Quarterly Bulletin

Summer 2001

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Research and analysis (continued)

Summaries of recent External MPC Unit discussion papers

Speeches

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Markets and operations
(pages 145–63)

This article reviews developments in international and domestic financial markets, drawing on information from the Bank of England's market contacts, and describes the Bank's market operations in the period 1 February to 11 May 2001.

Reports
(pages 164–82)

The Bank of England inflation attitudes survey. As part of a new regular series, the market research agency NOP undertook a survey of public attitudes to inflation for the Bank of England in February. The results show that, given a choice between higher interest rates or higher inflation, four times as many people would prefer interest rates to go up, rather than prices. Other results suggest that most people are aware that the Bank, rather than the Government, now sets interest rates. 55% are satisfied with the way the Bank is doing its job; just 10% are dissatisfied. Most people are aware that inflation is low, but only one in three knows that it is currently between 1% and 3%. However, very few expect inflation to rise sharply in the year ahead.

The London Foreign Exchange Joint Standing Committee: a review of 2000. This article gives an overview of the role of the London Foreign Exchange Joint Standing Committee, and reviews the work undertaken by the Committee during 2000.

Over-the-counter interest rate options (by Richhild Moessner of the Bank's Gilt-edged and Money Markets Division). The Bank of England's Monetary Policy Committee uses market expectations of future interest rates to inform its policy decisions. Interest rate expectations can be inferred from a range of financial instruments, including interest rate options. This article surveys the structure and use of the over-the-counter (OTC) interest rate option market. It discusses what information OTC interest rate options may contain about market interest rate expectations, additional to that available from products traded on exchanges. It also considers the linkages between OTC interest rate option markets and the markets in the underlying assets.

Research and analysis
(pages 183–221)

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.

Explaining the difference between the growth of M4 deposits and M4 lending: implications of recent developments in public finances (by John Power and Peter Andrews of the Bank's Monetary Assessment and Strategy Division). The growth of sterling lending by UK monetary financial institutions to the UK private sector has substantially exceeded the growth of UK private sector sterling deposits over the past two years. This article considers the possible influence on this growth differential of two events in the past financial year: the unexpected extent of the Government's cash surplus; and the assumption by the Debt Management Office of responsibility for government cash management. The article also describes how the gap between sterling lending and deposits was financed over the past two years.

Using surveys of investment intentions (by Jens Larsen of the Bank's Monetary Assessment and Strategy Division and Rain Newton-Smith of the Bank's Structural

Economic Analysis Division). Business investment is an important component of aggregate demand in the UK economy. But it is volatile and difficult to predict. Surveys of investment intentions provide a timely and useful source of information on future investment plans, and can be used to forecast changes in business investment. This article describes a model that uses surveys of investment intentions to forecast business investment, and compares its forecast performance with the business investment equation in the Bank of England's macroeconometric model.

Can differences in industrial structure explain divergences in regional economic growth? (by Beverley Morris of the Bank's Conjunctural Assessment and Projections Division). During the early to mid-1990s, the pace of economic growth in the South was broadly comparable with that in the rest of the United Kingdom. During 1996–98, however, the pace of activity in the South strengthened considerably relative to the rest of the country. This article investigates one possible explanation for divergences in growth between the two regions—namely differences in the relative importance of the manufacturing and service sectors. The results suggest that such differences in industrial structure do not account for the majority of the regional divergences in growth. Rather, it appears that they are explained mostly by a pick-up in population growth and stronger service sector activity in the South relative to that in the rest of the country over the period.

Has there been a structural improvement in US productivity? (by Stuart Berry of the Bank's International Economic Analysis Division and David England of the Bank's Monetary Assessment and Strategy Division). Annual labour productivity growth in the United States has averaged 2.8% a year since 1996, compared with an average rate of 1.6% during the preceding 25 years. This marked increase in productivity growth has been a key component of what many commentators have suggested is a 'new economy'. Given the US slowdown since the second half of 2000, a key question is the extent to which these gains reflect structural improvements, rather than cyclical factors. The evidence so far points towards a large role for structural improvements in productivity. If these gains prove to be more cyclical, however, this would have important implications for corporate performance, financial markets and, ultimately, output and inflation.

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The speeches contained in the *Bulletin* can be found at www.bankofengland.co.uk/speech/index.html

Markets and operations

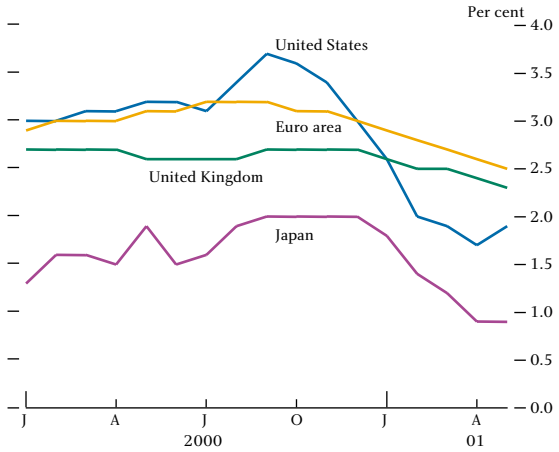
- *This article reviews developments in international and domestic financial markets, drawing on information from the Bank of England's market contacts, and describes the Bank's market operations in the period 1 February to 11 May 2001.*
- *Private sector forecasts for short-term growth prospects in the G7 countries were revised down during the period. World equity markets fell sharply until late March but recovered somewhat thereafter.*
- *Official interest rates were reduced by 100 basis points in the United States, by 75 basis points in the United Kingdom, and by 25 basis points in the euro area. The Bank of Japan also eased its monetary policy during the period.*
- *Short-term interest rate expectations fell in the United States, the United Kingdom and Japan, but were broadly unchanged in the euro area. Uncertainty about the short-term outlook for future changes in monetary policy increased in these areas.*
- *US and European government bond yields beyond two years' maturity rose as market participants became more confident that the reductions in official rates would limit the extent of the global slowdown.*
- *The dollar appreciated against the other major currencies during the period.*

