (2001)) and are available on request.

The theoretical structure of the model

This box sets out the theoretical structure behind the model used in this article in more detail. The value of the company is assumed to equal the present value of its capital stock plus the present value of its labour force:

$$s_t = k_{t+1}Q_t^K + n_{t+1}Q_t^N$$

where: s_t is the value of the company;
k_{t+1} is the value of the company's capital stock;
Q_t^K is the present value of investment;
n_{t+1} is the size of the company's labour force;
Q_t^N is the present value of hiring workers;

and t subscripts indicate the time period.

What are these present values? The present value of investment is the expected stream of future revenues from using capital (after-tax, and discounted to take into account the interest rate and the depreciation rate). The present value of hiring is the expected stream of future revenues from employing workers, net of their wages (after-tax, discounted to take account of the interest rate and the match break-up rate).

The model differs from the standard approach to valuing companies, in that the present value expressions are the key determinants of the share price. In the special case where changing the level of capital is costless (so $Q_t^K = 1$), and there are no hiring costs for labour (so $Q_t^N = 0$), then the market value equals the value of the capital stock (ie $s = k$). This is the standard 'neo-classical' model. Alternatively, if there are no hiring costs for labour ($Q_t^N = 0$) but the firm faces costs when it wants to change capital, the model becomes essentially analogous to Tobin's Q theory, which states that the market value of a company should be related to the replacement cost of its assets.

So the model in this article encompasses models from three strands of literature. The first is the literature on adjustment costs of physical capital, in particular Tobin (1969) and Tobin and Brainard (1977). This is known as Tobin's Q model. The standard Q model assigns no direct role for labour, as determination of the company's value only requires taking into account the capital and any associated adjustment costs. The second is the literature on the adjustment costs of labour. When there are costs in adjusting labour, such as hiring or firing costs, the company extracts rents. These rents compensate it for the adjustment costs. Such costs are inherent in the search and matching model of the labour market (Mortensen and Pissarides (1999) survey this literature). The third is the production-based asset-pricing model for a company's market value proposed by Cochrane (1991, 1996). This model takes the Tobin's Q equation from the first strand cited above and, taking investment as given, explains share prices using the company's optimal investment decision.

Chart 2 shows the Fed market value series divided by non-financial business sector GDP, ie the ratio of market value to GDP. This will be the series used in the empirical work reported later. The sample includes the large increase in share prices from 1995 to 2000, and the sharp drop thereafter.

Testing the model also requires series for capital and labour stocks. We also need to consider the investment rate — the ratio of investment to the capital stock — and the gross hiring rate — gross hiring divided by employment, shown in Charts 3 and 4.(1)

The investment and hiring rates are negatively correlated: for example, when investment rates rose in the 1990s, hiring rates fell. So although companies hire and invest at the same time, when they increase investment rates they have tended to reduce hiring rates and *vice versa*.

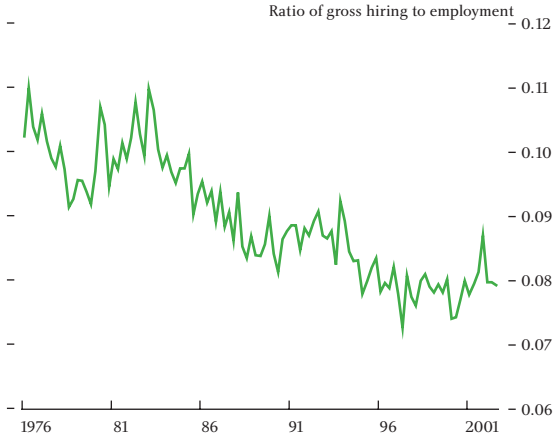
Using these data, the model can now be estimated. The key component of the model is the value of the firm: this is set out in more detail in the box above. The value of the firm depends on the present values of investment and hiring. In turn, these depend on the amount of profit the company expects to generate by hiring an

(1) The quarterly capital data have been interpolated from annual data. The hiring rate data were supplied by Hoyt Bleakley, Ann Ferris, Jeff Fuhrer and Elizabeth Walat, and are based on Bleakley *et al* (1999). All data are available on request.

Chart 3
US investment rate

Source: Bureau of Economic Analysis.

Chart 4
US hiring rate



Source: Based on Bleakley *et al* (1999).

extra worker or buying an extra machine. If a new machine is expected to generate extra profit, then the present value of investing in that machine is positive; and if that profit exceeds the cost of buying the machine, the company will probably buy it. Hence, the present value of investment is likely to vary with the investment rate. But the hiring rate could also be related to the present value of investment: if a company buys a new machine, it may also need more workers to operate that machine. Alternatively, the machine could replace existing workers. The reverse also applies: when the firm hires new workers, it may also decide to change its investment spending.

So not only is the present value of investment related to the investment rate, and the present value of hiring to the hiring rate: in both cases the interaction between investment and hiring is also likely to be important. For this article, the present value of investment is estimated as a function of the investment rate and the product of the investment and hiring rates; and the present value of hiring is estimated as a function of the hiring rate and the product of the investment and hiring rates:

$$\textit{Present value of investment} = \alpha + \beta^{*}\textit{investment rate} + \eta^{*}(\textit{investment rate}^{*}\textit{hiring rate})$$

$$\textit{Present value of hiring} = \delta + \zeta^{*}\textit{hiring rate} + \eta^{*}(\textit{hiring rate}^{*}\textit{investment rate})$$

Measuring the present values in this manner, the relationship between the market value of the firm on one hand and the stocks of capital and labour (multiplied by their estimated present values) on the other can be assessed using regression analysis. More details on the model are available in the appendix.

In the benchmark model, firms face costs in changing both capital and labour: this is referred to as the job-worker match (JWM) model. But two common alternatives are also estimated. Often it is assumed that there is no role for labour in determining the market value of the firm: in that instance, the model becomes the so-called 'Tobin's Q' model, where the market value of a company is related to the replacement cost of its assets. Another alternative form of the model is where there is no role for labour and firms face no costs in adjusting their level of capital: in that instance — the so-called 'neo-classical' model — the market value of the company (or the share price) equals the value of capital. These models are discussed in more detail in the box on page 454.

The regression results, based on 108 quarterly observations between 1976 and 2002, are reported in Table A below.(1) The models are estimated using Two Stage Least Squares (2SLS). The table reports a measure of the goodness of fit — the adjusted R^2 — and the Durbin Watson (DW) statistic, a simple test to check whether the residuals from the model are serially correlated (that is, related to one another over time). If the DW statistic was equal to two, that would indicate

Table A
Summary statistics for the estimated models(a)

Model specification	Adjusted R^2	DW statistic
JWM	0.80	1.13
Tobin's Q	0.71	0.24
Neo-classical	0.09	0.15

(a) Based on 2SLS estimation. Full estimation results are available in the technical appendix.

(1) Estimation results are available in the technical appendix.

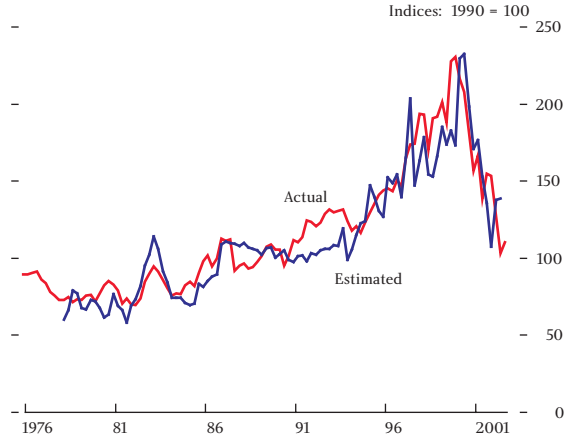
that the residuals were not serially correlated. But if there is serial correlation, that is generally a sign that the model is deficient in some way — for example that it is set up wrongly, or variables that play an important role have been mistakenly left out of the estimation.

The JWM model has the best 'fit' to the data, closely followed by the Tobin's Q model. But the neo-classical model fares poorly. In fact, it finds a negative relationship between company market value and the price of investment. Some serial correlation is present in all of the models — that could indicate that the models are misspecified, or that important variables have been omitted. But, of the three models tested, the JWM model fares the best by far.

Explaining share prices

What can these estimation results tell us about the behaviour of share prices and their relationship with the present values of capital and labour? Chart 5 shows actual market value to GDP data, and the estimate based on the JWM model: the fit is quite close. The fit of the other models, especially the neo-classical model, was not as good.

Chart 5
Actual and estimated US market value to GDP ratios

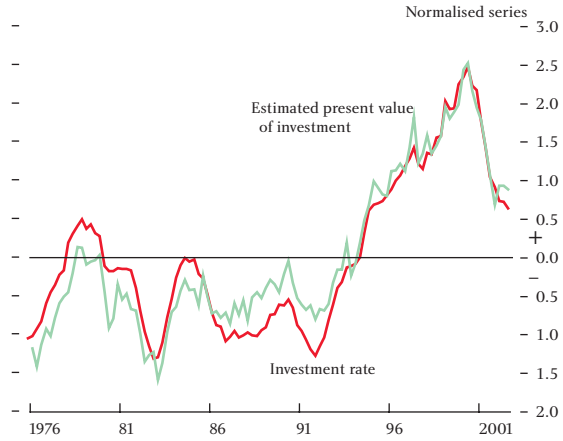


Sources: Based on Hall (2001) and Bureau of Economic Analysis.

Given this close fit, the model can tell us about the different 'components' of the share price, as it differentiates between the roles played by the present value of investment and the present value of hiring.

Chart 6 shows the investment rate series and the estimated present value of investment; Chart 7 shows the hiring rate and the estimated present value of hiring. By construction the estimated present values are close to the hiring and investment rates, given the latter are used to model the former. One interpretation is that the 'share price' of capital can be deduced from observing the investment rate and the 'share price' of labour can be deduced from observing the hiring rate. Observing these two components can then inform what is driving changes in quoted share prices.

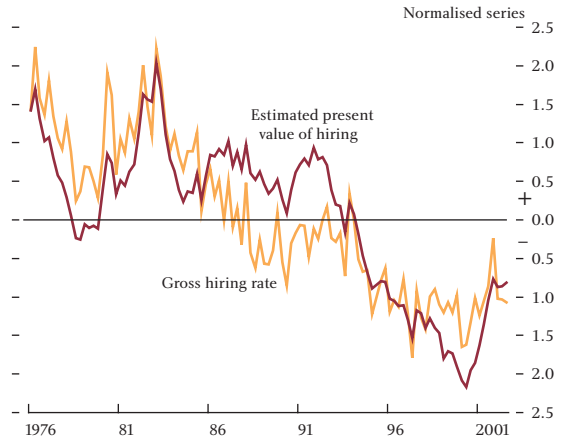
Chart 6
The investment rate and the estimated present value of investment[(a)]



Source: Bureau of Economic Analysis.

(a) Both series have been normalised.

Chart 7
The hiring rate and the estimated present value of hiring[(a)]



Source: Based on Bleakley *et al* (1999).

(a) Both series have been normalised.

Charts 6 and 7 also show a marked negative correlation between the present values of investment and hiring, as well as the actual investment and hiring rates. Why do we observe this negative correlation?

The representative firm is hiring and investing at the same time. But that does not mean that hiring and investment are positively correlated: both occur at the same time, but hiring could rise while investment declines (or *vice versa*). Why might that happen?

Suppose the present value of investment rises, but at the same time the present value of hiring falls. By itself, the former would probably lead to higher investment and higher hiring: in contrast, the latter would be likely to result in lower investment and lower hiring. What matters is which effect is more important for the actual rates of investment and hiring. If the impact of the higher present value of investment is more important for investment than the lower present value of hiring, then investment would rise. Similarly, if the impact of the lower present value of hiring is more important for hiring than the higher present value of investment, then hiring would fall. So investment could rise while hiring falls, as observed in the data and shown in the estimated model.

Are the estimated relationships stable over time? Table B shows the correlations between the market value to GDP ratio, the fitted series and its components for the full sample (1976–2002). Correlations are also reported for two subperiods within this sample: 1976–89 and 1990–2002.

Table B
Correlations between the estimated model and actual data

Correlation between:	Sample period 1976–2002	1976–89	1990–2002
Actual and estimated market value to GDP	0.92	0.81	0.85
Estimated present values of hiring and investment	-0.99	-0.99	-0.99
Market value to GDP and estimated present value of hiring	-0.81	0.31	-0.82
Market value to GDP and estimated present value of investment	0.85	-0.24	0.83

Some of the correlations are fairly stable across the whole sample and the subsamples, for example the correlation between the actual and fitted ratios of market value to GDP. The estimated present values of hiring and investment are also consistently negatively correlated, as observed in the data. The other correlations are less stable, switching sign between the first subperiod and the second. That suggests that the investment and hiring rates have been important drivers of share prices at different times over the past 30 years, rather than one consistently dominating the other. In the early part of the sample, when the investment and hiring rates were relatively flat, the present value of hiring is positively correlated with the value of the firm. In the second half of the sample, when the investment rate rose and the hiring rate fell, market value followed the present value of investment more closely.

The analysis presented here is very much in its early stages. Much more work needs to be done, such as experimenting with different forms of the model. The structure outlined in this article is deliberately simple, and testing the robustness of the results to different assumptions about the costs firms face when investing, or varying the measurement of present values, would be worthwhile. But the model appears to offer a useful avenue for analysing the ratio of the market value of firms to GDP. Movements in this value are related to movements in investment rates and in hiring rates. So the model offers an insight into the relationship between equities and companies' demand for capital and labour. Further work could elaborate on the transmission mechanism between these variables in more detail — for example, by investigating how hiring, investment and share prices respond when they are away from equilibrium. Future investigations could also test the usefulness of asset prices as a leading indicator of employment and investment, or *vice versa*.

Conclusions

Typically, the value of workers is assumed to be unrelated to share prices. This article has examined a theoretical model that explicitly makes the link between the two. It explores the idea that the job-worker match has a present value and that the company is a collection of such job-worker matches. Or in other words, firms decide on employing workers on the basis of how much extra profit those workers are expected to generate for the company over time, and those profits are related to share prices. These present values of labour (and capital) make up the market value of the company, as the expectations that drive share prices also affect investment and hiring. So changes in share prices may be reflected in hiring or investment behaviour; and when the model is tested on US data, a relationship does appear to be evident. While in its early stages, this work offers a new insight into the link between financial variables on the one hand — share prices and market value — and real macroeconomic variables, such as hiring and investment, on the other.

Technical appendix

This appendix shows the formal derivation of the model. Full details are presented in Merz and Yashiv (2004).

Companies use physical capital and labour as inputs in order to produce output goods (y) according to a constant returns to scale production function:

$y_t = f(k_t, n_t)$

where other variables are defined in the box on page 454.

Hiring costs include advertising, screening, and training. Investment costs include installation costs, learning the use of new equipment, etc. These are modelled using an adjustment cost function, $g[i_t, k_t, q_t v_t, n_t]$: i denotes investment, and qv gross hiring (vacancies (v) multiplied by the rate at which they are filled (q)). This adjustment cost function is assumed to be convex in the company's decision variables (investment and vacancies) and exhibits constant returns to scale (in all its arguments). Hiring costs and capital adjustment costs interact.

In every period, the existing capital stock depreciates at the rate δ_t and is augmented by new investment i_t:

$k_{t+1} = (1 - \delta_t)k_t + i_t, \qquad 0 \leq \delta_t \leq 1.$

Similarly, the number of a company's employees decreases at the rate ψ_t. It is augmented by new hires $q_t v_t$:

$n_{t+1} = (1 - \psi_t)n_t + q_t v_t, \qquad 0 \leq \psi_t \leq 1.$

Companies' profits net of taxes π, are given by:

$$\pi_t = (1-\tau_t)\left[f(n_t, k_t) - g(i_t, k_t, q_t v_t, n_t) - w_t n_t - p_t^I i_t \right]$$

where τ_t is the corporate income tax rate, w_t is the wage, p_t^I is the real tax-adjusted price of investment goods. Hence profits are revenues less adjustment costs, wage payments and investment.

The representative company's market value, s_t , is defined as the present discounted value of future profits:

$$s_t = E_t \left\{ \sum_{j=1}^{\infty} \left(\prod_{i=1}^{j} \beta_{t+i} \right) \pi_{t+j} \right\}$$

where E_t denotes the expectations based on information available in period t. The discount factor between periods $t + j - 1$ and $t + j$ for $j \in \{1, 2, \ldots\}$ is given by:

$$\beta_{t+j} = \frac{1}{1 + r_{t+j-1, t+j}}$$

where $r_{t+j-1, t+j}$ denotes the time-varying discount rate between periods $t + j - 1$ and $t + j$. This rate could be a weighted average of the cost of equity and the cost of debt.

The company's period t market value can also be defined as the expected discounted market value of the following period:

$$s_t = E_t\left[\beta_{t+1}\left(s_{t+1} + \pi_{t+1}\right)\right]$$

The first-order conditions for dynamic optimality are the same for any two consecutive periods $t + j$ and $t + j + 1$, $j \in \{0, 1, 2, \ldots\}$, so for the sake of notational simplicity, *I* drop the subscript *j* from the respective equations to follow:

$$Q_t^K = E_t\left\{\beta_{t+1}\left[\left(1-\tau_{t+1}\right)\left(f_{k_{t+1}} - g_{k_{t+1}}\right) + \left(1-\delta_{t+1}\right)Q_{t+1}^K\right]\right\}$$

$$Q_t^K = \left(1-\tau_t\right)\left(g_{i_t} + p_t^I\right)$$

$$Q_t^N = E_t\left\{\beta_{t+1}\left[\left(1-\tau_{t+1}\right)\left(f_{n_{t+1}} - g_{n_{t+1}} - w_{t+1}\right) + \left(1-\psi_{t+1}\right)Q_{t+1}^N\right]\right\}$$

$$Q_t^N = \left(1-\tau_t\right)\frac{g_{v_t}}{q_t}$$

In order to establish a link between the company's market value and its stock of capital and employment using the first-order conditions, the latter can be manipulated using the CRS properties of *f* and *g*, and can be written as:

$$s_t = k_{t+1}Q_t^K + n_{t+1}Q_t^N$$

The present value of the marginal unit of capital is given by:

$$Q_t^K = E_t\left\{\sum_{j=0}^{\infty}\left(\prod_{i=0}^{j}\beta_{t+1+i}\right)\left(\prod_{i=0}^{j}\left(1-\delta_{t+1+i}\right)\right)\left(1-\tau_{t+1+j}\right)\left(f_{k_{t+1+j}} - g_{k_{t+1+j}}\right)\right\}$$

where f_k is the marginal product of capital, g_k is the reduction in marginal adjustment costs due to an additional unit of capital, τ is the corporate profit tax rate, β is the discount factor, and δ is the depreciation rate. E_t denotes expectations of future values at time *t*. Basically the expression above is the expected, discounted stream of future after-tax marginal revenue from capital, with discounting taking into account both the interest rate (via β) and the depreciation rate (δ).

The present value of the marginal worker is given by:

$$Q_t^N = E_t\left\{\sum_{j=0}^{\infty}\left(\prod_{i=0}^{j}\beta_{t+1+i}\right)\left(\prod_{i=0}^{j}\left(1-\psi_{t+1+i}\right)\right)\left(1-\tau_{t+1+j}\right)\left(f_{n_{t+1+j}} - g_{n_{t+1+j}} - w_{t+1+j}\right)\right\}$$

where f_n is the marginal product of labour, g_n is the reduction in marginal hiring costs due to an additional worker, τ is the corporate profit tax rate, β is the discount factor, and ψ is the separation rate. The latter represents the rate at which job-worker matches break up. The expression above is the expected, discounted stream of future after-tax marginal revenue from workers, net of wages, with discounting taking into account both the interest rate and the separation rate.

It should be remarked that in the special case of a perfectly competitive labour market with no hiring costs, Q_t^N equals zero. In the special case of no adjustment costs for capital as well as no hiring costs, the share price equals the value of the capital stock, as in the neo-classical model. Thus the model differs from the standard approach in that there are positive present value expressions for hiring and investment that are key determinants of the share price.

Estimation results

In the main model, the value of the firm was estimated as a function of capital and labour, multiplied by their present values:

$$\frac{s_t}{f_t} = (1-\tau_t)\left[\frac{k_{t+1}}{k_t}\left[\frac{p_t^I}{\frac{f_t}{k_t}} + Q^K\left(\frac{i_t}{k_t}, \frac{q_t v_t}{n_t}\right)\right] + \frac{n_{t+1}}{n_t}\left[Q^N\left(\frac{i_t}{k_t}, \frac{q_t v_t}{n_t}\right)\right]\right]$$

This model nests the three different types of model set out in the box on page 454, depending on how the present values were estimated. In the benchmark JWM model, these were estimated as:

$$Q^K\left(\frac{i_t}{k_t}, \frac{q_t v_t}{n_t}\right) = f_1 + e_1\frac{i_t}{k_t} + e_3\frac{q_t v_t}{n_t}\frac{i_t}{k_t}$$

$$Q^N\left(\frac{i_t}{k_t}, \frac{q_t v_t}{n_t}\right) = f_2 + e_2\frac{q_t v_t}{n_t} + e_3\frac{q_t v_t}{n_t}\frac{i_t}{k_t}$$

The estimated coefficients and t-statistics, based on Two Stage Least Squares (2SLS estimation) using lagged variables as instruments, are shown in Table A1.

Table A1
Estimated present values in JWM model

Coefficient	Estimate	T-statistic
f_1	-94.1	-4.5
e_1	5441.7	7.8
e_3	-30870.5	-7.2
f_2	-6.8	-0.3
e_2	1229.8	6.3

In the Tobin's Q model, the present values are defined as:

$$Q^K\left(\frac{i_t}{k_t}\right) = f_1 + e_1\frac{i_t}{k_t}$$

$Q^N = 0$

The estimated coefficients are shown in Table A2.

Table A2
Estimated present values in Tobin's Q model

Coefficient	Estimate	T-statistic
f_1	619.5	12.9
e_1	-5.8	-5.0

Finally, in the 'neo-classical' model there are no adjustment costs. In this instance
$Q^K = 0$
$Q^N = 0$

so the value of the firm is estimated as:

$$\frac{s_t}{f_t} = e_0 + e_1\left[(1-\tau_t)\frac{k_{t+1}}{k_t}\left(\frac{p_t^I}{\frac{f_t}{k_t}}\right)\right]$$

Table A3 shows the coefficient estimates in this model.

Table A3
Estimated coefficients in neo-classical model

Coefficient	Estimate	T-statistic
e_0	39.8	11.1
e_1	-44.8	-9.4

References

Bleakley, H, Ferris, A and Fuhrer, J (1999), 'New data on worker flows during business cycles', *New England Economic Review*, July-August, pages 49–76.

Cochrane, J (1991), 'Production-based asset pricing and the link between stock returns and economic fluctuations', *Journal of Finance*, Vol. 146, pages 207–34.

Cochrane, J (1996), 'A cross-sectional test of an investment-based asset pricing model', *Journal of Political Economy*, Vol. 104, pages 572–621.

Hall, R (2001), 'The stock market and capital accumulation', *American Economic Review*, Vol. 91, pages 1,185–202.

Merz, M and Yashiv, E (2004), 'Labour and the market value of the firm', *CEPR Discussion Paper no. 4184*.

Mortensen, D and Pissarides, C (1999), 'Job reallocation, employment fluctuations, and unemployment differences', Chapter 18 in Taylor, J and Woodford, M (eds), *Handbook of macroeconomics*, Vol. 1B, Amsterdam (North-Holland).

Tobin, J (1969), 'A general equilibrium approach to monetary theory', *Journal of Money, Credit, and Banking*, Vol. 1, pages 15–29.

Tobin, J and Brainard, W (1977), 'Assets markets and the cost of capital', in Balassa, B and Nelson, R (eds), *Economic progress, private values and public policies: essays in honor of William Fellner*, Amsterdam (North-Holland), pages 235–62.

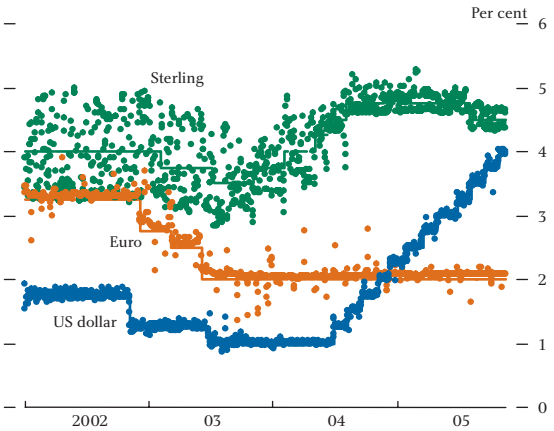
Stabilising short-term interest rates

By Seamus Mac Gorain of the Bank's Foreign Exchange Division.

This article describes how the Bank's new arrangements for implementing the Monetary Policy Committee's interest rate decisions should tie market interest rates more closely to the Committee's official rate. In the new framework, banks and building societies will be able to hold an average level of reserves at the Bank over a month-long 'maintenance period'. The article shows that the Bank's commitment to adjusting the supply of reserves on the final day of the maintenance period should ensure that the market rate is expected to be on target on that day. It also describes how the ability of scheme members to run their reserve balances up and down from day to day in response to changes in market rates should mean that the rate expected on the final day of the maintenance period prevails over the rest of the period.

Next year, the Bank of England will adopt new arrangements for implementing the Monetary Policy Committee's interest rate decisions through operations in the sterling money market. The primary reason for reforming the Bank's current operations is that they leave sterling overnight rates more volatile than is desirable, as evidenced by comparison with market rates in other major currencies (Chart 1).(1) The Bank's reforms also aim to bring about: an efficient, safe and flexible framework for banking system liquidity management; a simple, straightforward and transparent operational framework; and competitive and fair sterling money markets. This article focuses on the Bank's main objective of reducing the volatility of sterling interest rates at maturities out to the date of the next scheduled MPC policy decision, and describes how the new framework should tie these short-term market interest rates more closely to the Bank's official rate.

Chart 1
Overnight interest rates and policy rates(a)



Source: Bloomberg.

(a) Lines are policy rates and dots are overnight interbank interest rates.

As described in detail by Clews (2005), the new framework will be based on extending the ways in which banks and building societies can deal with the Bank.(2) In the current system, the settlement banks have to balance their accounts at the Bank each day. In the new framework, a wider group of banks will be able to commit to holding an average level of balances (reserves) at the Bank over a 'maintenance period', which will run from one MPC decision date to the next. In advance of each maintenance period, the banks will be free to choose a target level of reserves between zero and the larger of £1 billion or 2% of their eligible liabilities.(3) Banks will not be obliged to meet their reserve targets precisely: provided average reserves over the maintenance period are within a range of +/– 1% around the reserve target, they will be remunerated at the MPC's official interest rate. However, banks will be penalised if their average reserves fall outside the range or if their accounts at the Bank are overdrawn on any day.

(1) The volatility of overnight rates has been lower since the Bank announced that it was to review its money market operations. And longer-maturity money market rates have generally tended to be much less volatile than overnight rates (see Vila Wetherilt (2002)).
(2) The term 'banks' will be used to refer to both banks and building societies in the rest of this article.
(3) Eligible liabilities are a measure of banks' sterling deposit liabilities (net of interbank deposits).

The Bank will also make unlimited overnight standing lending and deposit facilities available. The rates on these facilities will be 25 basis points above and below the official interest rate on the final day of the maintenance period, and 100 basis points above and below on other days. The Bank will also conduct open market operations(1) each week, and on the final day of the maintenance period, in order to ensure that the supply of reserves is as close as possible to the level that will enable banks to meet their reserve targets.

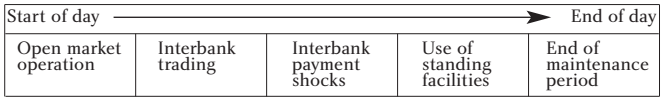
This article will first discuss how the Bank's commitment to adjust the supply of reserves on the final day of the maintenance period should mean that banks expect the market rate to be on target on that day. It will then show that the narrow spread between the lending and the deposit facilities on the final day of the period, as well as the range for reserve targets, should dampen interest rate volatility on that day. Finally, it discusses how the flexibility that reserve averaging gives banks in their liquidity management should mean that the interest rate expected on the final day of the maintenance period prevails over the rest of the period. The article summarises the Bank's work to model the new arrangements; a forthcoming Bank working paper will present these results in more detail.

The final day of the maintenance period

On the final day of the maintenance period, banks must meet their reserve targets. This means that the final day of the period is in effect a one-day maintenance period system, like the Bank's current system. As described earlier, on the final day banks will be allowed to borrow (against collateral) from the Bank in unlimited quantities at a rate 25 basis points above the official rate, and to deposit unlimited quantities at a rate 25 basis points below the official rate. As no bank would borrow in the money market at more than the lending facility rate, or lend funds for less than the deposit facility rate, the standing lending and deposit facilities should create a binding symmetrical 'corridor' for the market rate. Where the rate lies within the corridor should depend on the likelihood that banks will have to make use of each of the standing facilities. This should depend in turn on the accuracy of the Bank's supply of reserves, and the uncertainty faced by banks over their end-of-day balances at the Bank.

A simple model of a one-day maintenance period can illustrate the impact of these factors on the overnight interest rate.(2) However, a stylised model of this kind may not be a perfect guide to interest rate behaviour in the Bank's new system; as such, the article refers to 'the central bank' rather than 'the Bank' in describing the model results. Chart 2 shows the sequence of events over the course of the day in this model. The central bank conducts an open market operation at the start of the day, attempting to supply the correct amount of funds for the market rate to be on target, consistent with the central bank's policy rate. However, in choosing its supply of funds, it must make a forecast of factors other than open market operations which may affect the supply of reserves, including changes in banknotes in issue, and other movements of funds across the central bank's balance sheet. Because of uncertainty over these 'autonomous factors', errors will inevitably occur in the central bank's supply of funds.

Chart 2
Simple one-day maintenance period model



After the open market operation, a large number of banks trade the available reserves among themselves in a perfectly competitive money market. However, at the time of trading, they are still unsure of their individual end-of-day balances at the central bank, although they are assumed to know the size of the central bank's forecast error. This is because late payments from other banks could mean that their final balances are above or below their reserve target.(3) Suppose that banks must meet their reserve targets exactly. As such, if a bank's final balance is below its reserve target, it must make up the shortfall by borrowing at the central bank's overnight standing lending rate (in order to avoid the larger interest charges for missing its target). On the other hand, if a bank exceeds its reserve target, it must deposit the excess funds at the central bank's overnight standing deposit rate (or else they will receive no interest on these funds).

(1) In its open market operations, the Bank lends funds (against collateral) to the banking system at its official interest rate.
(2) The model is based on one proposed by Woodford (2001), among others. Bindseil (2004) discusses more complex models of overnight interest rate determination.
(3) For simplicity, throughout this article we assume that interbank payments uncertainty is the only source of uncertainty over banks' end-of-day balances. But in practice it is one of a number of sources of such uncertainty; others include the possibility of bookkeeping and operational errors.

In this model, banks base their choice of what quantity of funds to borrow or lend in the interbank market on the probability of having to use each standing facility. This means that the market rate is an average of the rate on the deposit facility and the rate on the lending facility, weighted by the probability of having to use each facility, that is to say the probabilities of exceeding and falling short of the reserve target respectively.(1) Because the interest rate corridor is symmetric, the market rate should match the official rate when these probabilities are equal. Provided the uncertainty faced by banks over their end-of-day balances is symmetrically distributed, this will happen when the funds supplied by the central bank equal the sum of the reserve targets of commercial banks plus any additional funds to offset the day's changes in autonomous factors, and when these funds are distributed optimally among banks.(2)

Even though the central bank aims to supply the correct amount of funds for the market rate to be on target, the difficulty of forecasting the autonomous factors means that errors in central bank supply are unavoidable. If the central bank's forecast errors are small relative to the uncertainty about payments faced by commercial banks, then any forecast error will have little effect on banks' expected likelihood of using the standing facilities — the error in central bank supply will be dwarfed by the uncertainty over possible unexpected late payments from other banks. But if the central bank's forecast errors are relatively large, they would significantly change the probability of using one or other of the standing facilities, and therefore move market interest rates. For example, a large positive error in central bank supply — an oversupply of funds — would increase the likelihood of banks using the deposit facility, and so would lead market rates to fall.(3)

To demonstrate this relationship, Charts 3 and 4 show the aggregate reserve demand curve in the model described above given two different levels of payment uncertainty. The market rate is given by the intersection of the demand curve with the central bank's supply (shown by the vertical lines). The lower the level of payments uncertainty, the steeper the demand curve, and so the greater the effect of a central bank forecast error on the market rate. For example, if banks faced no payments uncertainty at all, then the demand curve would be vertical at the optimal level of central bank supply; any central bank forecast error would leave banks certain of using the standing facilities, and so would move the market rate to the edge of the interest rate corridor. So the size of the central bank's forecast errors relative to commercial banks' uncertainty about payments determines the position of the market rate within the interest rate corridor, and hence the level of the market rate on any given day.

Chart 3
Illustrative demand curve

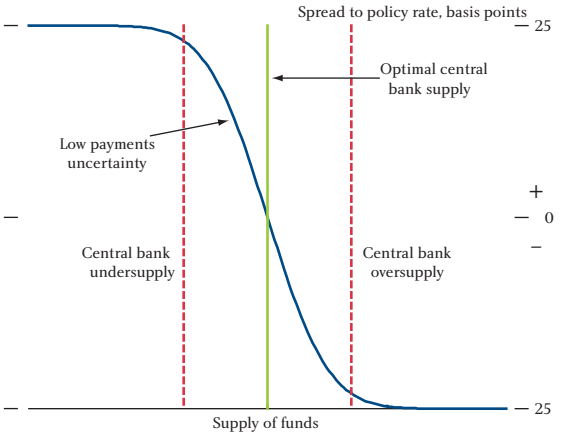
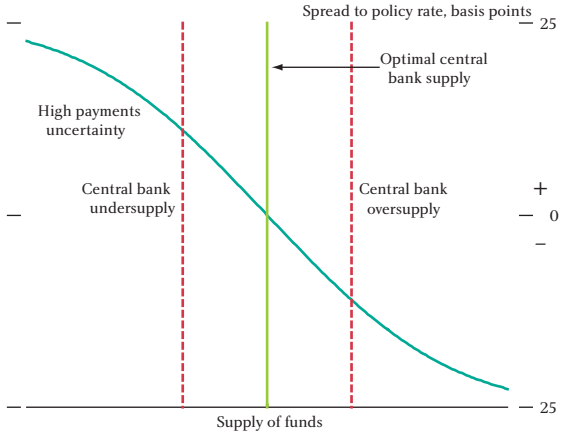


Chart 4
Illustrative demand curve

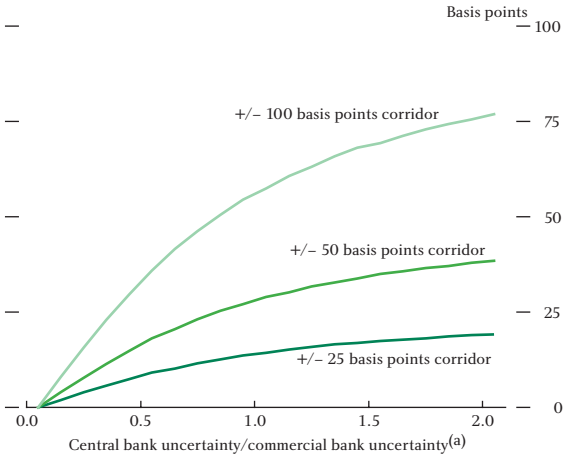


Provided that the central bank's forecast errors are symmetrically distributed around zero, banks will be equally as likely to exceed their reserve targets as to fall short of them. So, on average, the market rate should be on target. If banks expect the Bank to supply the correct amount of reserves for them to meet their reserve targets on the final day of the maintenance period, then they should expect the market rate to be on target on that day.

(1) The determination of the market interest rate is discussed in more detail in the technical appendix.
(2) That is, distributed in such a way as to minimise the expected aggregate recourse to the standing facilities.
(3) See Whitesell (2003) for a discussion of the effect of central bank forecast errors and commercial banks' uncertainty over their end-of-day balances on the market rate.

With regard to the volatility of the market rate, Chart 5 shows that interest rate volatility is higher when the central bank's forecast errors are large relative to commercial banks' payments uncertainty.(1) It also shows that, because the market rate is a combination of the lending rate and the deposit rate, volatility is proportional to the width of the interest rate corridor. This implies that the narrower corridor of +/– 25 basis points on the final day of the maintenance period in the Bank's new system should bring lower volatility than a wider corridor.

Chart 5
Interest rate volatility



(a) The ratio of the standard deviation of the central bank's forecast errors to the sum across commercial banks of the standard deviation of their payment shocks.

The range for reserve remuneration

Rather than requiring banks to meet their reserve targets exactly, the Bank will remunerate average reserve holdings at the official interest rate provided they fall within a range of +/– 1% of the point target. This 'reserve range' should mitigate the effect of central bank forecast errors on the market rate. This is because it reduces the probability that the standing facilities will be used, as small deviations from the reserve target will simply result in a higher or lower balance within the reserve range, rather than forcing banks into the standing lending or deposit facilities. A range of +/– 1% should be sufficiently large to absorb most likely errors in the Bank's liquidity forecast on the final day of the maintenance period, based on forecast errors over the past five years.

In the stylised model described above, with a reserve range, the market rate is a combination of the lending rate, the deposit rate, and the reserve remuneration rate (which, in this case, is the official interest rate), weighted by the probability of falling short of the reserve range, exceeding it, or falling within the range. This means that the range creates a flat portion of the aggregate demand curve around the level of supply consistent with banks meeting their reserve targets precisely, as shown in Charts 6 and 7. The larger the reserve range, the more closely the market rate is anchored to the remuneration rate. For example, an infinitely large range (with no penalty for daily overdrafts) would imply that the central bank was prepared to borrow and lend in unlimited quantities at the remuneration rate, so that the market rate would be identically equal to the remuneration rate.(2) As with the conventional corridor system, the market rate will be on target if the central bank supplies funds equal to the banks' reserve targets, as well as the correct amount to offset any changes in the autonomous factors.

Chart 6
Illustrative demand curve

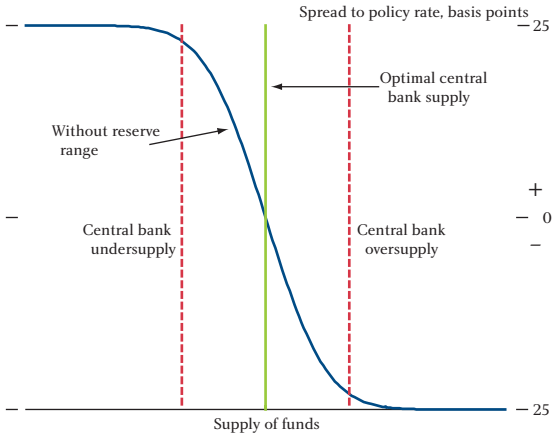
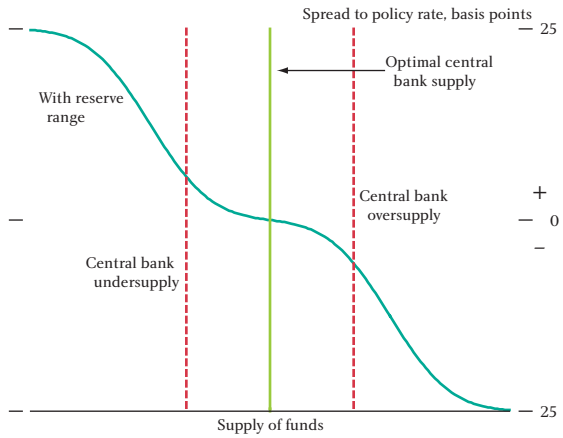


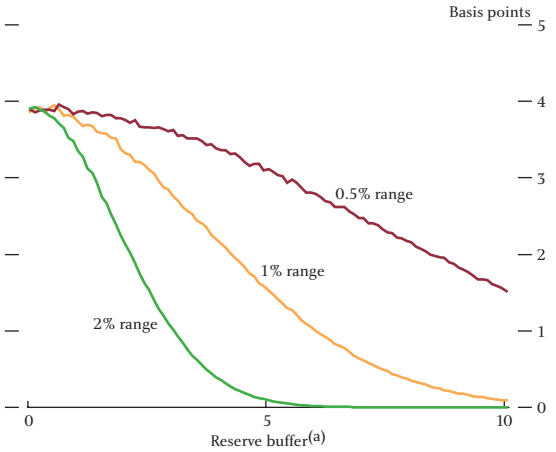
Chart 7
Illustrative demand curve



(1) The chart is based on a large number (20,000) of simulations of the one-day model described above.
(2) While an infinitely large range should tie down the market rate, it would have several disadvantages. In particular, if banks were permitted to run their balances at the central bank up and down without limit instead of dealing with other banks, the money market could become less liquid and the central bank's balance sheet might become very large.

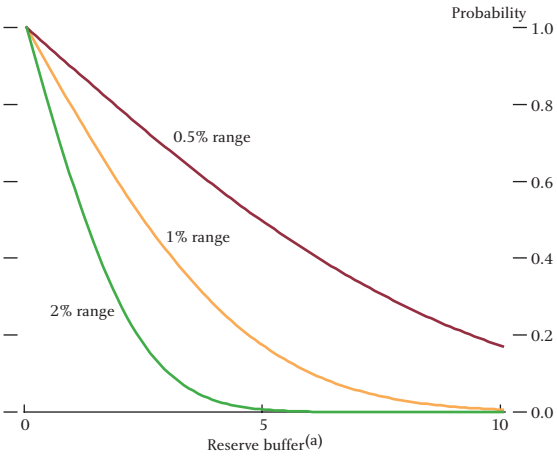
The effectiveness of the reserve range in lessening volatility will depend, among other things, on the level of reserve targets chosen by banks. Chart 8 shows how the volatility of the market rate depends on the size (in money terms) of the reserve range, which depends in turn on the reserve targets chosen by banks (shown in the chart as 'reserve buffers' — the ratio of reserve targets to banks' payments uncertainty), and on the percentage width of the range around these targets (each line in the chart represents a different percentage width).(1) This is because the larger the reserve range, the less likely banks are to be forced to make use of the standing facilities as a result of central bank forecast errors or late payments from other commercial banks, as shown in Chart 9.

Chart 8
Illustrative rate volatility
(Central/commercial bank uncertainty = 1/5)



(a) The ratio of aggregate reserve targets to the sum of the standard deviation of payment shocks across commercial banks.

Chart 9
Probability of using standing facilities
(Central/commercial bank uncertainty = 1/5)



(a) The ratio of aggregate reserve targets to the sum of the standard deviation of payment shocks across commercial banks.

In summary, the model suggests the Bank's proposed new system should ensure that the market rate is expected to be on target on the final day of the maintenance period. It should also dampen volatility on that day. The next section discusses how reserve averaging can ensure that the market rate remains close to target over the rest of the maintenance period.

Reserve averaging and the martingale property

Meeting a reserve target on average over the course of a month gives banks much greater flexibility in their liquidity management than if they have to balance their accounts every day. In particular, on any given day they can hold a balance which is higher or lower than their average reserve target, to take advantage of any divergence between the market rate and the rate expected on the remaining days of the maintenance period. In fact, if meeting the reserve target at the end of the maintenance period was the only constraint faced by banks, their ability to run their reserve balances up and down, and so to arbitrage between rates on different days of the period, should mean that market rates over the period would not deviate at all from the rate expected on the final day.(2)

This result is known as the martingale property. It implies that as long as the central bank is expected to provide the correct amount of liquidity to the market on the final day of the maintenance period, and so the market rate is expected to be on target on that day, the rate should be on target throughout the entire maintenance period. For example, any bank which had an average reserve balance below its reserve target early in the maintenance period would know that it could borrow the shortfall at the official interest rate on the final day of the period. Likewise, any bank with an average reserve balance above its target could lend any excess reserves on the final day at the official interest rate. Because banks know that they will be able to adjust their reserve position on the final day of the maintenance period by borrowing or lending at the official interest rate, no bank has an incentive to borrow in the money market at a higher rate or lend at a lower rate on any day of the period. This means that banks' demand curves should be perfectly elastic (flat) at the official interest rate, so that changes in the supply of reserves would have no impact on the market rate.

(1) Chart 8 shows the results of a large number (20,000) of simulations of the one-day model with a reserve range based on the final day of a 28-day maintenance period. As discussed in the previous section, the level of interest rate volatility depends in part on the ratio of central bank forecast errors to commercial bank payment uncertainty. The simulations underlying the chart assume that the latter is five times as great as the former. This means that the level of volatility in Chart 8 might not be the same as the level of volatility in the Bank's new system.
(2) Davies (1998) examines such a case, as do Bartolini, Bertola and Prati (2002).

However, if banks cannot arbitrage perfectly between holding reserves on different days of the maintenance period, then changes in their reserve positions may cause the market rate to deviate from the rate expected on the final day. Indeed many studies, including that by Hamilton (1996), have found that the martingale property does not hold for the US federal funds rate. One possible constraint on interday arbitrage is the penalty applied if banks' accounts at the central bank are overdrawn on any day.(1)

The effect of the overdraft constraint

Because daily overdrafts are penalised, a bank which exceeds its cumulative reserve target before the end of the maintenance period cannot run an overdraft in order to correct its position without incurring interest rate penalties. Equally, it will not want to hold additional reserves, which would receive no interest. This means that a bank which has exceeded its reserve target before the end of the maintenance period will tend to target a reserve balance of zero on each of the remaining days of the period, and so will be at risk of being forced into the standing facilities by unexpected liquidity flows. So in choosing the quantity of reserves to borrow or lend on the earlier days of the maintenance period, a bank must consider not only how its decision affects the probability of using the lending and deposit facilities on that day, but also how it affects its cumulative reserve balance, and so the probability of using the standing facilities later on in the same period. Changes in the aggregate supply of reserves (and changes in the distribution of that supply, due to interbank shocks) can therefore affect banks' probabilities of using the standing facilities, and so influence market rates.