Changes in the macroeconomic environment

One of the main influences on financial market movements in February, March and April was changes in perceptions about the likely severity of the global economic slowdown in 2001. Activity data for the G7 economies released during the period were somewhat mixed. The pace of activity in the service sectors of all seven countries generally weakened by less than the growth rates of industrial production, which slowed quite sharply. Annual rates of GDP growth have consequently slowed in most of the G7 economies. However, the quarterly rate of US GDP growth in Q1 was stronger than most commentators had been expecting and was higher than in Q4.(1)

Reflecting these developments, forecasts for GDP growth in 2001 in the United States, Europe and Japan were revised down during the review period. But these revisions were the same size as, or smaller than, those recorded in the three months to February (see Chart 1). In particular, Consensus Economics' surveys suggest

Chart 1
Forecasts for GDP growth in 2001(a)



Source: Consensus Economics.

(a) Means of survey samples.

(1) For further details about recent changes in global economic conditions, see pages 14–17 of the May 2001 *Inflation Report*.

that the mean projection for US GDP growth in 2001 was revised down by only 0.1 percentage point in the three months to May, after a fall of 1.4 percentage points in the previous three months. The mean forecasts for GDP growth in Japan, the euro area, and the United Kingdom were revised down by 0.5, 0.3 and 0.2 percentage points respectively during the review period. Looking further ahead, forecasts for GDP growth in 2002 were also revised down. Nevertheless, in mid-May they continued to suggest that growth in the United States and Europe was expected to recover to around 2¾%–3% next year.

Forecasts for consumer price inflation in 2001 have generally been revised up slightly since February (see Table A), while inflation forecasts for 2002 have remained largely unchanged.

Table A
Forecasts for consumer price inflation in 2001

Per cent; percentage points in italics

	February	May	Change (a)
United States	2.6	3.1	*0.5*
Euro area	2.0	2.3	*0.3*
United Kingdom	2.1	1.9	*-0.2*
Japan	-0.4	-0.3	*0.1*

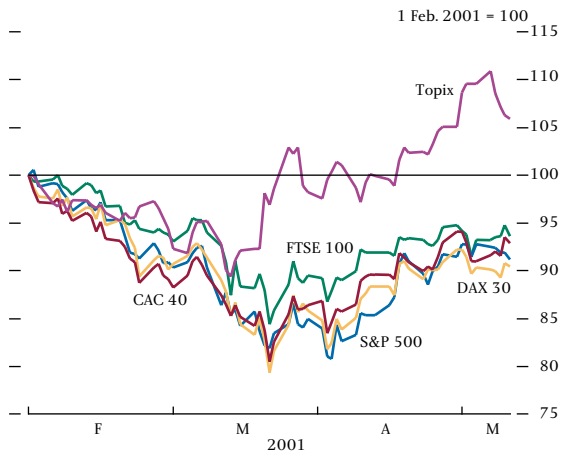
Source: Consensus Economics.

(a) Change between February and May 2001.

Equity markets

Share price indices fell sharply in most countries during the period. Between the end of January and 22 March, the FTSE 100, the S&P 500 and the DAX 30 declined by 16%, 18% and 21% respectively (see Chart 2). These reductions occurred across a broad range of firms and sectors, including well-established 'blue chip' companies and the so-called 'new economy' technology, media and

Chart 2
International stock market indices(a)



(a) In local currencies.

Table B
International equity market performances

Percentage changes from previous period, using end-period observations in local currencies

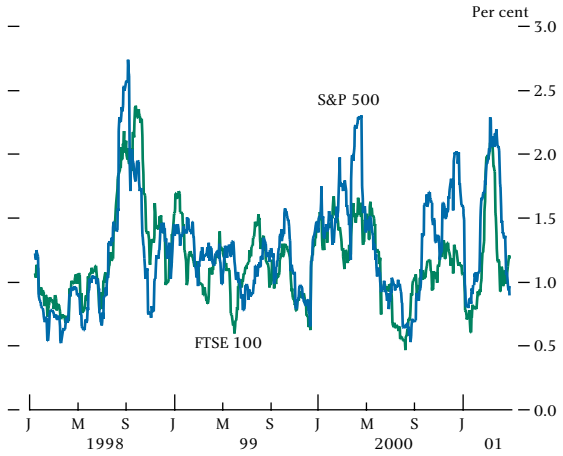
	2000		2001
	Year	Q4	Q1 (a)
United States			
S&P 500	-10.1	-8.1	-9.3
Wilshire 5000	-11.9	-10.6	-9.5
Europe			
CAC 40	-0.5	-5.4	-5.6
DAX 30	-7.5	-5.4	-8.4
FTSE All-Share	-8.0	-1.5	-5.5
FTSE 100	-10.2	-1.1	-5.7
Japan			
Topix	-25.5	-12.7	6.0
TMT indices			
NASDAQ Composite	-39.3	-32.7	-24.3
FTSE techMARK 100	-32.2	-31.4	-27.6
Neuer Markt	-40.1	-43.7	-31.2

Source: Bloomberg.