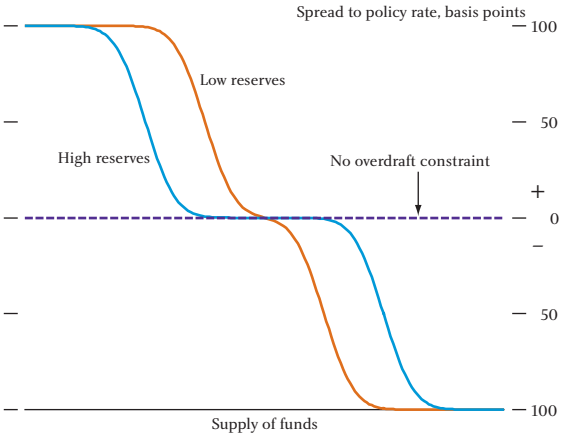
The magnitude of this effect depends on the level and distribution of banks' reserve targets. If reserve targets are low relative to banks' payments uncertainty, then a large negative swing in the supply of reserves could put them at risk of going overdrawn; equally, a large positive swing could put banks at risk of being forced into the deposit facility either on that day or later in the maintenance period.

On the other hand, if reserve buffers are high, banks would be unlikely to be at risk of using the standing facilities even in the presence of large swings in the supply of reserves, as their reserve buffers would be more than sufficient to absorb the change in reserve supply.

In particular, if each bank chooses a sufficiently high reserve target relative to its payments uncertainty, so that the probability of going overdrawn on any day is negligible, then it will also face only a minimal chance of being forced into the deposit facility. With a negligible probability of going overdrawn, it can simply reverse a positive or negative unexpected payment received on one day by lending to or borrowing from other banks on the following day. It follows that day-to-day changes in the supply of reserves will have little effect on the market rate if banks' reserve buffers are high.

By way of illustration, Chart 10 show how the aggregate demand curve for the penultimate day of the maintenance period depends on the level of banks' aggregate reserve targets. The larger the reserve buffer, the less likely changes in the supply of reserves are to affect the banks' probabilities of being forced into the standing facilities. Correspondingly, supply changes are less likely to affect the market rate, and the demand curve is closer to the case where there is no overdraft constraint.

Chart 10
Illustrative demand curve
(Penultimate day of the maintenance period)



For the averaging system to work most effectively in keeping the market rate close to target, reserve buffers must be not only high in aggregate, but also uniformly high across banks. If some banks targeted low levels of reserves relative to their payments uncertainty then, from time to time, they would have to trade in the market to offset unexpected payments flows, in order to avoid having to borrow or deposit funds using the standing facilities. In a competitive market, these trades would take place at close to the market rate. However, the

(1) Other possible constraints on interday arbitrage include transactions costs on interbank trading and limits on banks' credit exposures to any one institution.

banks targeting high reserves, from which some of the unexpected payments flows would originate, would not be obliged to trade them away, as they could simply hold a higher or lower reserve balance on that day. So if, for example, these banks wanted to avoid any transactions costs associated with trading in the interbank market, the rate might have to deviate from target in order to induce them to trade.

More generally, the effectiveness of the averaging system depends on how far the market rate needs to deviate from target in order to induce banks to arbitrage between rates on different days by running their reserve balances up or down. And the system also relies on the funds supplied by the central bank, typically through open market operations, being distributed roughly in proportion to banks' reserves targets. If not, one bank could hold a disproportionately large share of the available liquidity on one day, leaving other banks short of reserves and at risk of having to use the lending facility.

So the frequency of open market operations needed for the central bank to keep the market rate on target depends on the level of reserves held by the banking system. If reserve buffers are low, then day-to-day changes in the supply of reserves, caused by changes in autonomous factors, can have a significant effect on the market rate. In order to keep the market rate on target, the central bank would have to intervene frequently to offset changes in the autonomous factors. However, if reserve holdings are uniformly high, then the market rate should be close to target even if the central bank operates infrequently.

In the United States, where the level of reserves is relatively low, the Federal Reserve conducts open market operations on most days in order to keep the federal funds rate close to target. On the other hand, reserve holdings are considerably higher in the euro area, and the European Central Bank has succeeded in keeping market rates close to target during its reserve maintenance period with weekly operations.

Implications for the Bank's new averaging system

As reserve targets in the new system will be voluntarily chosen by banks, there is no guarantee that they will be uniformly high. However, discussions with market participants suggest that reserve holdings will be relatively high compared to their uncertainty over their end-of-day balances, perhaps in excess of £20 billion, and well distributed across the banking system. In fact, it was partly to encourage a high level of reserve holdings that the Bank decided to remunerate reserves at its official interest rate, and it was in anticipation of high demand for reserves that it imposed ceilings on banks' reserve holdings.

With a high and well-distributed level of reserves, there should be little chance of being forced into the standing facilities until the very end of the maintenance period, and weekly operations should be sufficient to keep the market rate on target, as in the euro-area system. The Bank expects that the standing facilities will not play a crucial role in rate-setting on the earlier days of the maintenance period, but instead will be used as liquidity insurance. So the rates on these facilities will, in normal circumstances, be at a wider spread of +/– 100 basis points to the official interest rate, except on the final day of the maintenance period.

Conclusion

This article has discussed how the Bank of England's new reserve averaging system should tie market rates more closely to the MPC's official interest rate. The Bank's commitment to 'fine tune' the supply of reserves on the final day of the period should mean that the market rate is expected to be on target on that day. Interest rate volatility should be proportional to the width of the corridor formed by the lending and deposit facilities, so the narrow corridor of +/– 25 basis points on the final day of the maintenance period in the Bank's new system should ensure low volatility. And having a range for the remuneration of reserves makes it less likely that errors in the Bank's liquidity forecast would force banks to make use of the standing facilities, which should dampen volatility further.

By allowing banks to run their reserve balances up and down in response to changes in market rates, averaging should also ensure that the rate expected on the final day of the maintenance period prevails over the rest of the period. In theory, the penalty applied to any daily overdrafts on banks' accounts at the Bank could hamper their ability to arbitrage between market rates on different days of the period. But this should not happen if the reserve targets voluntarily chosen by banks are uniformly high in relation to payments uncertainty across those banks facing significant payments uncertainty, as the Bank's discussions with market participants suggest they will be.

Technical appendix

This appendix outlines in more detail the model for the determination of the market interest rate underlying the article.(1) In the model, a large number of identical banks dealing in a perfectly competitive market must hold an average target level of reserves in their accounts at the central bank over a maintenance period. Initially, consider the case where any shortfall from its average reserve target at the end of the period, or a negative balance on any day, must be made up by recourse to the central bank's lending facility. Meanwhile, any reserves held in excess of the bank's cumulative reserve target must be deposited with the central bank at its deposit facility rate.

Each day banks choose their demand for reserves, x_t, in the knowledge that they will face interbank payment shocks after trading. Assuming that banks' end-of-day payment shocks are identically and symmetrically distributed, the market interest rate on the last day of the maintenance period, T, is given by

$$r_T = F\left(\frac{RR - Z_T - \mu_T - x_T}{\sigma}\right)l + \left[1 - F\left(\frac{RR - Z_T - \mu_T - x_T}{\sigma}\right)\right]d \qquad \textbf{(1)}$$

where RR is the banks' cumulative reserve target (ie the average reserve target times the number of days in the maintenance period), Z_T is the level of reserves accumulated at the start of the day, μ_T is the change in the autonomous factors on that day, l is the lending facility rate, d is the deposit facility rate, σ is the aggregate uncertainty over banks' payment flows and $F()$ is the cumulative distribution of the shock to banks' end-of-day balances. The market rate will be on target if the central bank offsets the day's change in the autonomous factors, and supplies what remains of banks' reserve targets (ie if supply equals $RR - Z_T - \mu_T$), so that banks are equally likely to make use of each standing facility.

If reserves are remunerated provided they fall within a range of the reserve target, and if the level of accumulated reserves at the start of the last day of the maintenance period lies below bottom of the reserve range for each bank, then the market interest rate is(2)

$$\begin{aligned} r_T = {} & F\left(\frac{(1-\lambda)RR - Z_T - \mu_T - x_T}{\sigma}\right)l + \left[1 - F\left(\frac{(1+\lambda)RR - Z_T - \mu_T - x_T}{\sigma}\right)\right]d \\ & + \left[F\left(\frac{(1+\lambda)RR - Z_T - \mu_T - x_T}{\sigma}\right) - F\left(\frac{(1-\lambda)RR - Z_T - \mu_T - x_T}{\sigma}\right)\right]r_{rem} \end{aligned} \qquad \textbf{(2)}$$

where λ is the percentage deviation from the reserve target allowed by the central bank and r_{rem} is the rate at which reserves are remunerated (in the case of the Bank's new system, this is the official policy rate). The larger the reserve range, the higher is the probability that banks' final balances will fall within it (the last term in brackets in the equation), and so the more closely the market rate is tied to the remuneration rate. Again the market rate will be on target if supply equals $RR - Z_T - \mu_T$.

On the penultimate day of the maintenance period, and assuming for simplicity that banks must meet their reserve targets exactly, the market rate is

$$\begin{aligned} r_{T-1} = {} & F\left(\frac{-\mu_{T-1} - x_{T-1}}{\sigma}\right)l + \left[1 - F\left(\frac{RR - Z_{T-1} - \mu_{T-1} - x_{T-1}}{\sigma}\right)\right]d \\ & + \left[F\left(\frac{RR - Z_{T-1} - \mu_{T-1} - x_{T-1}}{\sigma}\right) - F\left(\frac{-\mu_{T-1} - x_{T-1}}{\sigma}\right)\right]E(r_T) \end{aligned} \qquad \textbf{(3)}$$

(1) Similar models are developed in, for example, Poole (1968), Whitesell (2003) and Woodford (2001).
(2) Equation **(2)** relies on the assumption that all banks hold identical reserves buffers (RR/σ).

Equation **(3)** shows that market rate on the second-last day, r_{T-1}, is an average of the lending rate, the deposit rate, and the rate expected to prevail on the final day of the period, $E(r_T)$, weighted by the probability of going overdrawn, the probability of exceeding the reserve target, and the probability of avoiding both standing facilities. By implication, if the probability of being forced into each standing facility on the second-last day of the period is very close to zero, the market rate will be very close to the rate expected to prevail on the last day. In the same way, if banks are very unlikely to be forced into the standing facilities throughout the maintenance period (until the last day), the market rate should also remain very close to the rate expected on the last day.

References

Bank of England (2005), *Reform of the Bank of England's operations in the sterling money markets: a paper on the new framework*.

Bartolini, L, Bertola, G and Prati, A (2002), 'Day-to-day monetary policy and the volatility of the federal funds rate', *Journal of Money, Credit and Banking*, Vol. 34, pages 137–59.

Bindseil, U (2004), *Monetary policy implementation: theory, past and present*, Oxford University Press.

Clews, R (2005), 'Implementing monetary policy: reforms to the Bank of England's operations in the money market', *Bank of England Quarterly Bulletin*, Summer, pages 211–20.

Davies, H (1998), 'Averaging in a framework of zero reserve targets: implications for the operation of monetary policy', *Bank of England Working Paper no. 84*.

Hamilton, J (1996), 'The daily market for federal funds', *Journal of Political Economy*, Vol. 104, pages 26–56.

Poole, W (1968), 'Commercial bank reserve management in a stochastic model: implications for monetary policy', *Journal of Finance*, Vol. 23, pages 769–91.

Vila Wetherilt, A (2002), 'Money market operations and volatility in UK money market rates', *Bank of England Quarterly Bulletin*, Winter, pages 420–29.

Whitesell, W (2003), 'Tunnels and reserves in monetary policy implementation', *US Federal Reserve Finance and Economics Discussion Series*.

Woodford, M (2001), 'Monetary policy in the information economy', *Economic Policy for the Information Economy*, Federal Reserve Bank of Kansas City.

Wealth and consumption: an assessment of the international evidence

Working Paper no. 275

Vincent Labhard, Gabriel Sterne and Chris Young

Since the mid-1990s, there have been remarkable changes in stock market capitalisation in many of the major economies, related in part to changes in the valuation of equities. Between Autumn 1994 and Autumn 2000, stock market capitalisation increased by over 100% of GDP in the United Kingdom and the United States; while between 2000 Q3 and 2003 Q2, market capitalisation fell by 65% of GDP in the United States and by 87% in the United Kingdom. These changes have motivated renewed interest in the wealth effect on consumption.

The wealth effect on consumption is often captured by the marginal propensity to consume from financial wealth (mpcw). The existing empirical literature suggests that this quantity varies greatly across countries, and new results presented here, based on single-country structural vector autoregressions (VARs) for eleven OECD countries, tend to confirm this finding. This divergence though is at odds with the values used in calibrated models, which tend to be more similar across countries. The main objective of this paper is to offer a critique of the literature, and to assess several possible explanations that might justify such differences in the mpcw across countries.

It is concluded that many potential explanations cannot account for the magnitude of the differences reported in the empirical literature on the mpcw, including differences in demographics and in the type of assets held across economies. It is argued that there is little theoretical rationale for such a wide cross-country dispersion of empirical estimates. In part, this may be due to the empirical approach taken in much of the literature: partial equilibrium approaches to capturing the impact of changes in wealth on consumption face a cocktail of data problems and cannot account for underlying structural causes of simultaneous changes in both consumption and wealth. For example, in circumstances in which there are shocks to expected earnings, economies where market capitalisation is low and wealth held in unquoted equities is underrecorded might be (inaccurately) estimated to have a higher mpcw. Because conventional empirical estimates of the mpcw are commonly calculated by dividing an empirical estimate of the partial elasticity of consumption with respect to wealth by the observed wealth to consumption ratio, if the reaction of consumption to an earnings shocks is similar, but wealth is underrecorded because of data problems, then the mpcw will be overestimated.

This leaves the question of how it may be possible to assess empirically the likely wealth effect on consumption. Using a suitable panel technique we find that the hypothesis of the long-run mpcw being the same across countries cannot be consistently rejected, and obtain a plausible estimate for the cross-section of eleven OECD countries. This estimate is a little over 6%, broadly consistent with estimates used in a wide range of policy models.

Corporate expenditures and pension contributions: evidence from UK company accounts

Working Paper no. 276

Philip Bunn and Kamakshya Trivedi

Understanding how companies react to financial pressures is an important academic and policy concern. Apart from being relevant to any comprehensive appreciation of corporate behaviour, the ways in which companies adjust their balance sheets and the size of those responses are also inextricably linked to financial stability risks. In this paper we focus on one specific source of financial pressure — contributions to company pension schemes — and investigate the empirical relationship between corporate expenditures and variation in pension contributions within a panel of non-financial UK firms.

Contributions to fund shortfalls in defined benefit pension schemes are a useful example of financial pressure because these must often be made by the sponsoring companies in line with regulatory requirements, and therefore constitute a relatively exogenous source of variation in internally generated finance. The presence of a budget constraint implies that such contributions to the pension scheme divert cash from alternative uses such as dividend payouts or investment. If a firm is financially constrained, or if external finance is costly, pension contributions could force a company to cut dividends and/or not make investments it might otherwise have pursued. Indeed, if the funding positions of pension schemes are related to the stock market (say because they are all exposed to similar equity markets) then financial pressures may affect many companies at the same time, and individual company level responses may add up to large systemic effects.

The recent financial difficulties of company pension schemes resulting from falling asset values and declining interest rates have been highlighted by the introduction of new accounting standards such as FRS17 in the United Kingdom. There have been many estimates of the magnitude of these difficulties, but they all imply that an economically significant increase in pension contributions would be required by sponsoring companies to eliminate the current deficits faced by defined benefit pension schemes in the absence of a sustained rise in the stock market. The results of this paper can therefore be used to inform an assessment of the possible implications of these increases in contributions for company balance sheets.

Using a panel of quoted non-financial UK companies between 1983 and 2002 we estimate generalised methods of moments models for dividends and investment based on those in the existing literature. The main innovation of this paper is to augment these models with a measure of company pension contributions. Our results suggest that firms pay lower dividends than they would have otherwise done in response to increases in pension contributions, controlling for other components of the balance sheet such as capital, cash flow, debt and investment. Dividends have a similar elasticity with respect to pension contributions as cash flow; this is plausible because pension contributions are effectively reductions in corporate cash flow. But this marginal effect implies that dividends are not reduced in response to higher pension contributions on a one for one basis, and therefore in the presence of a binding budget constraint there may also be further adjustment through other channels such as investment, debt or equity issuance. Empirically we find only weak evidence that firms reduce their investment in a statistically significant way as pension contributions rise. This result implies that adjustment to company balance sheets on account of increased financial pressure from higher pension contributions comes mainly through financial rather than real channels.

When is mortgage indebtedness a financial burden to British households? A dynamic probit approach

Working Paper no. 277

Orla May and Merxe Tudela

Since the mid-1990s the volume of secured lending to households has expanded rapidly, both in absolute terms and in relation to household incomes. In 2004, the stock of secured lending to households exceeded £850 billion (compared to around £400 billion in 1995) and represents the largest domestic on balance sheet exposure of UK-owned banks. The rates of arrears and write-offs on secured debt have fallen in recent years and, despite a slight pickup in the second half of 2004, are currently at historically low levels. But there is a risk these could rise further if households began to encounter problems servicing their mortgage debt.

This paper seeks to explain the determinants of mortgage payment problems using disaggregated data from the British Household Panel Survey (BHPS). By using disaggregated data, we can examine how both macroeconomic factors (such as interest rates and house prices) and household-level factors (such as employment status and saving behaviour) affect the probability of households meeting their mortgage commitments. Since the BHPS is a panel survey, it allows us to track the same individuals over time; so we can also examine the dynamics of mortgage payment problems. In particular, we can analyse whether changes in a person's circumstances (such as changes in income) and previous experience of payment problems affect their current ability to service mortgage debt.

The data confirm that the two most important household-level factors associated with mortgage payment problems are adverse changes in employment and the level of income gearing (the ratio of mortgage payments to household income). Becoming unemployed significantly increase the probability of mortgage payment problems. But the results show that if the household is persistently unemployed this is not associated with a higher probability of payment problems, presumably because the household can adjust consumption so that servicing the mortgage is no longer a problem. However, this result may be driven by the fact that there are only a small number of mortgagors in our sample who are unemployed for two or more years.

We find evidence of a positive relationship between income gearing and the probability of mortgage payment problems — a higher level of income gearing significantly increases the probability of payment problems. However, this relationship is only apparent when gearing passes 20% — below that level there is no significant effect on payment problems from income gearing.

The level of effective mortgage interest rates is also found to increase the probability of mortgage payment problems. This is the only non-household-specific variable that is found to have a significant effect. The aggregate level of unemployment has no independent effect beyond that identified at the household level.

The results also show that problems paying for secured debt are persistent. The experience of payment problems has a genuine behavioural effect upon the household in the sense that previous experience of problems increases the probability that the household will subsequently have difficulty servicing its mortgage. There are a number of possible explanations for this. Past experience of problems could affect access to credit if lenders use information about previous payment difficulties in their lending decisions. Alternatively, the experience of problems could lessen any stigma attached to payment difficulties and this could make the household less careful in avoiding these in the future. The evidence implies that policies addressing mortgage payment problems can have long-lasting effects.

We find no evidence for collateral effects: neither the amount of housing equity nor the presence of negative equity affects the probability of mortgage payment problems (although they will affect loss given default). This result is new and contrasts with previous work which has identified housing equity as a determinant of the aggregate level of mortgage arrears. This difference may be due to the sample period we use. The BHPS contains information on housing equity from 1993 onwards, so it does not allow us to directly measure the effects of falling house prices between 1990 and 1993 upon mortgage payment problems. It is possible that falling housing equity had already affected some mortgagors' ability to service their debts before 1993 and that these households would not appear in our sample.

We use the estimation results to construct a measure of mortgage debt at risk. Changes in the probability of payment problems and in the amount of secured debt held will both affect the amount of debt at risk. Over the sample period 1994 to 2002, we find that mean debt at risk has fallen. This implies that the probability of mortgage payment problems has fallen sufficiently to offset the effects of increasing mortgage debt over the same period. There is also evidence that mortgage debt is now concentrated in less risky households. This implies that the short-term financial stability risks associated with the stock of mortgage debt in 2002 are lower than in the mid-1990s.

Misperceptions and monetary policy in a New Keynesian model

Working Paper no. 278

Jarkko Jääskelä and Jack McKeown

Over the past decade, equity prices in the United Kingdom and other major industrial countries have risen sharply and have subsequently fallen back. Towards the end of the period in which equity prices were rising, UK household borrowing and house price inflation also picked up. One — but by no means the only — explanation for these events might be that people expected future incomes to be higher and so increased their borrowing to bring forward this higher expected future income in order to smooth consumption. But what if these expectations for future income were over-optimistic — what if the private sector expectation of higher future income were a misperception? How should monetary policy respond in a situation where behaviour today is influenced by misperceptions? In this paper, we discuss how monetary policy might react in an environment where behaviour may have been driven by over-optimistic expectations — misperceptions — about future output.

We develop a model to analyse how monetary policy might respond to these potential misperceptions about future output. Our laboratory economy is a calibrated New Keynesian model in which both the output gap and inflation depend on the expected future output gap and inflation. Both inflation and the output gap also display persistence. Misperceptions are modelled as persistent demand shocks, which feed through the expectations channel of current demand into the determination of output. It is assumed that while policy cannot create or dispel misperceptions, it can offset their effects. We assume that policy takes the form of a 'Taylor rule', that is, the central bank sets the interest rate in response to two variables — inflation and the output gap. Within this class of simple policy rules, we describe how optimal weights on output and inflation in the policy rule change in response to misperceptions. We also calibrate the costs and benefits of responding to misperceptions under uncertainty.

Using this laboratory we come to the following conclusions. First, and unsurprisingly, we find that misperceptions cause welfare to be lower. Furthermore, varying the persistence of the misperceptions, we find that welfare decreases as persistence increases — the longer agents are wrong, the worse are the effects of a given misperception. Second, by allowing for some rule-of-thumb behaviour, we look at how the degree of forward lookingness interacts with misperceptions. We find that in our set-up forward lookingness is bad — the more forward looking agents are, the more welfare is reduced by a given misperception. Intuitively, this result comes from the fact that agents who are more forward looking will try to bring forward more of their misperceived higher expected future income. Third, policy can partially offset the effects of misperceptions by responding more actively to both deviations of inflation from target and to output gaps. Because misperceptions distort demand, output and inflation are pushed in the same direction and so policy should respond more to both in order to offset the effects of misperceptions. Policy should, however, place relatively less weight on output gap fluctuations. How policy should react to misperceptions depends crucially on the persistence of the misperception — the more persistent the misperception, the less weight the policymaker should place on output. This result is intuitive; as the noise in the target variables increases the less weight should be placed on it. Fourth, we consider situations in which policymakers are uncertain about the process driving misperceptions. We find that unless the policymaker is confident there are no misperceptions, or that any misperceptions will be quickly corrected, the policymaker should assume that persistent misperceptions are present: policy rules derived on the assumption that misperceptions are persistent do better in the event that this assumption is incorrect than do policies based on assuming no misperceptions when in reality the opposite is true. When we also include policymaker uncertainty about the degree of output persistence, we note that, in the presence of misperceptions, the robust 'safe' strategy is to overestimate the degree of forward-looking expectations (and so the size of the misperception).

Monetary policy and private sector misperceptions about the natural level of output

Working Paper no. 279

Jarkko Jääskelä and Jack McKeown

There is ongoing debate about by how much the real world differs from the world described by models of rational expectations. This paper describes a simple model that offers some insight into the consequences for monetary policy design of problems the private sector and the central bank might have in estimating the natural level of output.