(a) 1 February 2001 to 11 May 2001.

telecommunications (TMT) sectors. International equity indices then rebounded from 22 March. The FTSE 100 index ended the period at 5897, 5.7% lower than its level on 1 February (see Table B). In the United Kingdom and the United States, equity market volatility rose to levels last seen during the financial market turbulence of autumn 1998 (see Chart 3).

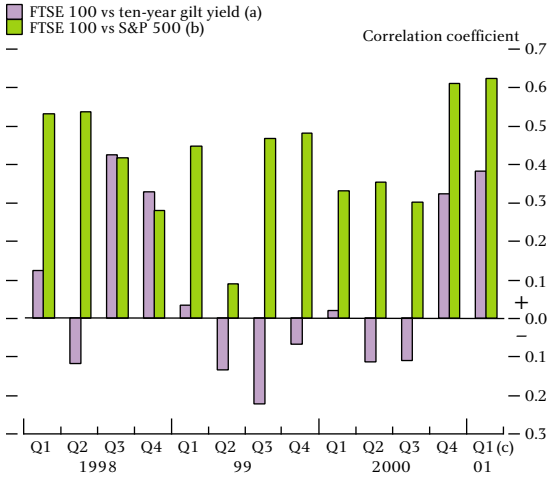
Chart 3
Equity market volatility(a)



(a) Rolling one-month standard deviations of daily percentage changes in the identified equity indices.

During the review period, correlations between the daily changes in different international share price indices, and between equity and bond markets, were high by recent standards (see Chart 4 and Table C). The correlation coefficient between the daily changes in the FTSE 100 and the ten-year gilt yield rose to 0.40, while the correlation coefficient between daily changes in the FTSE 100 and the S&P 500 was 0.62 during the period. These figures are broadly comparable with the strength of the inter-market relationships observed at the time of

Chart 4
Financial market correlations(a)



(a) Quarterly correlations between the daily percentage changes in the FTSE 100 index and the daily changes in the ten-year par gilt yield.
(b) Quarterly correlations between the daily percentage changes in the S&P 500 and FTSE 100 share price indices.
(c) 1 February 2001 to 11 May 2001.

Table C
Correlations between the FTSE 100 and other equity indices(a)

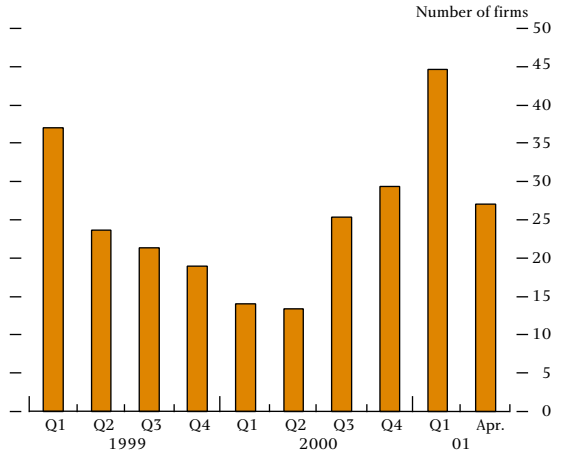
		S&P 500	DAX 30	CAC 40	Topix
2000	Q1	0.33	0.69	0.65	0.24
	Q2	0.35	0.71	0.70	0.07
	Q3	0.30	0.55	0.69	0.10
	Q4	0.61	0.75	0.70	0.29
2001	Q1 (b)	0.62	0.84	0.88	0.26

(a) Correlations between daily percentage changes in FTSE 100 and identified equity indices.
(b) 1 February 2001 to 11 May 2001.

the financial market turbulence in autumn 1998. These relatively high correlations suggest that common factors are likely to have influenced the movements in the different markets.

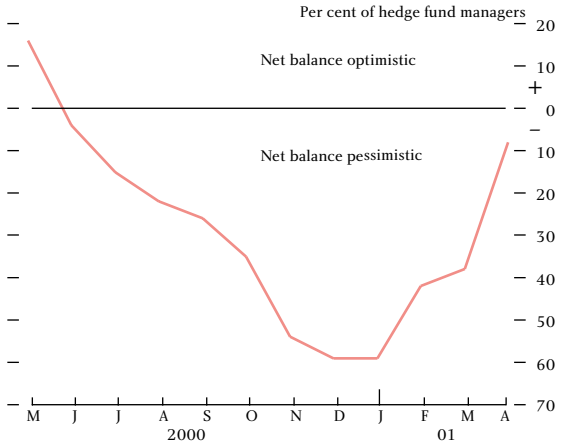
The most significant common influence appears to have been changes in investors' sentiment about the outlook for global growth and, in particular, about prospects for US activity. Until late March, the fall in equity indices occurred alongside a decline in government bond yields as economists and market participants downgraded their expectations for world economic growth in 2001. These declines in equity prices and changes in sentiment about the likely pace of economic activity in the United States and Europe were linked to the number of profit warnings released by firms both in the United Kingdom and internationally. In 2001 Q1, the number of UK companies warning shareholders that their profits would not meet expectations rose to its highest level since the Bank's series began in mid-1997 (see Chart 5). During April, however, it fell back to close to its average since 1997. Similarly, Merrill Lynch's survey-based measure of the global net balance of fund managers with a positive

Chart 5
Profit warnings issued by UK firms(a)



(a) Monthly average number of firms listed in the FTSE All-Share index to issue a profit warning or negative trading statement.

Chart 6
Global economic optimism(a)



Source: Merrill Lynch Fund Managers survey.

(a) Chart shows the difference between those fund managers who think the outlook for the global economy over the next twelve months has got stronger and those fund managers who think it has got weaker.