The paper uses a simple model with two agents, a private sector and a policymaker. The private sector bases its behaviour on its perception of the sustainable level of output and on its perception of the objectives and actions of the policymaker. The policymaker sets policy to keep inflation stable around an inflation target, and to keep output stable around its sustainable level. The paper assumes that the private sector and the policymaker have asymmetric information sets. These asymmetries cause the private sector and/or the central bank to have mistaken expectations — misperceptions — about the natural level of output. Furthermore, these misperceptions are not a function of the fundamentals contained in the model, but rather are some non-modelled factor. Three variants of the misperceptions problem are considered. In the first two cases, only the private sector has misperceived natural output, while in the third case, both the private sector and the central bank have misperceived natural output. In the first case, the private sector misperception is known by the policymaker, while in the second case, the misperception is unobserved by the central bank. In the third case, both agents' misperceptions are stochastic and unobservable (to the other agent). In all three variants it is found that, in the face of a private sector misperception, appointing a monetary policy maker who will be tougher on deviations of inflation from target than society can partially offset the negative effects of the private sector misperception.

A quality-adjusted labour input series for the United Kingdom (1975–2002)

Working Paper no. 280

Venetia Bell, Pablo Burriel-Llombart and Jerry Jones

Government policy, demographic shifts and social change have radically altered the structure of the UK labour force. For example, since the 1970s, the workforce on average has become older, better educated, and more balanced between the genders. This paper examines these changes in the labour market from 1975 to 2002, and their implications for labour quality.

Economists are interested in evaluating factor inputs (such as capital and labour) because they are measures of an economy's productive potential. The standard measure of labour is to aggregate the number of hours worked by each person in the economy. Yet this method does not take into account the fact that some people are more productive than others. By adjusting standard measures of an economy's total hours worked with a labour quality index, we can derive a truer measure of the contribution of labour to production.

An overall shift in the structure of the workforce can change the aggregate skill (quality) level in an economy. Measuring 'skill' is difficult, since it is a loose term that in part reflects the characteristics of a worker and is not directly observable. To compound matters, individuals are different, and, to a certain extent, their skill levels are subjective. For example, it could be argued that a younger workforce is likely to be more innovative and dynamic than an older one. Conversely, an older workforce, with greater work experience, might be more productive. In order to capture skill levels, it is necessary to find proxies. This paper uses information on wage differentials between worker groups as a measure of skill.

Data from the Labour Force Survey and the General Household Survey are used to construct the quality-adjusted labour input series over the period 1975–2002. The total hours worked by particular groups of workers are weighted by their respective wage bill shares. Our benchmark series takes into account gender, five age groups and four education levels.

We find that the quality of the UK workforce has increased since 1975. Adjusting for labour quality adds 0.67 percentage points per annum to the growth rate of labour input from 1975–2002. This increase can be attributed to changes in the educational distribution. Meanwhile, the workforce, in general, has become older, reflecting the temporary increase in the birth rate after the Second World War. This has had a positive effect on measured labour quality, particularly after 1990.

Adjusting labour input for quality changes has some interesting economic implications. The final section of the paper explores these issues. Its key finding is that a large proportion of what is usually considered to be TFP (total factor productivity) growth can be attributed to an improvement in the quality of the labour input. This result has no implications for the measurement of UK growth from 1975–2002, but it does help us to identify more accurately the sources of that growth.

Monetary policy and data uncertainty

Working Paper no. 281

Jarkko Jääskelä and Tony Yates

The data policymakers use to assess the state of the economy are often uncertain proxies for the things they really want to know about. Data releases referring to the most recent periods contain the most signal about the future for policymakers, but typically also contain the most noise. Many data are revised over time, and improved in the process. Those that are not revised are still uncertain, but over time other corroborative evidence arrives that can help us interpret them. We ask how policy should be designed in the face of this kind of data uncertainty. What if policymakers do not know how much variation there is in data uncertainty over time, or over vintages? We also ask whether the response of policy to what we term time variation in data uncertainty, or more properly variation across vintages, can account for the observation that interest rates seem to move more sluggishly in response to news than most models would predict they should.

We present a model that allows us to study variation in measurement error across data vintages. In our model, there are two endogenous variables the central bank has to measure: inflation, and the output gap. In the United Kingdom, and in many other countries, inflation data typically do not get revised, and therefore the measurement error in current period inflation data are (improvements in survey methods aside) the same as that in old data. Output data, however, are revised, and it is likely that early releases of output are less well measured than the revised estimates that succeed them. Our model is a metaphor for this world: inflation data are always perfectly measured, but output gap data become better measured over time.

We make three observations. First, we examine simple optimised rules for monetary policy: these rules are based on current and past-dated inflation and output data. The optimal coefficients change as the amount of noise in the output gap data increases, and as the measurement error in new data increases relative to older data. Intuitively, the more measurement error there is in the output gap data, and the worse current data are relative to lagged data, optimised simple rules put more weight on inflation compared to output gap terms; and more weight on lagged output gap terms relative to current ones.

Second, we note that an econometrician who tries to study the behaviour of central bank policy rates — but is unaware that central bank rates are designed to cope with data uncertainty — will conclude that interest rates move too sluggishly in response to news. But it is likely that vintage variation in measurement error alone cannot account for the amount of interest rate smoothing seen in the data.

Finally, we explore the effects on policy of uncertainty about noise in new data compared to that in older data. In the face of this lack of knowledge robust policies err on the side of assuming more vintage variation in measurement error, rather than less. This is an interesting theoretical result, but it could also have a practical angle: the apparent 'excess' smoothing in observed policy rates may reflect a robust response to an unknown degree of variation in measurement error across different vintages of data.

Stress tests of UK banks using a VAR approach

Working Paper no. 282

Glenn Hoggarth, Steffen Sorensen and Lea Zicchino

Stress tests were performed on the resilience of the UK banking system as part of the IMF Financial Sector Assessment Programme (FSAP). These tests revealed that the UK banking system was robust to a number of adverse shocks. Most of these tests were conducted by the large banks themselves, based on scenarios developed from the Bank of England's Medium Term Macroeconometric Model. To compare the robustness of such a conclusion to the choice of stress test, this paper proposes an alternative test of the resilience of the UK banking sector, which analyses the common developments in a measure of bank fragility and key macroeconomic variables. An advantage of the stress test proposed here is its ability to analyse — within a small system of equations — the increase in bank fragility following a shock to a single macroeconomic variable, allowing for the potential impact on other key macroeconomic variables that may also affect bank fragility. Furthermore, the test allows for feedback effects from an increase in fragility back to the macroeconomy — for example, an increase in the default rate on loans by the household and corporate sectors may cause consumption and investment to fall subsequently.

The stress tests used here, like most other methodologies, may not fully capture structural changes in the banking industry. Nonetheless, the results are robust to a number of checks and uncover some important relationships between macroeconomic dynamics and the loan write-off ratio — our measure of bank fragility. UK banks' aggregate write-offs, and particularly corporate ones, are found to be sensitive to a downturn in economic activity. Household write-offs, on the other hand, are found to be more sensitive to changes in income gearing. The results suggest that, even if the most extreme economic stress conditions witnessed over the past two decades were repeated, the UK banking sector should remain robust.

The approach to stress testing proposed in this paper is straightforward to implement and provides a useful complement to the suite of models used to assess banking sector vulnerability.

Measuring investors' risk appetite

Working Paper no. 283

Prasanna Gai and Nicholas Vause

Financial market participants and policymakers frequently cite increased 'risk appetite' as an important driver of the recent downward trend in risk premiums and yield spreads. Risk appetite reflects investors' willingness to hold risky assets and, as such, depends on their attitudes to risk as well as the size of other risks they carry on their balance sheets, such as that relating to employment. As a general determinant of asset prices, changes in risk appetite can generate correlation among the returns of otherwise unrelated assets. For example, a decline in risk appetite may help explain financial market contagion during the 1997–98 East Asian crisis. More recently, there have been concerns among policymakers that a build-up of risk appetite may have led to a 'search for yield', whereby investors demand more risky assets in pursuit of higher yields.

This paper reviews the concept of risk appetite, distinguishing it from the related notions of risk aversion and the risk premium. It suggests a precise definition of risk appetite, relating it to the price of risk — the compensation that investors require to hold a given amount of risk. This definition can be related to differences between investors' expectations about future asset returns and those implicit in options prices. Calibration of our measure of risk appetite suggests that it fluctuates within a relatively narrow range during 'normal' times, but falls sharply during crises.

The Governor's speech[1] to the CBI North East annual dinner

Over the past half century the UK economy has been almost as volatile as the sporting fortunes of the North East. In my first speech as Governor, two years ago, I talked about the '***nice***' decade — a period of ***n***on-***i***nflationary ***c***onsistently ***e***xpansionary economic growth. Following the Great Inflation of the 1970s and 1980s, the performance of the UK economy since 1992 might be characterised as the Great Stability. Inflation and output growth have been more stable than in any decade since the Second World War. So it is not surprising that the view has gained ground that the economy can grow at a constant rate every single quarter, and that it is the job of the Bank of England to ensure that it does.

Such a view is not supported by the lessons of economic history. The business cycle has not been abolished, although monetary policy can affect its amplitude. There are two main reasons for rejecting the view that the Bank can and should control the short-run path of output.

First, developments, often outside the UK economy and whose consequences are rarely evident at the time, can produce large shocks to total demand. Since there are lags between changes in interest rates and their impact on spending and ultimately inflation, it is usually not possible for monetary policy to offset those shocks in the short term. And we rarely have accurate information on spending until several months and often years later. Hence there will always be some volatility in the economy when demand changes in an unforeseen way — whether consumer spending, business investment or other components of demand.

The second and less widely appreciated reason is that the growth rate of potential supply is itself changing over time. The economy's potential to produce goods and services depends on the availability of labour and capital equipment and our ability to use them efficiently, none of which evolves steadily. For example, migrant labour from Eastern Europe has doubled the growth of labour supply in the United Kingdom over the past couple of years. And the IT revolution not only changed the technology used in almost every business operation; it also lowered the price of new capital goods, leading to increased rates of capital accumulation. Technology advances over time but not at a steady pace. Innovations are unpredictable and take time to enter business processes. And, as anyone who has invested in computers will know, it takes even longer to work out how to exploit them most effectively. So potential supply grows at a variable rate, and there is nothing that monetary policy can or should do to change that.

Uncertainty about the rates at which both demand and supply are growing poses two questions — the first long term and the second more immediate.

The long-term question is clear — will the Great Stability continue? Will the next ten years be as *nice* as the past ten? That seems rather unlikely. As I said two years ago in Leicester: 'The strategy which the Monetary Policy Committee has pursued in recent years — stimulating domestic demand to compensate for weak external demand in the face of a strong exchange rate — carries the risk that there could be a sharp correction to the level of consumer spending at some point in the future'. That risk has, at least in part, crystallised. Some of the influences that have in the past provided a boost to consumer spending may be going in to reverse.

Over the past decade the integration of China, India and other emerging markets in Asia into the world trading system has lowered the prices of clothes, electrical goods and other items that we import from them. The terms on which we trade with the rest of the world improved. That provided a boost to real disposable incomes and so to consumer spending. But the rapid growth of China and India also meant sharp increases in the prices of many commodities, such as copper, aluminium, iron ore and, particularly important, oil. In that sense the rises in oil prices over the past two years are very different from the oil price 'shocks' of the 1970s. They reflect rapid growth in the demand for oil — faster than the growth of capacity — rather than an OPEC-inspired contraction of supply. What we have seen is not so

(1) Delivered on 11 October 2005 in Gateshead. This speech can be found on the Bank's website at www.bankofengland.co.uk/publications/speeches/2005/speech256.pdf.

much an 'oil shock' but a consequence of the rise of China.

The lower prices for many consumer goods and the higher cost of oil are both the result of globalisation. Having benefited from the former we are now experiencing the latter. As a result, our import prices are no longer falling as rapidly as they were, and, indeed, over the past year even the prices of non-oil imports have risen. With the additional impact of higher oil prices, real disposable incomes are rising more slowly, and the long-awaited rebalancing of the economy away from consumer spending to business investment and net exports is underway.

Moreover, the higher oil prices may reduce the growth of the supply capacity of the economy. So it is likely that in future the shocks to both demand and potential output will be more challenging for monetary policy than during the Great Stability. Both inflation and output may be somewhat more volatile than the calm waters to which we had become accustomed. And the MPC can do little to change that. Expectations of its ability to stabilise the economy must be realistic.

The immediate question for the MPC is how to respond to the rebalancing of the economy and the rise in oil prices. Over the past year the economy, led by consumer spending, has slowed sharply. At the same time inflation — on our target CPI measure — has moved above the 2% target. It has now reached 2.4%. Only a year ago it was 1.1%. The MPC has been surprised by both the slowdown and the rate at which inflation has picked up.

So why has inflation picked up? One reason, of course, is the direct impact of higher oil prices on the cost of petrol and heating and the indirect effect on the cost of producing goods and services that use oil as an input. No more than one half of the pickup in inflation can be explained by oil prices. Other factors are at work, such as the pressure of demand on capacity over the past two years. And more and more spending is on services. The proportion of expenditure in the basket used to calculate the CPI accounted for by services — especially health, education and financial services — has risen from 36% in 1997 to over 46% this year. Since inflation of services is higher than that of goods it is not surprising that CPI inflation has risen as the share of spending on services has itself risen. Interestingly, the increase in the share of services is much less evident in the basket for the RPIX measure of inflation — from 38% to 41% over the same period.

Higher oil prices affect not just current inflation but also both demand and potential supply and hence future inflation. They mean a shift in spending power from oil consumers to oil producers. The purchasing power of wages and salaries must grow more slowly than would otherwise have been possible, by around 1%–2% in the major industrialised countries, spread over a couple of years.

The adverse effect of the rise in the oil price on consumers' purchasing power cannot be avoided. Inflation will for a short while be above target. But attempts to claw back lost purchasing power by bidding up money wages would simply result in higher unemployment as the MPC acted to keep inflation in line with the target looking further ahead. It is reassuring that so far earnings growth has remained stable.

As consumption slows, some of the impact of higher oil prices on overall demand will be mitigated as the beneficiaries of higher oil prices — the oil-producing countries and the oil companies and their owners — increase their spending. And the pressure on government finances will be eased somewhat by higher oil revenues. But it is likely that this rebalancing of the composition of demand will mean some volatility of total demand.

Moreover, as long as firms struggle to find effective substitutes for oil, a rise in its price will make it more costly to employ capital equipment that uses oil. Some machinery may even be scrapped, reducing the effective stock of capital equipment. The fall in the real purchasing power of wages and salaries may lower labour supply. Together these effects reduce the growth of the supply capacity of the economy, although how important they are is unclear. Monetary policy, though, cannot offset movements in potential supply. But what it can and should do is examine all the evidence on the balance between demand and potential supply, and how this affects the outlook for inflation. That is what the Committee will be doing as it prepares its next *Inflation Report*.

The problem of where to set interest rates is compounded by uncertainty about the recent levels of demand and potential output. The extent of the slowdown is unclear, with mixed messages from official output data, business surveys and data on the labour market. So there is uncertainty about the rate of spending in recent quarters, let alone where it is likely to go in the near future. And there is uncertainty too over potential output, and hence the degree of slack in the

economy. Will labour migration continue at recent rapid rates, or will the softening of the labour market lead to a fall in migration? How far will higher oil prices lower potential supply? Those are the questions which the MPC must try to answer, but we do so recognising that it would be unwise to place too much weight on any one estimate of the amount of slack in the economy. All central banks are struggling with the same problems, not just the Bank of England but the Federal Reserve too. As one of its Governors, Don Kohn, pointed out only two weeks ago, 'policymakers should be cautious about responding aggressively to estimated movements in economic slack'. But most important of all is the need to keep an open mind on the future path of interest rates.

There has grown up in recent years a false sense of our ability to maintain a smooth and steady growth rate of output. So it is important to understand what monetary policy can do and what it cannot. I noted earlier that, in the past, the sporting fortunes of the North East were as volatile as those of the UK economy. What of the future? About the former, I suggest we wait to hear from Rob Andrew. For the UK economy, monetary policy cannot ensure that output will grow at a constant rate. But in the medium term it can deliver low and stable inflation. In that way, it provides a platform for you — and businesses throughout the country — to make the long-term decisions that are the source of our prosperity.

UK monetary policy: the international context

In this speech,(1) Rachel Lomax,(2) Deputy Governor responsible for monetary policy, discusses how developments in the international economy influence UK monetary policy. The world economy has grown strongly over the past few years, and the outlook remains robust, despite the sharp rise in oil prices. But from a UK perspective, external developments have been less supportive, because our main export markets have grown relatively slowly and because trends in prices, in particular oil prices, have become less favourable. Further increases in oil prices pose significant risks for the international economy, as do the possibilities of a disorderly unwinding of global imbalances or departure from the recent exceptionally low long-term interest rates. If these risks were to materialise, the potential effects on the UK economy could be significant, but are highly uncertain. The central view remains that the international economy will continue to provide moderate support for a rebalancing of the domestic economy.

When the organisers of this conference pressed me for a title some weeks ago, I decided to talk about the international context for UK monetary policy for two reasons. First, I was fresh from a summer spent reading this year's top business books, whose key theme is the dizzying pace of change in the global economy. But second, I wanted to look beyond the shopping story that — understandably — tends to dominate the press, to some of the other factors that have to be weighed when the MPC sets interest rates.

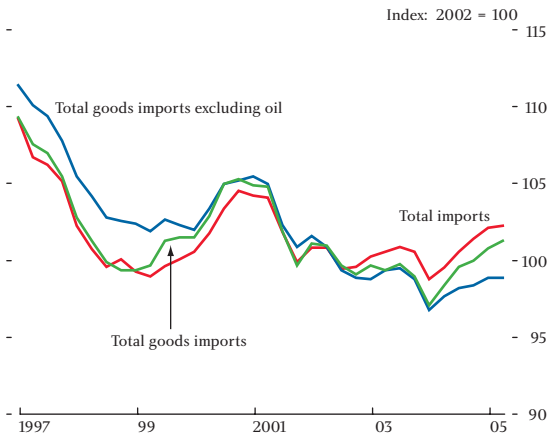
But let me start with the recent weakness in retail spending. Judging by the latest indicators, this looks like persisting, at least in the near term. But while spending on retail goods has been virtually flat since last autumn, total consumer spending, including services and utilities, has continued to grow, though quite slowly. And while the prospects for consumption are clearly important, so too are those for other key drivers of the economy, such as business investment and net exports. The question is: if consumers decide to save more, are the conditions in place for other sources of demand to take up the slack? The answer depends in part on what is happening in the rest of the world.

Plainly, developments in the rest of the world *will* influence domestic monetary policy. The UK is a very open economy, exposed to trends and shocks that affect supply as well as demand, and our financial markets are fully integrated with global markets. Sterling is one of the world's most liquid currencies, and the FTSE 100 is heavily weighted with multinational companies.

Let me give one example of what this can mean in practice. Over recent years, the progressive shift toward sourcing from low cost producers has been depressing import prices (Chart 1), and improving the terms on which we trade. This has exposed domestic producers to intense competitive pressures, but it has been unambiguously good news for consumers. And it has probably meant that the MPC has been able to set somewhat lower interest rates to meet its inflation target.

The establishment of global markets in key asset classes has created complex linkages between economies as well

Chart 1
UK import prices



Source: ONS.

(1) Delivered at the APCIMS Annual Conference on 17 October 2005. This speech can be found on the Bank's website at www.bankofengland.co.uk/publications/speeches/2005/speech257.pdf.
(2) I am grateful to Greg Kinsey, Jens Larsen, Chris Peacock and James Talbot for help in preparing these remarks and the charts.

as facilitating better risk sharing. On the one hand, the transmission of shocks has been speeded up — a generation ago, for example, who would have supposed that devaluation in Thailand would have set off a chain reaction that rippled through financial markets from New York to Tokyo?

On the other hand, the absorptive capacity of financial markets has massively increased. This has helped to cushion the impact of major shocks on the wider economy. But it has also facilitated the financing of huge current account imbalances. These have been the number one issue on the IMF's worry list for the past few years and now constitute a significant source of risk to the world economic outlook.

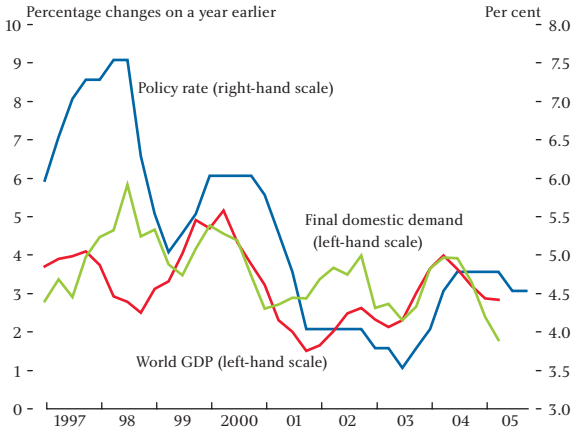
So you might expect the MPC's policy rate to respond to changes in the world economic outlook, though you might speculate that the relationship could be quite complex. What does recent experience show?

Between 2000 and 2004, there was, on the face of it, a very close relationship between fluctuations in world GDP and the policy rate; as all main regions of the world slowed after the stock market crash and the ending of the IT boom, the MPC first cut its policy rate sharply — and then held it down until the world economy had clearly turned the corner in the second half of 2003.

But it would be quite wrong to infer that the MPC ignored domestic demand during this period — though the data have now been so heavily revised it is difficult to generalise about past decisions. The important point is that the MPC's approach then, as now, is to form an *overall* judgement about demand relative to supply and, as far as it can, to set the policy rate to keep the two in balance, so that inflationary pressure is broadly constant. So with external demand very weak — and recall that by the end of 2001 world imports were actually falling — the logic of that approach pointed to easing policy to encourage a faster growth in domestic demand (Chart 2).

This approach worked well in the sense that it helped to ensure that the UK went on growing steadily through the world slowdown, while consumer price inflation remained close to the Chancellor's target. But there were side effects. One was a marked increase in the UK's trade deficit. Another was the creation of a monetary climate conducive to strong rises in house prices and consumer borrowing relative to disposable incomes —

Chart 2
World GDP,(a) UK final domestic demand and UK policy rates



Sources: IMF, ONS and Bank of England calculations.

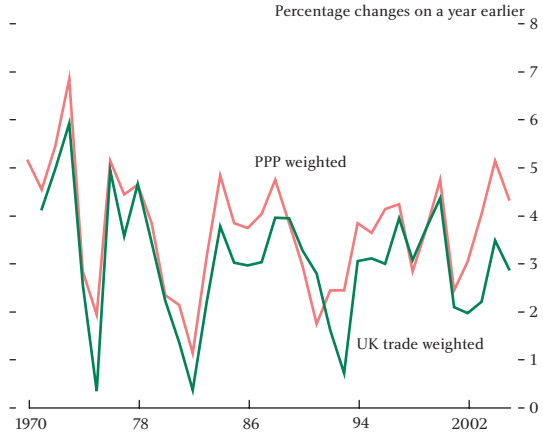
(a) Weighted by UK export shares.

an experience shared with other countries such as Australia and more recently the United States. Together with structural and demographic trends, this has helped to push the ratio of both house prices and consumer borrowing to household disposable incomes to levels well outside the range of previous experience.