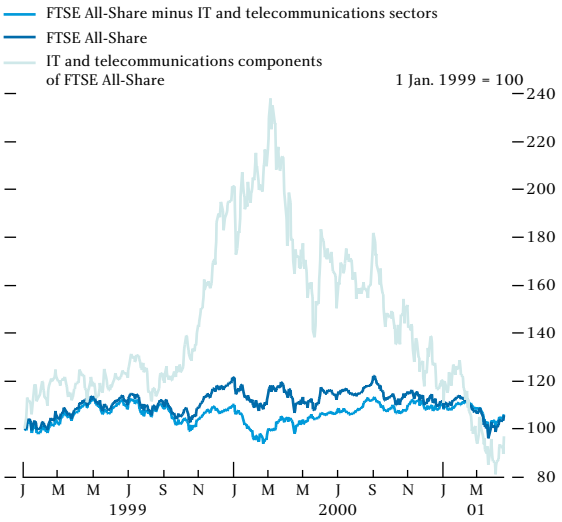
outlook about future economic prospects recovered from -59% in January to -8% in April (see Chart 6).

The behaviour of investors that actively manage their portfolios of bonds and equities may have accentuated the turnaround seen in March, and might help to explain the unusually high inter-market correlations. Commentators have suggested that some of these investors are likely to have moved investment capital from equity markets into fixed-income assets when equity prices were falling. This would have tended to increase the downward pressure on equity prices and the upward pressure on bond prices. In the second half of March and in April, the process seems to have been reversed.

Another component of the movements in equity markets during the period was the continued volatility in 'new

economy' TMT stocks. Indices covering these sectors fell by much more than broader indices; the FTSE techMARK index fell by 28% and the NASDAQ by 24%. But while the negative contribution from these sectors had previously outweighed small price increases in other sectors, they were accompanied by price falls in most other stocks between February and late March (see Chart 7).

Chart 7
FTSE All-Share by sector



Uncertainty about the future path of equity indices, derived from the prices of options on equity futures contracts settling on the FTSE 100 and S&P 500 indices, rose slightly during the period. Nevertheless, current levels of uncertainty remain below historical norms. In addition, the recent decline in equity prices appears to have led to a small reduction in the downside skew derived from option contracts. Hence at the end of the period, market participants attached a slightly smaller probability to further significant falls in these two equity indices.

Short-term interest rates

In the United States, the Federal Open Market Committee (FOMC) reduced the Federal funds target rate by 100 basis points during the period; 50 basis point reductions were announced on 20 March and 18 April, taking the official rate to 4.5%. In the United Kingdom, the Monetary Policy Committee (MPC) reduced the Bank of England's repo rate by 75 basis points in three 25 basis point steps (on 8 February, 5 April, and 10 May)(1) lowering the rate to 5.25%. The European Central Bank (ECB) reduced its minimum refinancing rate by 25 basis points to 4.5% on 10 May, and on 19 March the Bank of Japan changed its monetary policy target from the overnight call rate to the aggregate of current account balances held with it.

Short-term interest rate expectations in the United States, the United Kingdom and Japan declined over the review period. Rates implied by eurodollar futures contracts maturing in 2001 fell by 50–80 basis points, while rates implied by short sterling and euroyen futures contracts declined by 15–30 and 25–30 basis points respectively (see Charts 8 to 10). In contrast, short-term interest rate expectations in the euro area ended the period little changed from their starting-point (see Chart 11).

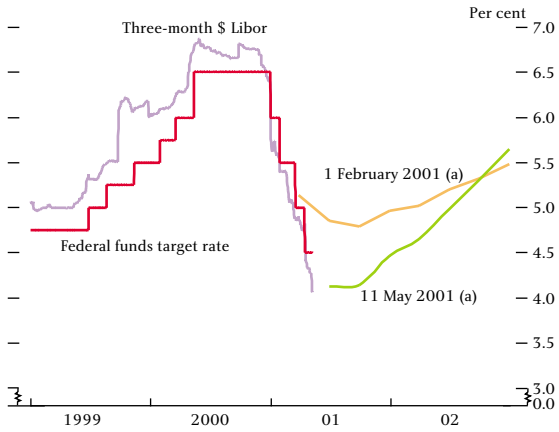
Near-term interest rate expectations in the United Kingdom, the United States and the euro area declined broadly in parallel in the seven weeks to 22 March and then diverged thereafter. The similar pattern of declines in the first half of the period (see Chart 12) reflected at least two common factors.

First, short-term rate expectations fell in all three regions in response to a series of weaker-than-expected activity and confidence indicators and an increase in the number of profit warnings announced by firms. These considerations, in turn, led to declines in equity prices and gave forecasters reason to revise down their expectations for GDP growth in 2001. Rates implied by futures contracts fell in the United States, and to a lesser extent in the United Kingdom and the euro area, following the January US industrial production data, the February University of Michigan consumer confidence survey, and the Federal Reserve Bank of Philadelphia February survey of business conditions, all of which were weaker than expected. In addition, domestic data in the United Kingdom and the euro area were also weaker than expected in February and early March, and contributed to the downward revisions to short-term interest rate expectations.

Second, the size of the reductions in US official interest rates also took market participants by surprise and led to lower expectations of future short-term interest rates. For example, rates implied by eurodollar, euribor and short sterling futures contracts expiring in 2001 fell following the FOMC's 50 basis point rate reduction on 20 March. In contrast, in the United Kingdom, the MPC's policy decisions were widely anticipated by market participants and had little impact on short

(1) For further details, see *Monetary Policy Committee Minutes and Press Notices, May 2001*.

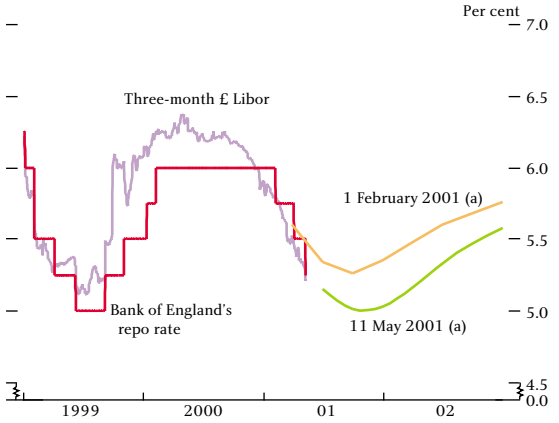
Chart 8
US interest rates



Source: Bloomberg.

(a) Three-month interest rates implied by eurodollar futures contracts at the dates specified. From May 2001 onwards, the x-axis relates to contract expiry dates.

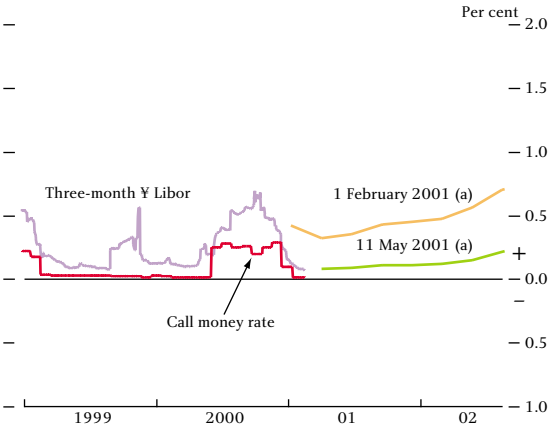
Chart 9
UK interest rates



Source: Bloomberg.

(a) Three-month interest rates implied by short sterling futures contracts at the dates specified. From May 2001 onwards, the x-axis relates to contract expiry dates.

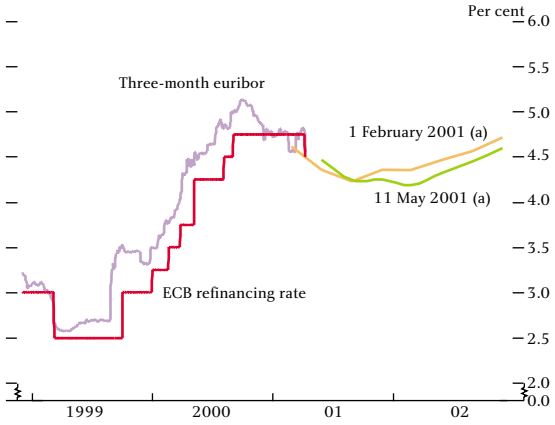
Chart 10
Japanese interest rates



Source: Bloomberg.

(a) Three-month interest rates implied by euroyen futures contracts at the dates specified. From May 2001 onwards, the x-axis relates to contract expiry dates.

Chart 11
Euro-area interest rates



Source: Bloomberg.

(a) Three-month interest rates implied by euribor futures contracts at the dates specified. From May 2001 onwards, the x-axis relates to contract expiry dates.

sterling futures contracts. The box on pages 150–51 discusses the extent to which UK interest rate expectations derived from surveys and from money market instruments have moved in line with each other in recent years.

After 22 March, movements in short-term interest rate expectations became less closely correlated internationally. Interest rate expectations implied by futures contracts expiring in 2001 continued to decline in the United States, and were volatile but little changed in net terms in the United Kingdom (see Chart 13). In contrast, rates implied by US and UK futures contracts maturing in 2002 and beyond rose in the second half of the period (see Chart 14). Market comment suggested that this rise reflected a growing belief that the FOMC's rate reductions would restore consumer confidence and stimulate economic growth. This greater optimism was also reflected in equity markets, which rose from mid-March. Interest rate expectations for 2002 in the United States also rose following some stronger-than-expected activity data releases. In the United Kingdom, interest rate expectations for 2002 reacted partly to US developments, and partly to domestic considerations. In particular, sterling interest rate expectations rose following the stronger-than-expected average earnings data released on 11 April.

In the euro area, rates implied by euribor futures contracts rose at all maturities after 22 March. The principal influence on interest rate expectations during this interval appears to have been the ECB's policy decisions. In particular, short-term euro interest rate expectations rose sharply on 11 April following the ECB's

Comparison of survey and market interest rate expectations

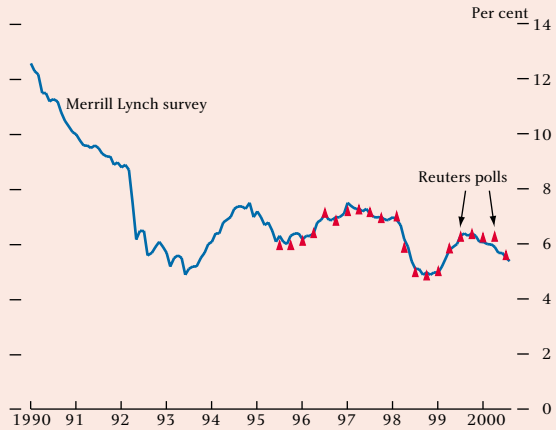
Interest rate expectations can be derived from surveys, as well as forward rates calculated from the prices of traded financial market instruments. This box compares these two sources for sterling interest rate expectations over an eleven-year period.

Surveys of nominal interest rate expectations

There is a range of nominal interest rate surveys available. The principal differences between them relate to: (a) the sample of the survey respondents; (b) the short-term interest rate that respondents are asked to comment on; and (c) the forecast horizon.