If, against the background of a much flatter housing market, households now go through a period of rather subdued spending, strong external demand would help to support activity and rebalance the economy. But is that in prospect? And what are the risks?

On some measures, last year — 2004 — saw the strongest growth in the world GDP in 30 years (Chart 3). While there has been some reduction in growth this year, most forecasters' central expectation is that it will not prove very marked.

Chart 3
World GDP growth

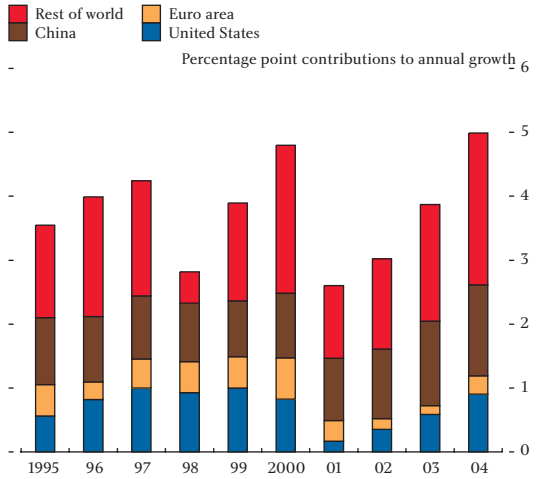


Sources: IMF and Bank of England calculations.

From a UK perspective however, the external conjuncture has been significantly less supportive than this implies.

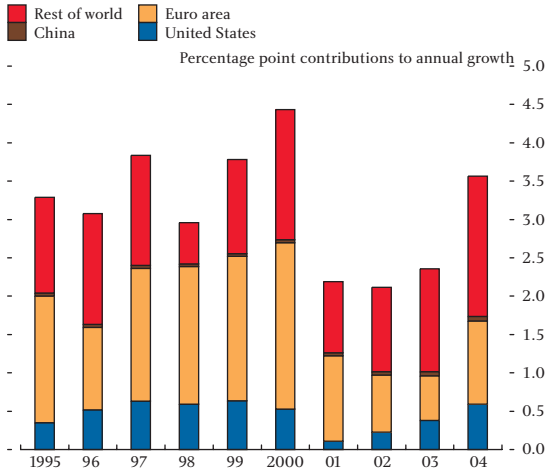
The key point is that the upturn in world growth has been very unbalanced, being driven largely by the US and China. Measures of world activity which give a high weight to these two countries paint a pretty buoyant picture, especially those which use purchasing power parities (Chart 4). However, less than 2% of UK exports go to China and rather less than 20% to the US. Fully 50% go to the euro area, which has grown only sluggishly, and whose growth forecasts have persistently been revised down. And Germany, Italy and the Netherlands — countries which between them take around 25% of UK exports — have underperformed the euro average. As a result world GDP weighted by countries' importance in UK export markets has shown much a weaker recovery (Chart 5).

Chart 4
World GDP (PPP weighted)



Source: Bank of England calculations.

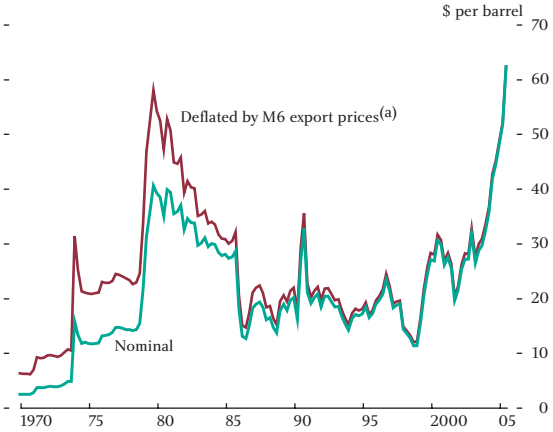
Chart 5
World GDP (UK trade weighted)



Source: Bank of England calculations.

World price pressures have also been stronger than in recent previous cycles. This largely reflects the sharp rise in the price of oil since early 2004 — a development which seems to have taken almost everyone by surprise (Chart 6). This is a complex story. On the demand side, the relative importance of China and the US in powering the world economy may help to explain why world oil demand grew quite so strongly relative to world GDP last year (Chart 7). This year, however, the sharp rise in prices owes at least as much to supply factors.

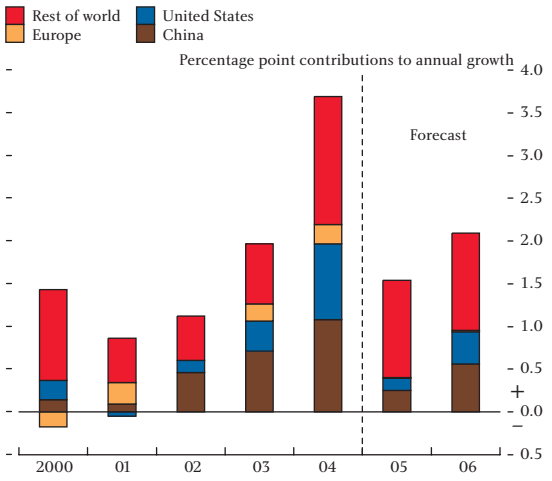
Chart 6
Oil prices — real and nominal



Sources: Thomson Financial Datastream and Bank of England calculations.

(a) M6 = G7 countries excluding the United Kingdom.

Chart 7
Contribution to oil demand growth



Source: IEA.

Allowing for these caveats, this is still a much stronger world economic background than, say, 2001. But there are several important risks to this outlook.

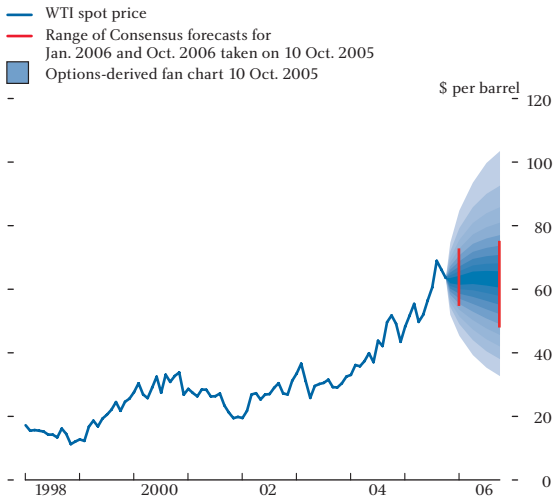
The first concerns oil prices. So far the world economy has apparently taken a tripling in oil prices in its stride,

thanks to the much lower oil intensity of output, and the greater flexibility in labour markets, in most advanced economies compared with a generation ago. It is also true that the short-term capacity of oil producing countries to spend their increased revenues is now much greater than it was in the 70s. This helps to explain why consensus forecasts for world GDP growth next year have remained remarkably steady.

But there is a very high level of uncertainty about future oil prices. Judging by the oil futures curve, the *central* view is that prices are likely to remain high, at around $60 per barrel for the next few years at least. This is in contrast to 2000, when the oil futures curve was downward sloping. But the range of current Consensus forecasts is very wide — from around $45 and $75 per barrel. And oil option prices — admittedly a very imperfect measure — suggest that there is a 15% probability of oil prices rising above $80 a barrel and a 5% probability of them falling below $40 in six months' time (Chart 8).

If oil prices rise no further their impact on headline inflation should be temporary. But a series of positive oil shocks might have the effect of pushing up headline inflation for an uncomfortably long period. In contrast to the 1970s and 1980s, inflation expectations in major oil consuming nations have been well anchored for the best part of a decade. But there's no room for complacency. The unfamiliar experience of higher inflation might well dislodge those expectations, if there was any wavering in central banks' perceived commitment to keep inflation low. This could also prove damaging to consumer and business confidence.

Chart 8
Oil price uncertainty



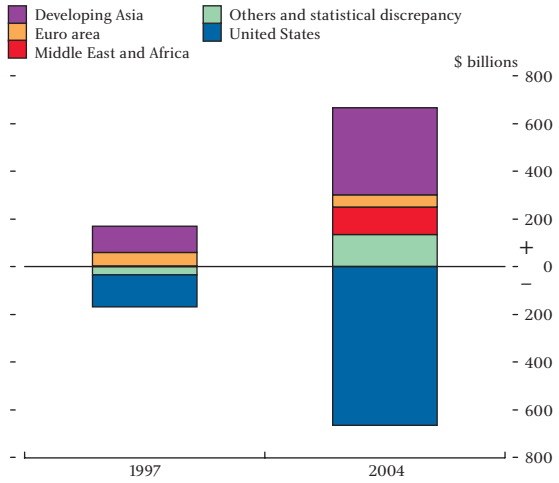
Sources: Bloomberg, Consensus Economics and Bank of England calculations.

I claim no special insight into the oil market, and especially into its likely short term movements. But it is hard to miss the longer term challenges which the rapid economic development of China — and India — pose for resource markets, and especially energy markets. China is now the world's second largest oil importing country after the US, and last year alone it accounted for nearly a third of the net increase in world oil demand. In per capita terms, its own oil resources account for less than 10% of the world average. Yet its oil demand is set to grow strongly in the longer term. Oil supply is traditionally slow to respond to changing prices — lead times for developing new fields are often around 3–7 years — and there are constraints on refinery capacity which may influence petrol prices.

This is bound to have implications for the UK and for our European markets. Over the past decade, we have benefited from the downward pressure on imported goods prices exerted directly and indirectly by low cost production in Asia. Even if these trends continue, as in principle they could for some time, it is becoming increasingly clear that consumers may also need to contend with upward price pressures as world energy markets adapt to meet the needs of emerging Asia.

The second key area of risk is global imbalances (Chart 9). These pose risks to foreign exchange markets and to world activity. Higher oil prices have intensified the scale of the problem. Yet we seem no closer to a denouement — indeed, as the US current deficit topped 6% of GDP, the dollar has tended to strengthen. What does this mean for the UK? I find it extremely hard to predict how sterling's effective rate would be affected, were there to be a major re-rating of the dollar. But a

Chart 9
Global current accounts



Source: IMF.

resolution of global imbalances which was accompanied by global recession would represent a major challenge for us — one to which, I suspect, we are now less well placed to respond than we were in 2001.

Finally, there is the puzzling matter of long-term interest rates; last year, as central banks raised their policy rates, long-term nominal (Chart 10) and real rates (Chart 11) *fell* to levels not seen in 40 years (though of course, US rates have now ticked up a bit recently). At the same time, risk premia of all kinds — bond spreads (Chart 12) and term premia — have been sharply compressed.

This state of affairs has caused a great deal of head scratching, and nowhere more than in central banks. Plausible explanations for low risk free real rates include the possibility that there is a global savings glut. It is also argued that there has been an investment 'strike' almost everywhere except China and maybe the US, perhaps reflecting a persistent overhang from the East Asian crisis or the last IT cycle. These are speculative explanations, and it is not easy to discriminate between them. However, they all seem to point to a more or less prolonged period of low rates.

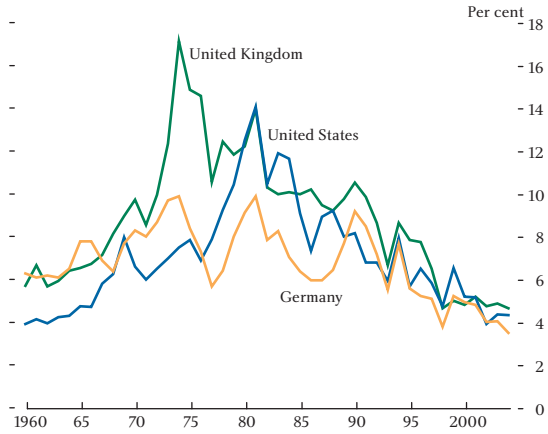
More worryingly, compressed risk premia of all kinds may reflect a belief that the world is no longer such a risky place, a belief fostered by the period of low inflation that many economies have enjoyed in the past decade. Hopefully, low inflation is here to stay. But in some countries, notably the US and the UK, low inflation has been coupled with an unusually low degree of output volatility; and this may have encouraged an exaggerated notion of the role that central banks can play in achieving exceptionally benign outcomes, in different circumstances.

Unrealistic expectations invite disappointment. And disappointment — if it dawns suddenly — is liable to have a disruptive effect on financial markets and potentially on real economies.

That is the dark side. But for now, low real interest rates are supporting activity, and the main puzzle is why companies are not taking more advantage of favourable financing conditions to increase their investment — though once they do, past experience suggests that spending could rise quite quickly.

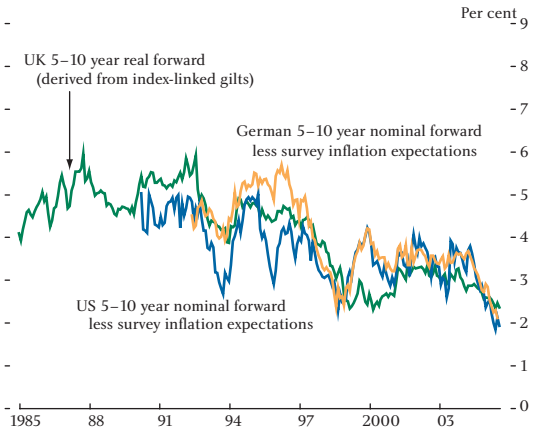
Let me sum up. The immediate prospects for the world economy are still robust, despite the sharp rise in oil

Chart 10
Long-term nominal interest rates



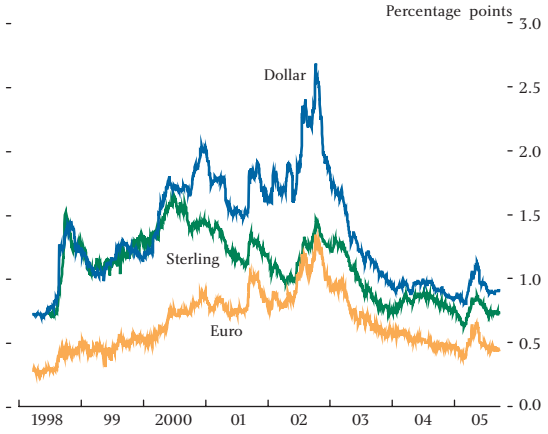
Source: Global Financial Data.

Chart 11
Long-term real interest rates



Sources: Consensus Economics and Bank of England calculations.

Chart 12
Investment-grade corporate bond spreads



Source: Merrill Lynch.

prices. The outlook for UK-weighted activity is less rosy, with relatively subdued growth in the euro area — though even here the latest business surveys are brighter

than they have been for some time. The UK is fully exposed to the impact of more adverse world pricing trends, notably higher oil prices. And there are some significant risks, with considerable uncertainty about oil prices. This outlook could provide some support for a rebalancing of the UK economy. But there is no guarantee of that.

The MPC may face some hard choices in the coming months. Looking back on my summer reading for inspiration — that list of the year's top business books — I am reminded of the mission statements of two of the companies under scrutiny. One was Disney — whose aim is, famously, to 'Make People Happy'. The other was Google — whose mission statement urges, somewhat austerely, 'Don't be Evil'.

One thing is for sure: the MPC must not set out to rival Disney. So let Google be our guide, as we search for a way through the policy maze.

Economic stability and the business climate

Since the adoption of inflation targeting in the United Kingdom, there has been greater stability at the level of the macroeconomy — stability in this context refers to the volatility of output growth. In this speech,[1] Kate Barker,[2] member of the Bank's Monetary Policy Committee, discusses preliminary work undertaken at the Bank which, in contrast, indicates that at the level of the individual firm volatility has tended to increase for real sales and profits over the same period. It is not clear what accounts for these divergent trends. But it is possible that, as markets have become more open to competition, firms look harder at how their competitors may react, and may be more cautious in their approach to wage and price-setting. This leads to greater variation in outcomes for firms but to a benign macro environment. This is good news for policymakers.

Looking at the period just since Bank independence in 1997, it is pointed out that improving terms of trade, a fall in real long-term interest rates, and a declining rate of equilibrium unemployment have all been factors which have supported a 'feel good' factor alongside low and stable inflation. These trends are now unlikely to continue. So the next few years may seem a little less favourable than the recent past, although still good compared to a longer historical perspective.

The Monetary Policy Committee's task could be described as forming an assessment of prevailing economic trends and future prospects, in order to reach a judgement about where to set short-term interest rates in order to keep inflation on target in the medium term. For the most part, the way in which we discuss the prevailing economic situation is from a top-down perspective, although trends among individual firms also form part of our information set.

In managing individual businesses, the viewpoint which many of you will have is the reverse of this. While conditions in the whole economy will be an important backdrop, your key focus will be on trends such as demand for individual products, specific domestic and foreign competitors, and product innovation. One topic which I want to discuss in these remarks is a possible difference in perception from these two perspectives about the stability of the United Kingdom over the past decade or so, and the potential significance of this for the future behaviour of the economy. In addition, I will look more generally at recent economic performance and at the risks around short-term prospects.

One striking feature of the recent past is a reduction in UK economic volatility (the change in inflation and output growth rates from year to year) since the move to inflation targeting in 1992. For example, Benati (2004) concludes that the period since 1992 can be shown to have seen less volatility of both GDP growth and inflation than any other period since 1945. Shallower cycles bring a number of benefits — including the avoidance of periods of sharply rising unemployment with associated costs in social terms, and a more stable planning environment for business, supporting investment plans.

Of course, the fact that this greater stability was apparent after the start of inflation targeting does not imply that it resulted from the regime itself — the question remains about whether the improved performance has been due to good policy or good luck. In the academic debate, the 'good policy' hypothesis

(1) Delivered at the Managing Directors' Club, Sheffield University on 24 November 2005. This speech can be found on the Bank's website at www.bankofengland.co.uk/publications/speeches/2005/speech260.pdf.

(2) I would like to thank Miles Parker for allowing me to draw on his work; Jennifer Deaville-Powner, Rebecca Driver and Jumana Saleheen for their help in preparing this speech; and the Governor, Karen Dury, Colin Ellis and Garry Young for helpful comments. The views expressed are my own and do not necessarily reflect those of the Bank of England or other members of the Monetary Policy Committee.

covers more than monetary policy institutions. For example, it includes the enhanced credibility of the policymaker, and a better understanding of the causes and costs of inflation (and of the trade-off between unemployment and inflation). The 'good luck' hypothesis on the other hand suggests that since 1992 the UK economy has been hit by fewer or smaller shocks, or that these shocks have had a more muted effect on the economy.

The reduction in economic volatility is not confined to the United Kingdom, but is also apparent in many other countries to a greater or lesser extent.(1) This includes some which have not adopted an inflation-targeting regime, casting some doubt on the 'good policy' hypothesis. Perhaps the best summary of the debate at present is that the jury remains out on what weight to give to 'luck' or to 'policy'.

But it is certainly not true that there have been no economic shocks since 1992. This period includes sterling's effective exchange rate appreciation of around 25% between December 1995 and April 1998, the Asian crisis and Russian defaults in the late 1990s, and the fears of a major crisis of confidence following the terrorist attacks in September 2001. And at present, the MPC is concerned about the response to the most recent shock: the approximate doubling in the price of crude oil since the end of 2003. Inevitably, the ability of the current monetary regimes to deal with shocks will continue to face new challenges, just as it has over the past decade.

Good policy judgement however does not only mean monetary policy. It is not easy to distinguish between better monetary policy and better supply-side policies which may have improved the working of the markets for goods and for labour.(2) So neither those who have established the monetary frameworks, nor the central bankers who operate them, are likely to be justified in claiming all the credit for good outturns. And nor have they done so.

However the relative stability of the macroeconomy is not necessarily repeated at the level of the individual firm. In the United States, some recent work(3) suggests that the decline in aggregate volatility has been associated with a rise in firm-level volatility. This rising volatility at the firm level is not related either to the age of firms, or to the sector in which they operate.

Why might this divergence in trends occur? Two possibilities have been suggested in the US context. The first is that it might result from an increase in product market competition — since in a more competitive environment firms will have more incentive to change prices frequently. This leads to greater variation in outcomes for firms, but implies a more flexible response to shocks, reducing the volatility of the whole economy.(4)

The second possible explanation is that as financial markets have become deeper, this has enabled firms to borrow to finance more risky projects. At the same time, the economy becomes more diversified, so that shocks are less prone to have the same effect across firms.(5)

Both these explanations suggest that the economy will tend to function more efficiently. There may also be implications for monetary policy; for example, there might be changes in the way firms set prices and bargain over wages.

Given the potential implications for policy, it is of interest to consider whether a similar picture of increased firm-level volatility can be found in UK data. In order to investigate this, preliminary work has been undertaken for the United Kingdom, with a similar approach to the Comin and Mulani (2004) study, using a database of company accounts data drawn from Datastream which covers the period from 1973 to 2003.(6) Inevitably, data are not available for all firms in the full sample throughout the entire period, and the results discussed below refer to a *balanced panel* of 167 companies, for which sales data were continuously available. Data drawn from the full sample (using all firms for which there were at least ten years of consecutive data) have also been considered and indicate broadly similar conclusions.(7)

Charts 1 and 2 show some of the key results from this study. Chart 1 indicates that the volatility of real sales

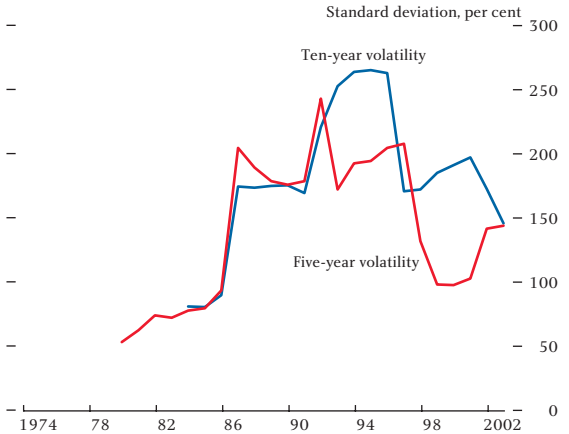
(1) For example, Stock and Watson (2003).
(2) Cecchetti *et al* (2004).
(3) Comin and Mulani (2004) and (2005).
(4) Philippon (2003).
(5) Acemoglu (2005).
(6) I am very grateful to Miles Parker for carrying out this work on my behalf.
(7) Total sales by year for the full sample of firms cover approximately 80% of GDP, and for the balanced sample cover approximately 20% of GDP.

growth (using the producer output price index as the deflator) has shown an upward trend using both a ten-year and a five-year measure of volatility. The volatility measure used is the standard deviation.(1) However, the chart also suggests that this is not a smooth trend. It is possible that volatility rose and fell during the 1990s, in which case it cannot be ruled out that the recent renewed increase will not also be reversed in the future.

Chart 1
Volatility of firm-level real sales growth (balanced panel)

Sources: Thomson Financial Datastream and Bank of England calculations.

Chart 2
Volatility of firm-level real profits growth (balanced panel)

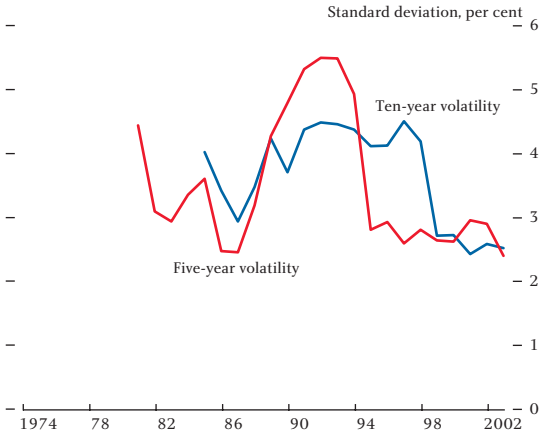


Sources: Thomson Financial Datastream and Bank of England calculations.