Three of the available sterling interest rate surveys ask directly about expectations for the Bank's official rate: Reuters, Merrill Lynch, and Market News International. Among these, the time series of observations available from the Merrill Lynch survey is the longest. This box focuses primarily on this source. Despite the different samples of respondents, the mean expectations from Reuters' surveys of the Bank's official rate are close to those of the Merrill Lynch surveys, in the instances where the forecast horizons coincide (see Chart A).

Chart A
Twelve-month ahead forecasts of the Bank's official rate



Sources: Merrill Lynch and Reuters.

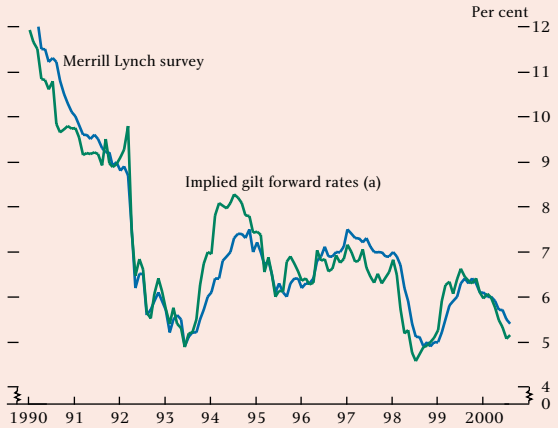
Other surveys ask about expectations for three-month market-determined interest rates. For example, Consensus Economics ask respondents for their forecast of the three-month interbank rate likely to prevail three and twelve months ahead. The latter expectations show a high degree of co-movement with Merrill Lynch's survey of forecasts for the Bank's repo rate, also at the twelve-month horizon.

Comparison of survey-based and market-determined interest rate expectations

One difficulty in comparing survey-based and market-determined interest rate expectations is that the timing of the survey responses may extend over several days and is somewhat uncertain. This makes it difficult to generate exactly matched comparisons.

Since general collateral (GC) repo is the closest instrument to the Bank's repo agreement, the Merrill Lynch survey results are compared against two-week forward rates derived from the Bank's gilt yield curve (which is constructed from both gilts and GC repo contracts).(1) Chart B shows survey-based expectations of the Bank's repo rate at a twelve-month horizon and comparable two-week forward rates derived from the Bank's gilt yield curve. Between

Chart B
Twelve-month ahead expectations of two-week interest rates



Sources: Merrill Lynch and Bank of England.

(a) Calculated using the Bank's VRP curve-fitting technique.

mid-1990 and the start of 2001, a period that includes several interest rate cycles, the average difference between the two series was only 2 basis points. Furthermore, movements in the two different measures of interest rate expectations have been highly correlated.

However, while at some times within an interest rate cycle the two measures have closely agreed with each other, they have diverged substantially at other times. The standard deviation of the differences is slightly

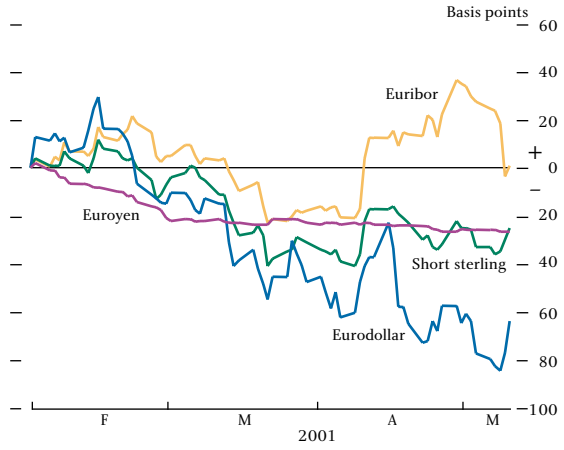
(1) For further details of this technique, see Anderson, N and Sleath, J, *Bank of England Quarterly Bulletin*, November 1999.

above 50 basis points. Gilt forward rates have tended to be higher than the survey expectations when rates are rising, and below them when rates are falling. On a few occasions the survey-based measure of expectations has diverged substantially from the forward rates. For example, in the second half of 1994, the difference between the two measures reached almost 120 basis points (see Chart B).

Using statistical tests for Granger causality between interest rate expectations from the Merrill Lynch surveys and two-week forward rates derived from the gilt yield curve at the twelve-month horizon, no strong evidence was found that survey or financial market interest rate expectations persistently lead or lag each other over periods of greater than one month.

When the two measures track each other closely, it gives added confidence to a correct reading of market participants' expectations. When the two diverge, investigating the causes of the divergence may lead to additional insights. Given that financial market instruments are affected by other considerations as well as pure interest rate expectations (eg changes in term premia, liquidity conditions, and hedging activity), it seems likely that most of the divergences between the two measures of interest rate expectations will be related to 'special' factors affecting the traded financial instruments.

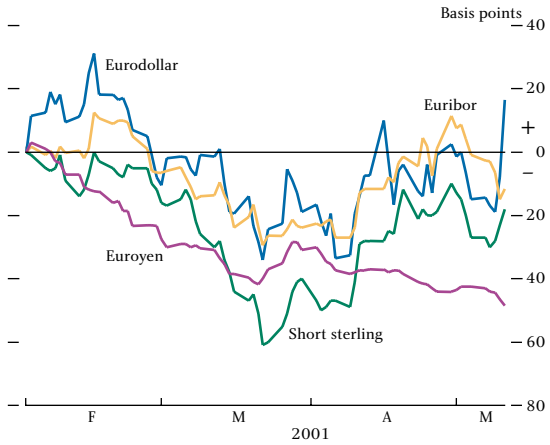
Chart 12
Cumulative changes in expectations for three-month interest rates likely to prevail in September 2001(a)



Source: Bloomberg.