Chart 2 shows similar data, but for the volatility of the real growth rate of profits. Again, five-year volatility suggests a more hump-shaped profile, with higher volatility during the early 1990s, when there was also greater volatility at the whole-economy level.

Charts 3 and 4 point up the contrast a little more clearly. They show the volatility of real sales growth and real profits growth for the aggregate of the firms in the panel.(2) In both cases, particularly the latter, the aggregate data appears to be on a declining trend. The contrast between aggregate and individual firm data is especially noticeable between 1998 and 2003. So for individual firms, there seems to be no evidence of the increased stability that has been such a feature at the macroeconomic level; and it may be that the contrast between the whole economy and individual firms will be helpful in further work on identifying the reasons for the greater overall stability. It is not, of course, the case that macroeconomic stability is designed to help individual firms; although by delivering low and stable inflation firms should be enabled to focus on their business strategy without also having to worry about inflation prospects.

Chart 3
Volatility of aggregate real sales growth (balanced panel)



Sources: Thomson Financial Datastream and Bank of England calculations.

(1) The ten-year standard deviation of the growth rate of real sales for *each company i*, is computed as:

$$\sqrt{\frac{1}{10}\sum_{s=0}^{9}\left(x_{it-s}-\bar{x}_{it}\right)^2},$$

where x_{it} is the growth rate of real sales for company i in year t, and $\bar{x}_{it}$ is the average growth rate of real sales for company i over the past ten years. The average of this standard deviation across (167) companies each year gives the measure of firm-level volatility reported in Charts 1 and 2.

(2) Aggregate volatility is measured as the ten-year standard deviation of the growth rate of *total* real sales (the total being the sum of sales across the 167 companies). It is given by:

$$\sqrt{\frac{1}{10}\sum_{s=0}^{9}\left(x_{t-s}-\bar{x}_{t}\right)^2},$$

where x_t is the growth rate of total real sales, and $\bar{x}_t$ is the mean value of total sales over the past ten years.

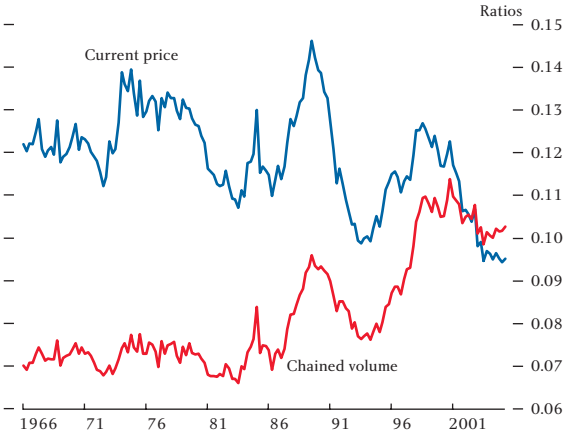
Chart 4
Volatility of aggregate real profits growth (balanced panel)

Sources: Thomson Financial Datastream and Bank of England calculations.

What are the implications of these studies for policy? Part of the explanation for the divergence between aggregate and individual experiences is that the economy as a whole is now more flexible. Shocks are smoothed out better by shifts in the allocation of labour and capital. As markets have become more open to competition, firms look harder at how their competitors may react, and may be more cautious in their approach to wage and price-setting — especially in an environment where their inflation expectations are firmly anchored. Firms may also be more likely to perceive shocks as idiosyncratic. This leads to greater variation in outcomes for firms but to a benign macro environment in which policymakers can deliver low inflation, and so reinforce the message of aggregate stability.

In the late 1980s and early 1990s, the business sector frequently argued that a more stable economy would enable firms to plan from a longer-term viewpoint, resulting in a higher rate of investment and fostering stronger growth. Chart 5, which shows the share of business investment in GDP in real and nominal terms, suggests that there is little evidence of a change of trend in investment. Given the falling relative price of investment goods, and under a plausible assumption about the degree to which capital and labour are substitutes, the real share of investment in GDP has not risen particularly strongly.(1) One partial explanation for this might be the evidence referred to above, which suggests that at the firm level uncertainty may have increased, rather than decreased. Looking at the CBI survey of manufacturing companies, it is interesting to note that the proportion of firms citing uncertainty about demand as a constraint on their investment plans has if anything tended to rise under inflation targeting — an average of 45% cited this as a constraint between 1980 and 1992, rising to 51% post-1992.

Chart 5
Business investment to output ratio



Source: ONS.

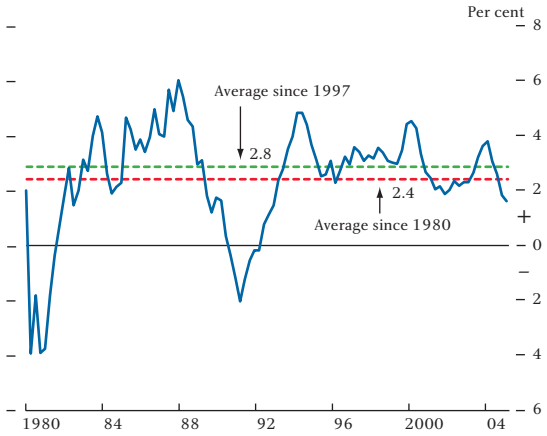
I will now turn to discuss some of the broad trends over the period since the Bank of England took over the setting of interest rates in 1997, and consider the outlook against that background. A key question for the MPC, in considering the judgements around our quarterly economic forecast, is how the present level of demand in the economy relates to the supply capacity of the economy. Too great a pressure of demand will tend to put upward pressure on inflation. Judgements about supply capacity are always difficult to reach — there is much uncertainty about what a plausible estimate of the long-term growth rate, and, more relevantly, about how supply capacity is changing over the forecast period. One way to think about this question might be to consider the recent GDP growth performance, compared with the historic average.

Chart 6 shows the annual growth rate in the United Kingdom by quarter since 1980. Taking this period as a whole, growth has averaged around 2.4%. This rises to 2.7% from 1992, when the United Kingdom moved to inflation targeting, and to 2.8% since Bank independence in mid-1997.

The overall picture of robust economic performance since 1997 has certainly been one of the reasons why the formation of the MPC is regarded as a success, in addition to the achievement in terms of keeping

(1) See Ellis and Groth (2003).

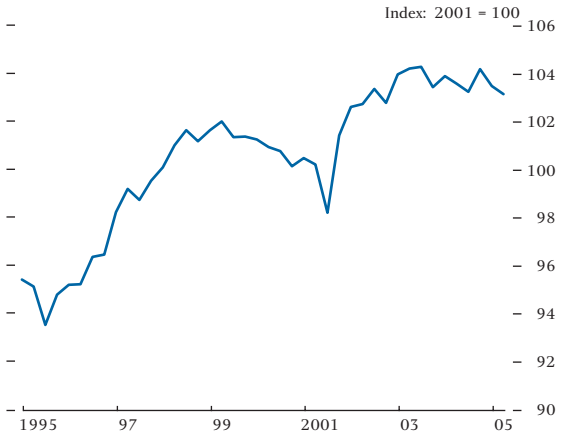
Chart 6
Annual GDP growth



Source: ONS.

inflation close to target over the period. But some of this favourable picture has been due to factors which the MPC is not able to influence. In particular, the United Kingdom has benefited since the mid-1990s from a rise in our export prices relative to our import prices (Chart 7).(1) This was most marked up to 1998, and since then has been more stable. This has implied an increase in the purchasing power of UK consumers, which was associated with, and may have contributed to, an increase in the growth of consumer spending. Spending was also boosted by the rise in house prices, in turn partly driven by the decline in long-term real interest rates which increased the relative attractiveness of housing assets.

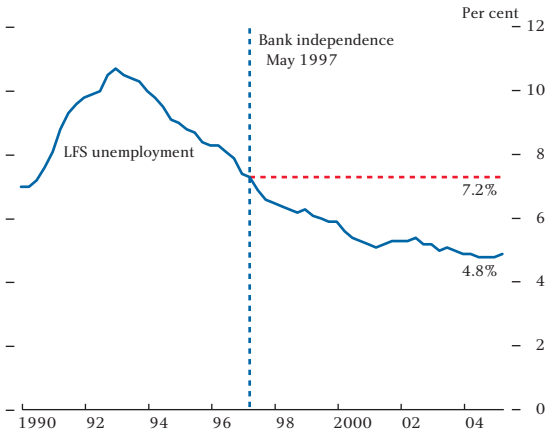
Chart 7
UK terms of trade



Source: ONS.

A second supportive factor has been the improvements in the labour market. Unemployment fell from over 10% in 1992 to 4.7% in August 2005 (Chart 8). During this period wage growth has been relatively stable, averaging 4% and fluctuating within a narrow band of 2%–6%. The fact that the fall in the unemployment rate did not lead to a sizable pickup in wage pressure has led to the conclusion that since 1992 there has been a decline in the rate of unemployment at which it is possible to keep inflation stable.(2) (It might be noted for example that in Sheffield, since Bank independence, claimant count unemployment has fallen from over 22,000 to around 8,500.) This can be attributed to a number of factors, including improvements in labour market flexibility and more recently the impact of increased inward migration. A further influence may well be the improved credibility of the inflation-targeting framework, so that wage bargainers take into account an expectation that inflation is likely to remain at, or return to, the target. Whatever these various factors have contributed, the key point is that the benefit of declining unemployment, in terms of boosting growth per head of working-age population, is likely to have run its course.

Chart 8
Unemployment rate



Source: ONS.

Looking at the past five years, the Chart 6 suggests that since 2001 there has been a general slowdown from a period of strong growth (although compared with the early 1980s and 1990s this slowing has been very modest). Indeed, GDP growth has averaged just 2.3% over this period (and 1.7% per person of working age, see Table A, which suggests that GDP on this latter basis has slowed more over the recent past). Over the past year, even allowing for the tendency for recent estimates of growth to be revised up (the ONS suggests that GDP data are likely to be revised up by a little less than 0.4%, on an annual basis, within around two years from the

(1) See Dury *et al* (2003).
(2) See for example Nickell and Quintini (2002).

first estimate)[1] it seems that growth has been weaker than its average since 1980.

Table A
Annual average growth rates (per cent)

	1980 Q1–2005 Q2	1992 Q1–2005 Q2	1997 Q2–2005 Q2	2001 Q1–2005 Q2
GDP	2.4	2.7	2.8	2.3
GDP/working-age population	1.9	2.3	2.3	1.7
GDP/16+ population	1.9	2.3	2.3	1.7

In order to consider what this slowdown means for the balance of demand and supply in the economy, the MPC's general approach is to estimate the United Kingdom's production capacity, given the existing stock of capital and the potential labour supply consistent with stable inflation. This is also supplemented by consideration of business survey evidence. At present these give a mixed reading, although the general impression is that capacity pressures have recently eased back a little.

In the middle of this month the MPC published its latest forecast, in which the central projection was for GDP growth to recover quite strongly, as the economy moves beyond the recent slower patch. The key assumptions underlying this recovery (set out in more detail in the *Inflation Report*) included a continuation of strong global growth, helping to improve the United Kingdom's external trade position, and a modest pickup in consumer spending, supported in part by the stabilisation of the housing market. This was judged to be consistent with inflation remaining on track to meet the target in the medium term.

As always, there are many upside and downside risks to these projections for growth and inflation. Some of these relate to the rise in the oil price — where it remains uncertain how much of the rise in the oil price has so far fed through into CPI inflation, and unclear whether higher oil prices will reduce supply potential by prompting the scrapping of some less energy efficient capital. The MPC has however also explained that part of the adjustment to the oil price rise will be a period of slower real wage growth and commented on the uncertainty about how far employees might resist this adjustment.

This is not intended as a repetition of the various risks outlined in the *Inflation Report*. Rather, the following comments are about risks which may not crystallise until beyond the forecast period, but could at some time have probable downside implications for growth. One key risk relates to long-term real global interest rates, which are presently at low levels by historical standards. It is generally unclear why this decline has taken place, and there is consequently a risk that it will be reversed (for example, to the extent that it related to an excess of savings in Asia, relative to investment opportunities, then as domestic demand strengthens in Asia, capital flows to the rest of the world might fall back). An upward shift in long-term real interest rates, unless related to an improvement in prospects for growth, could have a significant downward impact on house prices, not just in the United Kingdom but also the United States and elsewhere, with consequent downward pressures on consumer spending growth.

There is also the possibility of interlinked risks — as rising domestic demand in China and elsewhere could put greater pressure on the global capacity to supply, pushing up the rate of goods price inflation. This could bring a reversal of the beneficial impact of the shift in trade prices described above, with import prices rising more rapidly and domestic real incomes growth having to be reduced in order to keep inflation on target.

Drawing these remarks together, preliminary work suggests that the 'Great Stability' of the UK economy since the inception of inflation targeting has not been reflected at the level of individual firms — and indeed that in the UK individual firms may have seen increased volatility for sales and for profits. In the United States, where a similar contrast is apparent, various explanations for it have been put forward. It is possible that the divergent trends in volatility might be related, to the extent that firms undertake more risky projects in a more stable macro environment. However, an alternative explanation might be that greater firm volatility is due to greater competitive pressures. This latter case would provide some explanation for the fact that business investment in the United Kingdom has been weaker than expected given the more stable macroeconomic performance.

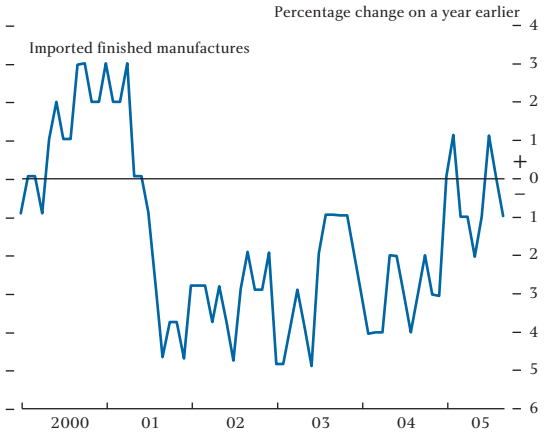
Looking at recent trends in growth rates, there are some indications that the pickup in growth apparent during the first decade or so of inflation targeting has recently fallen back a little. In particular, despite the recent sharp decline in the pace of growth, business surveys do not suggest that the UK economy in the second half of

(1) See George (2005).

2005 is much below its supply capacity. The MPC's latest best central projection is that growth will recover over the next year, and move above its average of the past 25 years. In terms of the risks around this projection, my own view is that these are balanced for inflation, and indeed in the short term there remains a risk that the recent rise in inflation might spark a more persistent upward shift in inflation expectations. But for growth the risks may be towards the downside, with particular uncertainties around the world outlook in the medium term.

Taking a longer view, it is encouraging that, as suggested above, the contrast between aggregate and individual volatility may support the resilience of the economy to shocks. But there are other concerns. Since 1997, the MPC's reputation has been good — and there has been a good outturn not just in terms of low and stable inflation, but also improvements in household income growth, rising asset values due to lower real long-term interest rates and a declining unemployment rate. As discussed above, for the most part credit for these other favourable trends is not due to the MPC. Prospects appear rather less positive. Recent trends in import prices to the United Kingdom (Chart 9) suggest that the terms of trade improvement may not continue. Real long-term interest rates are unlikely to fall further. The decline in the rate of unemployment consistent with stable inflation seems likely to have come to an end. But while this is a note of caution, it should not be overplayed. It is possible that other favourable trends could emerge — such as sustained faster euro-area growth, or an improvement in the United Kingdom's productivity performance. Even if these do not occur, while the outlook may be less favourable than the recent past, it is still good when compared to a longer historical perspective. And of course whatever emerges, the MPC will continue to focus on the important goal set for us by government, of delivering low and stable inflation.

Chart 9
The inflation rate of imported finished manufactured goods



Source: ONS.

References

Acemoglu, D (2005), 'Discussion of Comin and Philippon 'The rise in firm-level volatility: causes and consequences'', *NBER 20th Annual Conference on Macroeconomics*.

Benati, L (2004), 'Evolving post-World War II UK economic performance', *Bank of England Working Paper no. 232*.

Cecchetti, S, Flores-Lagunes, A and Krause, S (2004), 'Has monetary policy become more efficient? A cross-country analysis', *NBER Working Paper no. 10973*.

Comin, D and Mulani, S (2004), 'Diverging trends in macro and micro volatility: facts', *NBER Working Paper no. 10922*.

Comin, D and Mulani, S (2005), 'A theory of growth and volatility at the aggregate and firm level', *NBER Working Paper no. 11503*.

Dury, K, Piscitelli, L, Sebastia-Barriel, M and Yates, T (2003), 'What caused the rise in UK terms of trade', *Bank of England Quarterly Bulletin*, Summer, pages 164–76.

Ellis, C and Groth, C (2003), 'Long-run equilibrium ratios of business investment to output in the United Kingdom', *Bank of England Quarterly Bulletin*, Summer, pages 177–87.

George, E (2005), 'Revisions to quarterly GDP growth and its production and expenditure components', *Economic Trends*, No. 614.

Nickell, S and Quintini, G (2002), 'The recent performance of the UK labour market', *Oxford Review of Economic Policy*, Vol. 18, Issue 2.

Philippon, T (2003), 'An explanation for the joint evolution of firm and aggregate volatility', *mimeo*, New York University.

Stock, J and Watson, M (2003), 'Has the business cycle changed? Evidence and explanations', Federal Reserve Board of Kansas City Symposium, *Monetary policy and uncertainty*.

Challenging times for monetary policy

In a speech[1] delivered at the National Association of Pension Funds meeting in Belfast on 19 October 2005 Richard Lambert, member of the Monetary Policy Committee, sets out his views on the challenges facing monetary policy makers.

These are challenging times for monetary policy makers in the United Kingdom. Over the past year, growth in the economy has slowed down and the pace of inflation has picked up — in both cases more rapidly than most people expected. And oil prices have roughly doubled in dollar terms over the past 18 months, with very uncertain implications both for the level of activity in the economy and the pace of consumer price inflation.

So what I would like to do today is to spell out how things look to me now as a member of the Monetary Policy Committee. In particular, I would like to discuss the implications of higher oil prices for monetary policy. I should emphasise that what follows is very much a personal view.

It's important to start by reminding you of the MPC's mission, as defined by statute. Our job, according to the 1998 Bank of England Act, is '...to deliver price stability (as defined by the Government's inflation target) and subject to this objective, to support the Government's economic policy, including its objectives for growth and employment'.

So we are not in business to rally shoppers back to the High Street. And it's not our job to try to fine tune the economy. We don't have the tools, or the knowledge, or the mandate to achieve such a task.

No, our job is to set monetary policy in such a way as to deliver low and stable inflation over the short, medium and long term.

It's also important to remember that we are set a symmetric target: that is, we have to worry just as much about undershooting the target — currently 2% a year as measured by the consumer prices index — as we do about overshooting the mark.

And monetary policy has always to be forward looking, since it can take many months for the full impact of a change in interest rates to pass through into the economy. We can't do much to alter the course of inflation over the next two or three months. Instead, we have to think about how the pressures of demand across the economy might be building up on potential supply a year or two ahead. As you may imagine, this is a very inexact science.

All this is particularly relevant in the current circumstances, for reasons which I will explain.

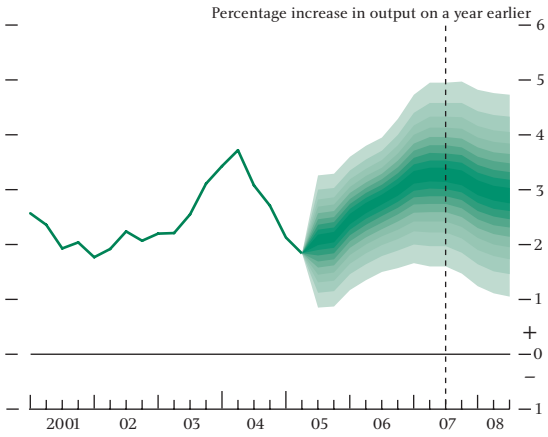
Back in August, I was among the small majority of MPC members who voted for a rate cut. For me, this was easily the most difficult decision in more than two years on the Committee.

Inflationary pressures had been building up in the previous months, and not just as a result of the rising oil price. When we went into the meeting, we knew that CPI inflation in the year to June had been bang on the target level at 2%, and that figure seemed likely to rise further in the subsequent months. As it happens, the figure published just yesterday for the month of September shows annual inflation of 2.5%. Although economic growth had obviously slowed, things weren't falling off a cliff: business and consumer confidence had remained steady, the world economy had continued to grow at a reasonable pace and the monetary and credit data were consistent with a pickup in household spending and GDP growth over the rest of the year.

(1) This speech can be found on the Bank's website at www.bankofengland.co.uk/publications/speeches/2005/speech258.pdf. I am grateful to Alison Stuart for help in preparing this speech. I have also benefited from comments and discussions with many colleagues at the Bank. The views expressed here are personal and should not be interpreted as those of the Bank of England or of other members of the Monetary Policy Committee.

Since our central projection pointed to a marked recovery in economic activity in 2006 and beyond, all this argued for keeping rates on hold (Chart 1).

Chart 1
August *Inflation Report* GDP projection



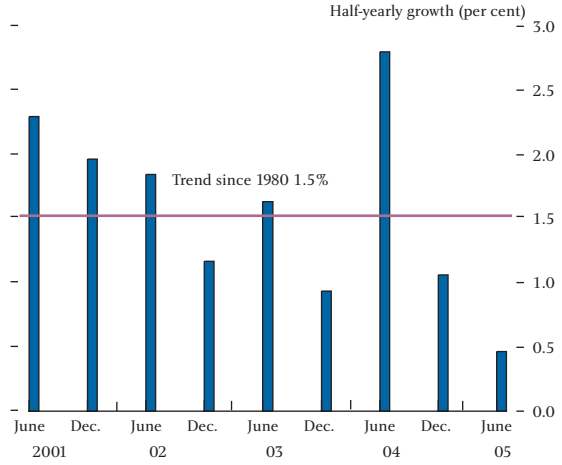
But against that, the economy appeared to have been growing below its long-term trend for twelve months or so, and there was evidence that some spare capacity was building up as a result. The labour market, for example, looked noticeably softer than it had done some months earlier. That would tend to pull down on inflation going forward.

The main reason for the economic slowdown had been the weakness in household spending, which accounts for around three fifths of the total economy. Thanks to data published since August, we now know that household spending in the first six months of the year grew at less than half its long-term average (Chart 2). Back at the August meeting, I worried that we may have underestimated the impact of our earlier rate increases on highly indebted households. Maybe the impact of the slowdown in house price inflation on consumer spending had also been greater than we had expected.

And from everything I could see, conditions on the High Street and elsewhere still seemed very fragile. Consumers were having to come to terms with sharp rises in the price of petrol and in their utility bills. Business investment prospects also looked uncertain, as did the outlook for exports.