(a) As indicated by changes in interest rates implied by futures contracts maturing in September 2001.

Chart 13
Cumulative changes in expectations for three-month interest rates likely to prevail in December 2002(a)



Source: Bloomberg.

(a) As indicated by changes in interest rates implied by futures contracts maturing in December 2002.

decision to leave its refinancing rate unchanged. Prior to this meeting, there had been a widely held expectation in the money markets that the ECB would reduce its official rate by 25 basis points in response to the evidence of weaker global economic conditions.

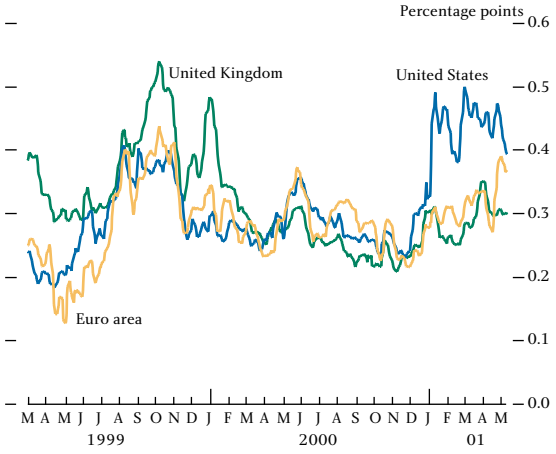
The rise in short-term interest rate expectations following the no-change decision appears to have been reinforced by comments by ECB officials that risks to price stability in the euro area were still present, and by a series of stronger-than-anticipated domestic data releases towards the end of the period. In particular, M3 growth for the euro area and consumer price inflation data for France and Italy were all above market expectations. These developments, combined with a rise in oil prices in the second half of the period, increasingly led market participants to the view that euro-area inflation pressures had not diminished sufficiently to allow the ECB to ease monetary policy. Consequently, the ECB's 10 May decision to reduce its minimum refinancing rate by 25 basis points was not anticipated by market participants and triggered a sharp decline in rates implied by euribor futures contracts expiring in 2001 (see Chart 13).

Movements in Japanese interest rate expectations were not well correlated with US and European developments during the period. Rates implied by euroyen futures fell during the first half of the period following a series of weaker-than-expected domestic activity data and consumer confidence indicators, and the strong decline in Japanese equity prices. However, sentiment then improved, helped by the easing of monetary policy and the rise in stock markets in the second part of the period.

On 11 May, eurodollar future contracts implied an expectation that the Federal funds target rate would be reduced to 4% in 2001 Q3, while euribor futures contracts suggested a floor of around 4%–4¼% in the ECB's minimum refinancing rate early in 2002. In the United Kingdom, short sterling futures contracts implied a trough of around 4¾%–5% in the Bank of England's repo rate towards the end of 2001, and in Japan euroyen futures supported the view that the Bank of Japan's quantitative monetary policy target would be maintained for the next year.

Information from options contracts settling on interest rate futures suggested that the uncertainty attached to these short-term projections remained high in the United States and increased in the euro area (see Chart 14). In contrast, while the degree of uncertainty about the short-term prospects for monetary policy in the United Kingdom increased slightly over the period, it remains broadly in line with recent norms.

Chart 14
Interest rate uncertainty(a)

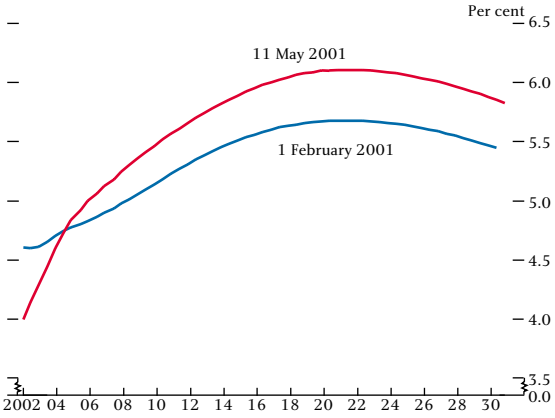


(a) Implied standard deviations of three-month constant-horizon interest rate futures contracts; five-day moving averages.

Long-term interest rates

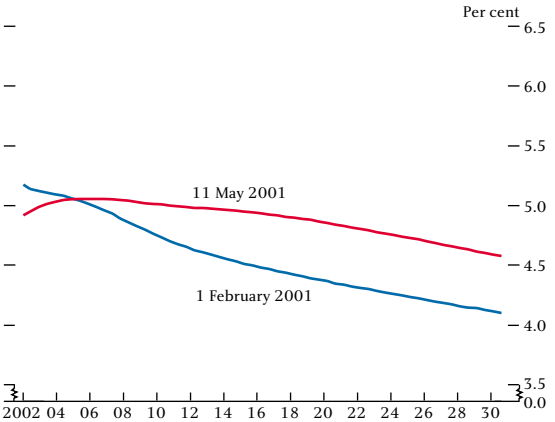
Over the period, two-year US Treasury, gilt and Bund yields fell by about 30, 15 and 10 basis points respectively (see Charts 15 to 17). In contrast, long-dated government bond yields rose. Movements in ten-year government bond yields in the three areas were highly correlated with each other, and were also highly correlated with equity markets (see Charts 18 and 19 and Table D). These yields fell between 1 February and mid-March, and then rose from late March, as equity markets rebounded. Movements in very long-dated government bond yields were not as closely synchronised with each other, however. At the twenty-year maturity, yields rose by about 45, 50 and 35

Chart 15
US Treasury yield curves(a)