So for me there was a risk that our central projections for economic growth in 2006 and beyond might turn out to be too optimistic, and that as a result inflation could start to drift below the target some time next year. Since policymaking has to be forward looking and the

Chart 2
Household consumption: half-yearly growth

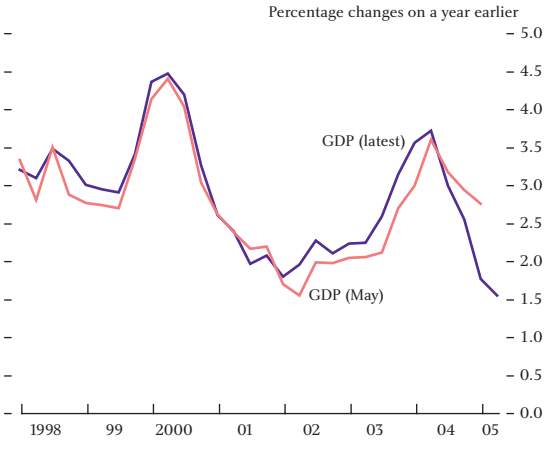


Source: ONS.

target is symmetric, that called for action so far as I was concerned.

Three months further on, short-term prospects for demand don't seem to have changed that much. According to the most recent official figures, GDP growth in the second quarter grew at an annual rate of just 1.5%, the lowest figure in twelve years (Chart 3). But quarter-on-quarter output growth recovered a little from 0.3% in the first three months of the year to 0.5% in the second, and the underlying pace of growth may have been broadly similar in the quarter that has just ended.

Chart 3
GDP growth



Source: ONS.

There are few signs yet of a recovery in consumption, and retail sales — which account for more than a third of household spending — are still looking flat. But the housing market seems to have been stabilising in recent months, which could put a bit more of a spring into the

steps of consumers. And though there is a little more slack in the jobs market than we might have expected earlier in the year, unemployment and inactivity rates have not changed much. This should also help to support household spending.

Although the latest figures for industrial production look rather dismal, that was a result of a particularly sharp fall in oil and gas production. Manufacturing output contracted slightly in August and some business surveys suggest that manufacturing might just about be turning the corner. Surveys of the service sector also look quite buoyant, if you exclude the retailers. And there has been rather more positive news over the summer about both business investment and trade. Indeed, net trade appears to have made a small but positive contribution to economic growth in the first half of this year, only the second time that this has occurred since 1997, and exports of goods have strengthened since the spring.

In some ways the picture here in Northern Ireland looks rather different. That's not surprising, because the structure of the economy is also rather different from other regions in the United Kingdom — a result of history, a land border with the eurozone, a high concentration in agriculture and manufacturing, and a large public sector workforce. Over the past few years growth here has been stronger than in the rest of the United Kingdom. Exports have also performed better, no doubt reflecting the fast growth of major trading partners such as the Republic of Ireland and the United States and the expansion of the pharmaceuticals sector. Firms' investment intentions also remain fairly upbeat.

Yet in recent quarters, as in the rest of the United Kingdom, growth appears to have slowed. Producers are clearly facing cost pressures from higher oil prices just as they are everywhere else. Perhaps more surprising is the slowdown in consumer spending. Given the continuing relative strength of the housing market, with house prices still rising at around 16% per year, one might not have expected to see the same extent of belt tightening in Northern Ireland as in the rest of the United Kingdom. But this perhaps illustrates that there isn't a single clear explanation for the slowdown of consumer spending. Along with the pressure affecting the rest of the United Kingdom, higher petrol prices may well have hit rural budgets particularly hard at a time when other costs have also been rising.

But for the MPC, of course, the big issues are about the likely pace of inflation in 2006 and beyond, and it is to those that I would now like to turn.

Question number one is: what would be happening to the pace of inflation today absent the rise in oil prices? It's impossible to provide a precise answer, since you can't unpick the impact of energy costs on a whole range of goods and services. All the same, it is clear that a number of things other than just oil have been pushing up on the pace of CPI inflation from what with hindsight looks like the freakishly low point of just over 1% last autumn. Let me mention a few, in no particular order.

First, revisions to the official data suggest that over the winter of 2003–04 the economy was growing well above its long-term trend, and noticeably more strongly than we had thought at the time. That extra pressure of demand on supply may well have acted to push up prices over the past year.

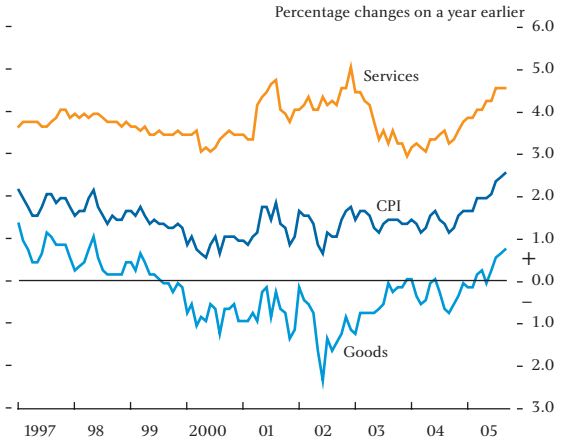
Second, the prices of imported goods have been rising, after a period of several years in which they had actually been falling and acting as a significant drag on price inflation. Excluding oil and erratics, the price of imported goods rose by nearly 2% in the most recent three months compared with a year earlier. This reflects rising inflation pressures overseas after a period of rapid increases in world output as well as the indirect effects of higher oil prices as they work their way down the supply chain.

Third, prices in the service sector have risen significantly over the past year. As measured by the CPI, service price inflation is now rising at an annual rate of 4.5%, up from 3.2% a year ago (Chart 4). This is partly an energy story — the prices of transport services have risen noticeably over the period. But there are other things going on as well. For example, prices of financial services and rents have also moved ahead.

It's hard to be sure, but my very rough guess is that CPI inflation, which was running at an annual rate of 2.5% in September, would not be far below the 2% target even with no contribution from higher oil prices.

Going forward, though — and still leaving the direct impact of oil out of the equation — there's reason to think that the pressure of inflation might start to abate in the coming months. For one thing, the economy is probably still growing a little below its long-term

Chart 4
CPI goods and services



Source: ONS.

potential, which implies that there is an extra margin of spare capacity to pull down on price inflation.

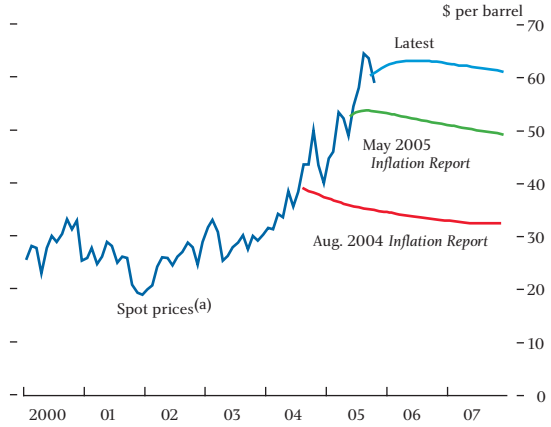
To find evidence of this, look at the labour market. It's true that private sector wage settlements have been ticking up a bit in recent months. But short-run measures of regular pay still look relatively weak, and regular pay drift — which you might expect to respond more quickly in response to unexpected changes in the economy — continues on a downward trend. One way or another, it looks as though earnings growth in the third quarter of this year will turn out to have been measurably lower than the MPC was expecting back in August.

But it's at this point that we have to turn to big question number two about the pace of inflation in 2006 and beyond which is: what are the likely implications of the higher oil price?

There is absolute uncertainty in one critical respect: we have very little idea about the future path of the oil price. This is a big problem, since the economic impact would be very different if prices were to continue to rise, as opposed to moving sideways or falling. Most people think that prices are unlikely to fall much in the near future, given the continuing pressures of demand for oil from around the world and against a background of tight supply constraints — a problem that has been exacerbated by hurricanes Katrina and Rita. But then most people completely failed to identify the conditions that led to the leap in oil prices in the first place, so that's not much help.

At its current level, the price of oil will continue to push up on CPI inflation for several more months to come (Chart 5). The key challenge for monetary policy in these circumstances is to choose a path for interest rates that keeps inflation expectations well anchored around the target level. The lesson from previous oil price shocks in the 1970s is that it is critically important to prevent the initial impact of higher energy prices from being translated into second-round effects — an upward spiral in wage settlements and a general expectation of higher inflation that encourages price setters to take pre-emptive action. People need to be *fully* convinced that higher oil prices will not be allowed to translate into higher inflation, otherwise policy is in trouble.

Chart 5
Spot oil prices and futures



Note: Simple average of spot prices of UK Brent, Dubai Fateh and West Texas Intermediate crude oil. These spot prices are deflated by a weighted average of percentage change of GDP deflator for the United States, Japan, euro area and the United Kingdom. The weights are as follows: United States (0.45), Japan (0.15), euro area (0.29) and United Kingdom (0.11).

Source: Bloomberg.

(a) Monthly averages of daily Brent crude oil spot prices.

So there are choices. The Committee could choose not to fight against the first-round effects of higher oil prices, and allow CPI inflation to rise temporarily a little above target. Instead, it would stand ready to tighten policy immediately there were any signs of second-round effects of higher energy costs passing through into the economy. To an extent this is where things now stand, with inflation currently running ahead of the target. The risk here is that if inflation expectations picked up and wage settlements started to rise, then monetary policy would need to tighten that much more sharply in order to bring inflation back to target.

Alternatively, policy could tighten earlier in response to the higher oil prices, with the aim of bringing inflation back to the target more quickly and pre-empting any rise in inflation expectations. But this would push down on growth and employment at a time when the economy already seems to have slowed down to a marked extent,

and when the labour market appears to be easing. That could risk unnecessary pain, a further slowdown in growth, and inflation drifting below the target.

The choice depends on whether oil prices continue to rise and how inflation expectations evolve, as well as on your view both of the amount of spare capacity in the economy and the degree of flexibility to adjust to the oil price shock. In particular, the ability of the labour market to adapt to changing cost pressures is critically important.

The reason is this. As the MPC's *Minutes* for September made clear, whatever policy choice is taken, the purchasing power of households' wages after tax will have to be lower than otherwise would have been the case as a result of higher energy costs.

High oil prices act like a tax, transferring wealth from the consumers of energy to the producers and the government. Faced with a sustained increase in energy costs, businesses may seek to push up prices even if that leads to a fall in demand. They may also work their equipment less intensively, thereby reducing potential supply. Unless the purchasing power of households' wages after tax is eroded, there are only two ways out. Either monetary policy would need to tighten further to rein back inflation, in which case unemployment would rise. Or if monetary policy did not respond in a timely way, then we could end up with inflation expectations accelerating, wage demands picking up, and eventually interest rates jumping to even higher levels to push inflation back to target. In the worst experiences of past decades, there has been a combination of all these bad outcomes.

Of course, much has changed in the past 30 years. We now use less than half as much oil to produce a unit of output as we did then. And the UK labour market is much more flexible than it used to be.

Nevertheless, you may be sure that the MPC is determined to contain any second-round effects.

With this in mind, we are paying even more attention than usual at the moment to the various measures of inflation expectations — both those which can be calculated from prices in the financial markets, and those which come from a range of different polling sources. So far as we can tell, inflation expectations for the short term may have risen a little in the past few months — hardly surprising, given all the news about petrol prices. But expectations for this time next year and beyond appear to remain firmly anchored to the target. That's good news.

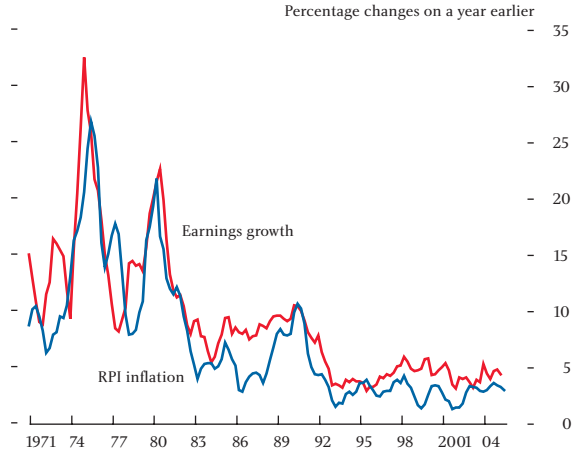
We can also take some comfort, as I've already suggested, from the apparent easing of conditions in the labour market. Whole-economy average earnings growth has not picked up as smartly as the rise in CPI inflation over the past year, and there are few signs so far that higher oil prices are being translated into higher wage settlements (Chart 6).

Chart 6
Long-run real oil prices and wages and price inflation

Real oil price

Source: Real oil prices IMF *World Economic Outlook*, Figure 1.1, IMF forecast for end-2005.

Earnings growth and inflation



Source: ONS.

Looking at the big picture, I still think it possible that our central projection back in August of a smart acceleration in economic growth from next spring may turn out to have been too optimistic. In the rather portentous language of central bankers, the risks are on the downside. Consumers still seem to be quite

cautious, and business conditions are mixed. If that's right, our projection for the pace of inflation going forward may in turn prove to be too high.

But a great deal depends on how the economy adjusts to the rise in the price of oil, and on the direction of energy costs in the months ahead. All I can promise you is that each month the Monetary Policy Committee will do its very best to exercise its independent judgement in order to meet its mandate.

I started by saying that these are challenging times. And I would like to end on a positive note.

Some slowdown in the pace of consumption growth was inevitable after the rapid expansion of past years. If that can be accompanied by a pickup in investment and net trade, so much the better.

In the meantime, we have a highly flexible labour force, a competitive economy, and a proactive monetary policy. For someone of my generation, the idea that we could have seen a doubling of oil prices in 18 months accompanied by a still expanding economy and consumer price inflation running at an annual rate of just over 2% is absolutely astonishing. It's up to all of us to ensure that these achievements are sustained.

Monetary policy challenges facing a new MPC member

In this speech,(1) David Walton,(2) member of the Bank's Monetary Policy Committee, reflects on the challenges he faced at his first two meetings of the MPC in July and August. In the context of the news that arose for the Committee between the May and August Inflation Reports, *he gives reasons for his policy recommendations and explains why he believes that the Committee was right to cut interest rates from 4¾% to 4½% in August. On the consequences of high oil prices for monetary policy, he concludes that the appropriate monetary policy response in future will depend on the reactions of households and businesses and notes that there is a wide range of possible outcomes.*

It has been 2½ months since I joined the Monetary Policy Committee. This is my first regional visit and my first opportunity to reflect publicly on some of the issues faced by the MPC in this period. I am grateful to Kevin Butler, the Bank of England's regional Agent for the South West of England, for arranging both.

The Bank's regional Agents, with their extensive network of contacts in the business community, are a rich source of intelligence for the MPC. Kevin and his colleagues do a tremendous job filtering and synthesising the information they receive, making it an integral part of the monthly monetary policy round. I have valued the opportunity to learn from the insights of local business people this morning and I'm looking forward to many more occasions in future. I'm confident that such contacts enable the MPC to be quick to spot any marked change in business conditions, for better or worse.

It has been a very interesting, and challenging, time to join the MPC. In July, at my first meeting, the Committee voted by a margin of five to four to leave interest rates unchanged. In August, it voted by the same margin to cut interest rates from 4¾% to 4½%. I voted for a 25 basis points cut at both meetings. Though the outcome of each of these meetings was as expected in financial markets, the closeness of the vote was not.

I would like to elaborate on what, for me, were some of the key judgements that the Committee had to make at the July and August meetings, and explain what led me to believe that an interest rate cut was appropriate.

I'd like to frame these thoughts in the context of the news that arose for the Committee between the May and August *Inflation Reports*. There were three significant sources of news.

First, extensive revisions to the National Accounts meant that the *level* of market sector output was higher than previously thought (Chart 1). Over the period 1999 to the end of 2003, the average level of output was revised ½% higher relative to the data available to the

Chart 1
Revisions to the level of market sector output(a)

(a) Comparison of market sector output estimates pre and post-*Blue Book*. Market sector output is defined here as the average measure of gross value added excluding the public administration, defence, social security, education and health sectors. The estimate of market sector output for 2005 Q1 was based on information in the preliminary GDP release for 2005 Q1 available at the time of the May *Report*.

(1) Given at a lunch with the Exeter Business Community on 16 September 2005. This speech can be found on the Bank's website at www.bankofengland.co.uk/publications/speeches/2005/speech254.pdf.
(2) I am grateful to Peter Andrews, Kate Barker, Charlie Bean, Spencer Dale, Phil Evans, Richard Harrison, Richard Lambert, David Lodge, Lavan Mahadeva, Alex Muscatelli, Stephen Nickell, Jumana Saleheen and Ryland Thomas for their helpful comments.

Committee in May. Since revisions to output more than a couple of years past should already have affected inflation, the Committee's collective judgement was that potential output had also been around ½% higher over this period.

At the same time, the data showed a more pronounced slowdown in *growth* since mid-2004 than previously thought. As a result, the level of market sector output in the second quarter of 2005 was virtually the same as expected by the MPC in May. Overall, the Committee judged that the economy was operating more or less at potential.

Doubtless, there will be more revisions, in time, to recent data. In the past, there has been a tendency for early estimates of GDP growth to be revised higher, and it is probably the case that growth has been stronger over the past year than official estimates currently show. Business surveys, for instance, have pointed to greater momentum in the economy in recent quarters than official data, particularly in the service sector. However, if we take into account the gradual easing in the labour market seen this year, and the stability of wage inflation, I think it is reasonable to believe that growth has been a bit below trend over the past year and this has generated a small amount of slack.

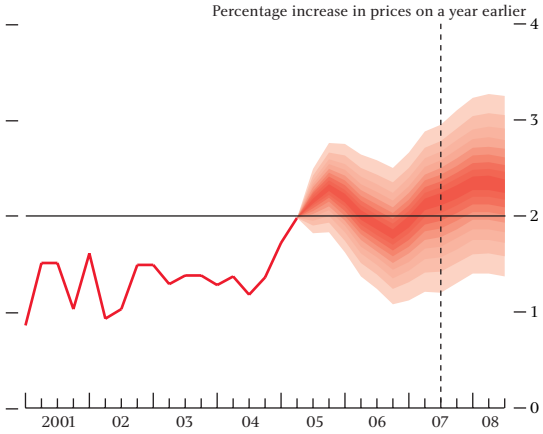
The second piece of news was the sharper-than-expected pickup in consumer price inflation. This continued the run of surprises to the upside that had occurred since the beginning of the year. From a low of 1.1% as recently as September 2004, consumer price inflation rose to the inflation target of 2.0% in June — the figure available at the August MPC meeting. It has since risen to 2.4%.

Between one third and one half of the rise in inflation can be attributed to the effects of higher oil prices, both the direct effect on petrol prices and the indirect effects working through the supply chain. The Committee also took the view, following the National Accounts revisions, that the pressure of demand on supply may have been greater than previously believed during 2003 and early 2004 and this had contributed to the upward pressure on inflation observed over the past year.

The third, and perhaps most significant, piece of news between May and August was a substantial movement in asset prices and a marked shift in interest rate expectations. The sterling exchange rate index depreciated by more than 3% and equity prices were about 6% higher than expected. Ahead of the August MPC meeting, the market yield curve implied a fall in official interest rates to around 4% over the next twelve months; in May, market expectations were for official interest rates to remain around 4¾%. These developments had a significant impact on the MPC's economic projections, pushing up inflation by around three quarters of a percentage point at the two-year horizon, relative to the May forecast.

At the August MPC meeting, there was broad agreement within the Committee that the interest rate market had got ahead of itself by pricing in almost three 25 basis points cuts in official rates by next spring. This was reflected in the Committee's central projection for inflation which, when conditioned on the market's implied path for official interest rates, showed inflation above target in two years' time and rising (Chart 2).

Chart 2
August *Inflation Report* CPI projection based on market interest rate expectations(a)

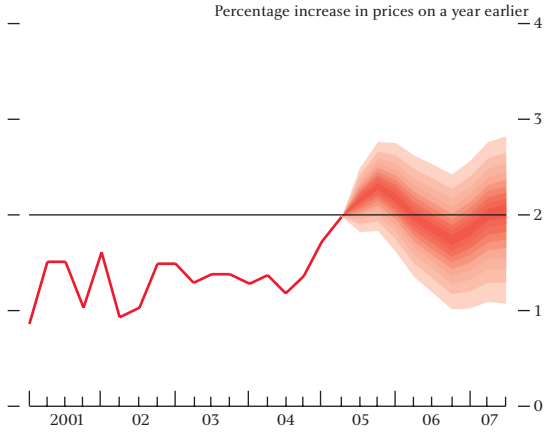


(a) The fan chart depicts the probability of various outcomes for CPI inflation in the future. If economic circumstances identical to today's were to prevail on 100 occasions, the MPC's best collective judgement is that inflation over the subsequent three years would lie within the darkest central band on only 10 of those occasions. The fan charts are constructed so that outturns of inflation are also expected to lie within each pair of the lighter red areas on 10 occasions. Consequently, inflation is expected to lie somewhere within the entire fan chart on 90 out of 100 occasions. The dashed line is drawn at the two-year point.

By contrast, when the Committee conditioned its forecast on unchanged interest rates — either at 4¾% or 4½% — inflation was close to target in two years' time and remained there (Chart 3). While there is no mechanical link between these projections and policy decisions, they indicated that a case could be made for leaving rates unchanged or cutting them by 25 basis points. As is clear from the 5–4 vote, it was a close call.

I will give you three reasons why I voted for a cut in interest rates in July and August and explain why I continue to believe that this was the appropriate course of action.

Chart 3
August *Inflation Report* CPI projection based on constant nominal interest rates at 4.5%(a)

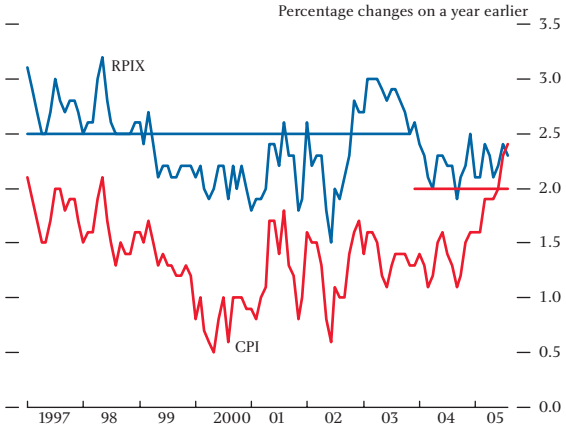


(a) See footnote to Chart 2 above.

First, there is a downside risk to the Committee's central projection for growth which, in turn, creates a downside risk for inflation further out. Household spending growth, in particular, has been very weak during the first half of this year. Although these data could yet be revised higher, a further period of subdued consumption growth seems quite likely. Higher oil prices and a loosening in the labour market will curb the growth of household real incomes. And households' willingness to borrow to maintain spending growth may be limited by their existing high levels of debt and the low level of the saving ratio. Business investment prospects are also very uncertain. Companies may remain reluctant to invest in the face of increased uncertainty about demand and profitability associated with high energy prices.

Second, the rise in inflation over the past year needs to be kept in perspective. Despite the severity of the oil shock, inflation is only a little above its *symmetric* target of 2% after a prolonged period in which inflation has been below target. Part of the rise might be idiosyncratic: consumer price inflation has picked up more sharply than RPIX inflation, for instance (Chart 4). Nevertheless, inflation is likely to remain above target in the next few months as the full effects of higher oil prices are felt. In this period, we must be vigilant for we cannot take the stability of inflation expectations for granted. But monetary policy must also be forward looking. If monetary policy reacts to actual inflation, rather than anticipating future inflation, it risks doing too little too late or too much too late. The slowdown in growth over the past year should lead to some moderation in inflationary pressure further ahead. The stability of wage inflation and the decline in cost and price pressures across a range of business surveys in recent months suggest that, for the moment at least, any second-round effects from higher oil prices will be modest.

Chart 4
CPI and RPIX inflation(a)



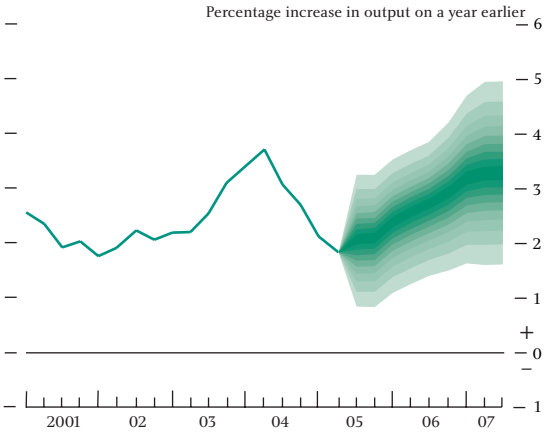
(a) Until December 2003, the target for monetary policy was 2.5% for RPIX inflation. Since then, the target has been 2.0% for CPI inflation.

Third, if it were not for the asset price movements observed between May and August, the Committee would have been faced with the prospect of an undershoot in the inflation target two years ahead. Some of the easing in financial conditions that had taken place, particularly the decline in the exchange rate, was likely to have been in anticipation of lower interest rates. Since a 25 basis points rate cut was consistent, on our central projection, with achieving the inflation target in two years' time, I saw no merit in surprising financial markets unnecessarily. To keep inflation on target, I judged it necessary to validate at least part of the market expectation for lower interest rates. Since the August MPC meeting, the sterling exchange rate index has recovered by around 2½% and this should help to keep inflation on target.

So much for the past. In concluding, let me give a few brief thoughts about the future. The MPC's forecasts in the August *Inflation Report* painted a fairly benign picture for the UK economy. On unchanged interest rates, the Committee expects growth to recover steadily back to trend over the next year (Chart 5) and inflation to remain close to target. Of course, the chances of the MPC's central projections being correct are extremely low. But they provide a useful benchmark for how I, and my colleagues on the Committee, will interpret the flow of news in coming months.

Oil is a big uncertainty for the outlook for both growth and inflation. Increasingly, the shock from oil prices

Chart 5
August *Inflation Report* GDP projection based on constant nominal interest rates at 4.5%(a)



(a) The fan chart depicts the probability of various outcomes for GDP growth in the future. If economic circumstances identical to today's were to prevail on 100 occasions, the MPC's best collective judgement is that GDP growth over the subsequent three years would lie within the darkest central band on only 10 of those occasions. The fan charts are constructed so that outturns of GDP growth are also expected to lie within each pair of the lighter green areas on 10 occasions. Consequently, GDP growth is expected to lie somewhere within the entire fan chart on 90 out of 100 occasions.

seems larger and more permanent than expected. Oil prices have doubled since the beginning of 2004; the oil futures market suggests that much of this increase in prices may persist. High oil prices act like a tax, transferring money from consumers to oil producers, leaving many of us worse off.

The appropriate monetary policy response depends on how households and businesses react. There is a wide range of possible outcomes. Demand could conceivably soften too much if business and consumer confidence are damaged. Inflation expectations could become destabilised if inflation moves too far away from target. And some productive capacity could be lost permanently. When thinking about my recommendation for interest rates in coming months, I will be considering carefully how each of these will affect the chances of meeting the inflation target.

If I have left you feeling uncertain about the future course of interest rates, then you are in good company. The one certainty is that the MPC will continue to set interest rates each month at the level it judges appropriate to keep inflation on track to meet the 2% target. I am very pleased to have been appointed to the Committee to be able to participate in that decision-making process.

Bank of England speeches

Speeches made by Bank personnel since publication of the previous *Bulletin* are listed below.

Financial stability: managing liquidity risk in a global system.
Speech by Sir Andrew Large, Deputy Governor, at the Fourteenth City of London Central Banking and Regulatory Conference, National Liberal Club, on 28 November 2005. www.bankofengland.co.uk/publications/speeches/2005/speech261.pdf.

Economic stability and the business climate.
Speech by Kate Barker, member of the Monetary Policy Committee, at the Managing Directors' Club, Sheffield University on 24 November 2005. www.bankofengland.co.uk/publications/speeches/2005/speech260.pdf. Reproduced on pages 489–96 of this *Bulletin*.

Comments by Stephen Nickell on a paper by Rachel Griffith and Rupert Harrison 'The link between product market reforms and macroeconomic performance'.
At the European Commission Workshop on Structural Reforms and Macroeconomic Performance in Brussels on 18 November 2005. www.bankofengland.co.uk/publications/speeches/2005/speech259.pdf.

Challenging times for monetary policy.
Speech by Richard Lambert, member of the Monetary Policy Committee, at a meeting of the National Association of Pension Funds in Belfast on 19 October 2005. www.bankofengland.co.uk/publications/speeches/2005/speech258.pdf. Reproduced on pages 497–502 of this *Bulletin*.

UK monetary policy: the international context.
Speech by Rachel Lomax, Deputy Governor, at the APCIMS Annual Conference on 17 October 2005. www.bankofengland.co.uk/publications/speeches/2005/speech257.pdf. Reproduced on pages 483–88 of this *Bulletin*.

CBI North East Annual Dinner.
Speech by Mervyn King, Governor, in Gateshead on 11 October 2005. www.bankofengland.co.uk/publications/speeches/2005/speech256.pdf. Reproduced on pages 480–82 of this *Bulletin*.

Practical issues in UK monetary policy, 2000–05.
Speech by Stephen Nickell, member of the Monetary Policy Committee and Professor at the London School of Economics, at the British Academy Keynes Lecture in London on 20 September 2005. www.bankofengland.co.uk/publications/speeches/2005/speech255.pdf.

Contents of recent Quarterly Bulletins

The articles and speeches that have been published recently in the *Quarterly Bulletin* are listed below. Articles from November 1998 onwards are available on the Bank's website at www.bankofengland.co.uk/publications/quarterlybulletin/index.htm.

Articles and speeches (indicated S)

Autumn 2004

How should we think about consumer confidence?
Household secured debt
Housing equity and consumption: insights from the Survey of English Housing
Why has world trade grown faster than world output?
The institutions of monetary policy (S)
The Governor's speech to the CBI Scotland dinner (S)
The Governor's speech at the Mansion House (S)
Keeping the party under control—anniversary comments on monetary policy (S)
Some current issues in UK monetary policy (S)
Managing the central bank's balance sheet: where monetary policy meets financial stability (S)
Household debt, house prices and consumption growth (S)

Winter 2004

British household indebtedness and financial stress: a household-level picture
The new sterling ERI
Using option prices to measure financial market views about balances of risk to future asset prices
The foreign exchange and over-the-counter derivatives markets in the United Kingdom
The external balance sheet of the United Kingdom: recent developments
Stability and statistics (S)
Why is inflation so low? (S)
Monetary policy, data uncertainty and the supply side: living with the statistical fog (S)

Spring 2005

Dealing with data uncertainty
Indicators of short-term movements in business investment
Divisia money
Inside the MPC
The role of central banks in payment systems oversight
The Governor's speech to the CBI Dinner in Manchester (S)
The Governor's speech on the International Monetary System (S)
Why monetary stability matters to Merseyside (S)
Monetary policy in an uncertain world (S)
Why has inflation been so low since 1999? (S)
The housing market and the wider economy (S)

Summer 2005

The impact of government spending on demand pressure

Summer 2005 (continued)

How important is housing market activity for durables spending?
The inflation-targeting framework from an historical perspective
Monetary policy news and market reaction to the *Inflation Report* and MPC *Minutes*
Addendum to *Report on modelling and forecasting at the Bank of England*
Public attitudes to inflation
Chief Economist Workshop April 2005: exchange rate regimes and capital flows
Implementing monetary policy: reforms to the Bank of England's operations in the money market
A review of the work of the London Foreign Exchange Joint Standing Committee in 2004
Monetary policy: practice ahead of theory
The Mais Lecture 2005: speech by the Governor (S)
Inflation targeting in practice: models, forecasts and hunches (S)
Monetary policy, stability and structural change (S)
How much spare capacity is there in the UK economy?
Communicating monetary policy in practice (S)
Monetary policy in the United Kingdom — the framework and current issues (S)
A matter of no small interest: real short-term interest rates and inflation since the 1990s (S)

Autumn 2005

Assessing the MPC's fan charts
Long-run evidence on money growth and inflation
The determination of UK corporate capital gearing
Publication of narrow money data: the implications of money market reform
The Governor's speech at Salts Mill, Bradford (S)
The Governor's speech at the Mansion House (S)
Monetary policy making: fact and fiction (S)

Winter 2005

Introducing the Agents' scores
Do financial markets react to Bank of England communication?
Financial stability, monetary stability and public policy
Share prices and the value of workers
Stabilising short-term interest rates
The Governor's speech to the CBI North East annual dinner (S)
UK monetary policy: the international context (S)
Economic stability and the business climate (S)
Challenging times for monetary policy (S)
Monetary policy challenges facing a new MPC member (S)

Bank of England publications

The Bank of England publishes information on all aspects of its work in many formats. Listed below are some of the main Bank of England publications. For a full list, please refer to our website www.bankofengland.co.uk/publications/index.htm.

Working papers

An up-to-date list of working papers is maintained on the Bank of England's website at www.bankofengland.co.uk/publications/workingpapers/index.htm, where abstracts of all papers may be found. Papers published since January 1997 are available in full, in portable document format (PDF).

No.	Title	Author
256	Comovements in the prices of securities issued by large complex financial institutions *(March 2005)*	Christian Hawkesby Ian W Marsh Ibrahim Stevens
257	The role of ICT in the global investment cycle *(March 2005)*	Michael McMahon Gabriel Sterne Jamie Thompson
258	Estimating UK capital adjustment costs *(March 2005)*	Charlotta Groth
259	Productivity growth in UK industries, 1970–2000: structural change and the role of ICT *(March 2005)*	Nicholas Oulton Sylaja Srinivasan
260	Financial constraints and capacity adjustment in the United Kingdom: evidence from a large panel of survey data *(March 2005)*	Ulf von Kalckreuth Emma Murphy
261	Default probabilities and expected recovery: an analysis of emerging market sovereign bonds *(April 2005)*	Liz Dixon-Smith Roman Goossens Simon Hayes
262	The impact of unsecured debt on financial distress among British households *(April 2005)*	Ana Del-Río Garry Young
263	The determinants of unsecured borrowing: evidence from the British Household Panel Survey *(April 2005)*	Ana Del-Río Garry Young
264	Liquidity risk and contagion *(May 2005)*	Rodrigo Cifuentes Gianluigi Ferrucci Hyun Song Shin
265	Asset pricing, asymmetric information and rating announcements: does benchmarking on ratings matter? *(June 2005)*	Spyros Pagratis
266	The determinants of household debt and balance sheets in the United Kingdom *(July 2005)*	Merxe Tudela Garry Young
267	Bank loans versus bond finance: implications for sovereign debtors *(July 2005)*	Misa Tanaka
268	Forecasting using Bayesian and information theoretic model averaging: an application to UK inflation *(July 2005)*	George Kapetanios Vincent Labhard Simon Price
269	Accounting for the source of exchange rate movements: new evidence *(August 2005)*	Katie Farrant Gert Peersman
270	A model of bank capital, lending and the macroeconomy: Basel I versus Basel II *(August 2005)*	Lea Zicchino
271	Consumption, house prices and expectations *(September 2005)*	Orazio Attanasio Laura Blow Robert Hamilton Andrew Leicester
272	What caused the early millennium slowdown? Evidence based on vector autoregressions *(September 2005)*	Gert Peersman
273	'Real-world' mortgages, consumption volatility and the low inflation environment *(September 2005)*	Sebastian Barnes Gregory Thwaites

274	The substitution of bank for non-bank corporate finance: evidence for the United Kingdom *(September 2005)*	Ursel Baumann Glenn Hoggarth Darren Pain
275	Wealth and consumption: an assessment of the international evidence *(October 2005)*	Vincent Labhard Gabriel Sterne Chris Young
276	Corporate expenditures and pension contributions: evidence from UK company accounts *(October 2005)*	Philip Bunn Kamakshya Trivedi
277	When is mortgage indebtedness a financial burden to British households? A dynamic probit approach *(October 2005)*	Orla May Merxe Tudela
278	Misperceptions and monetary policy in a New Keynesian model *(October 2005)*	Jarkko Jääskelä Jack McKeown
279	Monetary policy and private sector misperceptions about the natural level of output *(October 2005)*	Jarkko Jääskelä Jack McKeown
280	A quality-adjusted labour input series for the United Kingdom (1975–2002) *(October 2005)*	Venetia Bell Pablo Burriel-Llombart Jerry Jones
281	Monetary policy and data uncertainty *(November 2005)*	Jarkko Jääskelä Tony Yates
282	Stress tests of UK banks using a VAR approach *(November 2005)*	Glenn Hoggarth Steffen Sorensen Lea Zicchino
283	Measuring investors' risk appetite *(November 2005)*	Prasanna Gai Nicholas Vause

External MPC Unit discussion papers

The MPC Unit discussion paper series reports on research carried out by, or under supervision of, the external members of the Monetary Policy Committee. Papers are available from the Bank's website at www.bankofengland.co.uk/publications/other/externalmpcpapers/extmpcpaper0000n.pdf (where n refers to the paper number). The following papers have been published recently.

No.	Title	Author
9	The pricing behaviour of UK firms *(April 2002)*	Nicoletta Batini Brian Jackson Stephen Nickell
10	Macroeconomic policy rules in theory and in practice *(October 2002)*	Christopher Allsopp
11	The exchange rate and inflation in the UK *(October 2002)*	Amit Kara Edward Nelson
12	Measuring the UK short-run NAIRU *(April 2003)*	Nicoletta Batini Jennifer Greenslade
13	UK consumers' habits *(May 2003)*	Ryan Banerjee Nicoletta Batini
14	National Accounts revisions and output gap estimates in a model of monetary policy with data uncertainty *(May 2005)*	Lavan Mahadeva Alex Muscatelli

Monetary and Financial Statistics

Monetary and Financial Statistics (*Bankstats*) contains detailed information on money and lending, monetary and financial institutions' balance sheets, banks' income and expenditure, analyses of bank deposits and lending, external business of banks, public sector debt, money markets, issues of securities, financial derivatives, interest and exchange rates, explanatory notes to tables and occasional related articles.

Bankstats is published monthly on the internet but paper copies are available on a twice-yearly basis. Paper copies are published for the January and July editions in hard copy on Wednesday 1 February 2006 and Tuesday 1 August 2006 respectively. The price per annum in the United Kingdom is £40, or £20 per copy. *Bankstats* is available on a monthly basis free of charge from the Bank's website at www.bankofengland.co.uk/statistics/statistics.htm.

Further details are available from: Mark Thompson, Monetary and Financial Statistics Division, Bank of England: telephone 020 7601 5353; fax 020 7601 3208; email mark.thompson@bankofengland.co.uk.

The following articles have been published in recent issues of *Monetary and Financial Statistics*. They may also be found on the Bank of England's website at www.bankofengland.co.uk/statistics/ms/articles.htm.

Title	Author	Month of issue	Page numbers
A method for examining revisions to published statistics	Alison Franklin	July	20–21
Understanding the Bank of England's statistical requirements under International Financial Reporting Standards	Robert Westwood	June	16–19
Consolidated external claims of UK-owned banks: a new dataset	Kerry Baker	June	14–15
A new range of effective interest rates	Hannah Reynolds Michelle Ryan Jonathan Bailey	May	10–13
Seasonal adjustment of monetary data: annual review presentation	Martin Daines	April	9
A work programme in financial statistics — April 2005	Nick Davey	April	4–8
Average quoted household interest rates	Jonathan Bailey	February	1–3

Financial Stability Review

The *Financial Stability Review* is published twice a year, in June and December. Its purpose is to encourage informed debate on financial stability; survey potential risks to financial stability; and analyse ways to promote and maintain a stable financial system. The Bank of England intends this publication to be read by those who are responsible for, or have interest in, maintaining and promoting financial stability at a national or international level. It is of especial interest to policymakers in the United Kingdom and abroad; international financial institutions; academics; journalists; market infrastructure providers; and financial market participants. It is available from Financial Stability Review, Bank of England HO-3, Threadneedle Street, London, EC2R 8AH and on the Bank's website at www.bankofengland.co.uk/publications/fsr/index.htm.

Economic models at the Bank of England

The *Economic models at the Bank of England* book, published in April 1999, contains details of the economic modelling tools that help the Monetary Policy Committee in its work. The price of the book is £10. An update was published in September 2000 and is available free of charge.

The Bank of England Quarterly Model

The Bank of England Quarterly Model, published in January 2005, contains details of the new macroeconomic model developed for use in preparing the Monetary Policy Committee's quarterly economic projections, together with a commentary on the motivation for the new model and the economic modelling approaches underlying it. The price of the book is £10.

Practical issues arising from the euro

This is a series of booklets providing a London perspective on the development of euro-denominated financial markets and the supporting financial infrastructure, and describing the planning and preparation for possible future UK entry. Recent editions have focused on the completion of the transition from the former national currencies to the euro in early 2002, and the lessons that may be drawn from it. Copies are available from Public Enquiries Group, Bank of England, Threadneedle Street, London, EC2R 8AH and on the Bank's website at www.bankofengland.co.uk/publications/practicalissues/index.htm.

Payment Systems Oversight Report

The *Payment Systems Oversight Report* provides an account of how the Bank is discharging its responsibility for oversight of UK payment systems. Published annually, the *Oversight Report* sets out the Bank's assessment of key systems against the benchmark standards for payment system risk management provided by the internationally adopted Core Principles for Systemically Important Payment Systems, as well as current issues and priorities in reducing systemic risk in payment systems. Copies are available on the Bank's website at www.bankofengland.co.uk/publications/psor/index.htm.

Handbooks in central banking

The series of *Handbooks in central banking* provide concise, balanced and accessible overviews of key central banking topics. The *Handbooks* have been developed from study materials, research and training carried out by the Bank's Centre for Central Banking Studies (CCBS). The *Handbooks* are therefore targeted primarily at central bankers, but are likely to be of interest to all those interested in the various technical and analytical aspects of central banking. The series also includes *Lecture* and *Research* publications, which are aimed at the more specialist reader. All the *Handbooks* are available via the Bank's website at www.bankofengland.co.uk/education/ccbs/handbooks/index.htm.

Quarterly Bulletin

The *Quarterly Bulletin* provides regular commentary on market developments and UK monetary policy operations. It also contains research and analysis and reports on a wide range of topical economic and financial issues, both domestic and international.

Summary pages of the *Bulletin* from February 1994, giving a brief description of each of the articles, are available on the Bank's website at www.bankofengland.co.uk/publications/quarterlybulletin/index.htm.

The *Bulletin* is also available from ProQuest Information and Learning: enquiries from customers in Japan and North and South America should be addressed to ProQuest Information and Learning, 300 North Zeeb Road, Ann Arbor, Michigan 48106, United States of America; customers from all other countries should apply to The Quorum, Barnwell Road, Cambridge, CB5 8SW, telephone 01223 215512.

An index of the *Quarterly Bulletin* is also available to customers free of charge. It is produced annually, and lists alphabetically terms used in the *Bulletin* and articles written by named authors.

Bound volumes of the *Quarterly Bulletin* (in reprint form for the period 1960–85) can be obtained from Schmidt Periodicals GmbH, Ortsteil Dettendorf, D-83075 Bad Feilnbach, Germany, at a price of €105 per volume or €2,510 per set.

Inflation Report

The Bank's quarterly *Inflation Report* sets out the detailed economic analysis and inflation projections on which the Bank's Monetary Policy Committee bases its interest rate decisions, and presents an assessment of the prospects for UK inflation over the following two years. The *Inflation Report* is available at www.bankofengland.co.uk/publications/inflationreport/index.htm.

The *Report* starts with an overview of economic developments; this is followed by five sections:

- analysis of money and asset prices;
- analysis of demand;
- analysis of output and supply;
- analysis of costs and prices; and
- assessment of the medium-term inflation prospects and risks.

The *Minutes* of the meetings of the Bank's Monetary Policy Committee appear as a separate publication on the same day as the *Report*.

Publication dates

Copies of the *Quarterly Bulletin* and *Inflation Report* can be bought separately, or as a combined package for a discounted rate. Current prices are shown overleaf. Publication dates for 2006 are as follows:

Quarterly Bulletin		*Inflation Report*	
Spring	13 March	February	15 February
Summer	19 June	May	10 May
Autumn	25 September	August	9 August
Winter	11 December	November	15 November

Quarterly Bulletin and *Inflation Report* subscription details

Copies of the *Quarterly Bulletin* and *Inflation Report* can be bought separately, or as a **combined** package for a discounted rate. Subscriptions for a full year are also available at a discount. The prices are set out below:

Destination	2006					
	Quarterly Bulletin and *Inflation Report* package		*Quarterly Bulletin* only		*Inflation Report* only	
	Annual	Single	Annual	Single	Annual	Single
United Kingdom, by first-class mail (1)	£27.00	£7.50	£21.00	£6.00	£10.50	£3.00
*Academics, **UK only***	*£18.00*	*£5.00*	*£14.00*	*£4.00*	*£7.00*	*£2.00*
*Students, **UK only***	*£9.00*	*£2.50*	*£7.00*	*£2.00*	*£3.50*	*£1.00*
European countries including the Republic of Ireland, by letter service	£33.00	£9.00	£25.00	£7.00	£13.00	£4.00
Countries outside Europe: Surface mail	£33.00	£9.00	£25.00	£7.00	£13.00	£4.00
Air mail	£43.00	£12.00	£34.00	£9.00	£17.00	£5.00

(1) Subscribers who wish to collect their copy (copies) of the *Bulletin* and/or *Inflation Report* may make arrangements to do so by writing to the address given below. Copies will be available to personal callers at the Bank from 10.30 am on the day of issue and from 8.30 am on the following day.

Readers who wish to become **regular subscribers**, or who wish to purchase single copies, should send to the Bank, at the address given below, the appropriate remittance, payable to the Bank of England, together with full address details, including the name or position of recipients in companies or institutions. If you wish to pay by **Visa, MasterCard, Maestro or Delta**, please telephone 020 7601 4030. Existing subscribers will be invited to renew their subscriptions automatically. Copies can also be obtained over the counter at the Bank's front entrance.

The **concessionary rates** for the *Quarterly Bulletin* and *Inflation Report* are noted above in *italics*. **Academics at UK institutions** of further and higher education are entitled to a concessionary rate. They should apply on their institution's notepaper, giving details of their current post. **Students and secondary schools in the United Kingdom** are also entitled to a concessionary rate. Requests for concessionary copies should be accompanied by an explanatory letter; students should provide details of their course and the institution at which they are studying.

These publications are available from Publications Group, Bank of England, Threadneedle Street, London, EC2R 8AH; telephone 020 7601 4030; fax 020 7601 3298; email mapublications@bankofengland.co.uk.

General enquiries about the Bank of England should be made to 020 7601 4444.
The Bank of England's website is at www.bankofengland.co.uk.

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