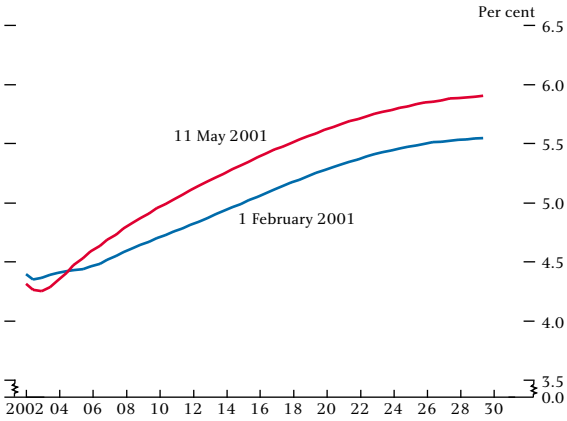
(a) Derived using the Bank's VRP curve-fitting technique. For further details on this technique, see Anderson, N and Sleath, J, *Bank of England Quarterly Bulletin*, November 1999.

Chart 16
UK gilt yield curves(a)



(a) Derived using the Bank's VRP curve-fitting technique.

Chart 17
German bund yield curves(a)

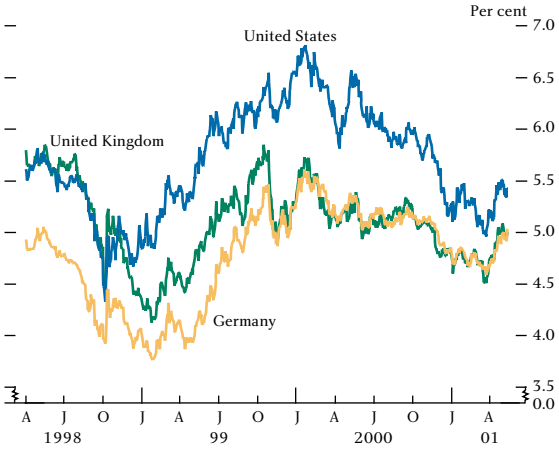


(a) Derived using the Bank's VRP curve-fitting technique.

basis points in the United States, the United Kingdom and the euro area respectively.

Market participants reported that the rise in international government bond yields out to ten-year

Chart 18
Ten-year government bond yields(a)



(a) Zero-coupon spot yields derived using the Bank's VRP curve-fitting technique.

Chart 19
Cumulative changes in FTSE and gilt yields since 1 February

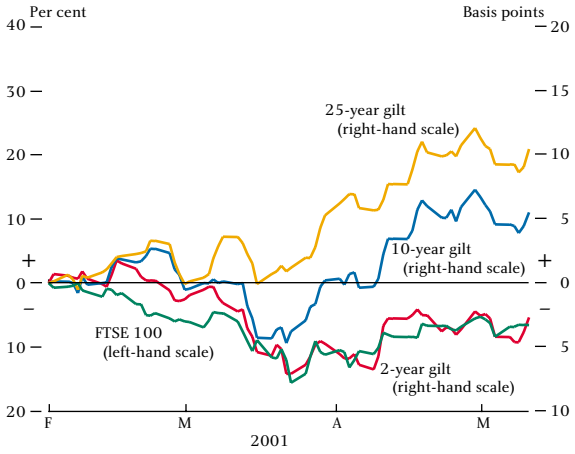


Table D
Correlations between equities and ten-year government bonds(a)

Coefficient

		US Treasuries with S&P 500	German Bunds with DAX 30	Gilts with FTSE 100
2000	Q1	0.12	-0.01	-0.02
	Q2	0.29	-0.01	-0.10
	Q3	-0.17	-0.17	-0.10
	Q4	0.24	0.48	0.32
2001	Q1	0.34	0.49	0.41

Sources: Bloomberg and Bank of England.

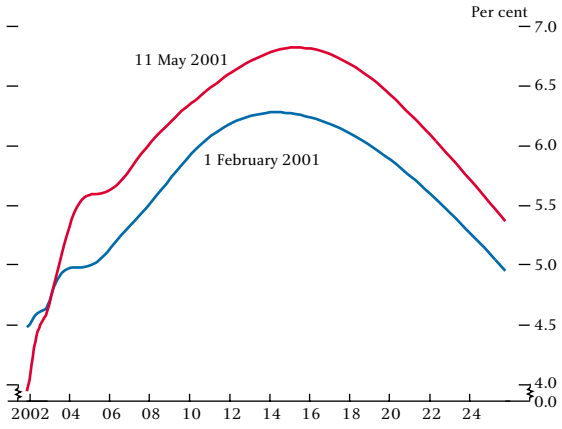
(a) Correlations between daily percentage changes in the identified equity indices and daily changes in government bond yields.

maturities was largely related to cyclical developments in the United States. Yields on ten-year government bonds reflect an average of interest rate expectations over the life of the bond, of which the nearest one to five years form an important part. As noted above, although US growth forecasts for 2001 have continued to be revised down, market participants seem to have become less pessimistic about the medium-term prospects for growth.

Some market participants have suggested that the easing by the FOMC may have led to greater inflation risks. The contrast between the rise in nominal bond yields of about 35 basis points and the fall of about 20 basis points in the yields of index-linked Treasury securities (TIPS), both at the ten-year maturity, provides some support for this view. However, liquidity in the TIPS market is not considered to be particularly good; its prices therefore, may not provide an accurate reflection of market participants' real interest rate expectations.

If the above-mentioned short-term cyclical considerations were the only factors to have influenced government bond yields, there would have been little change in forward rates beyond a seven to ten-year horizon. However, one-month forward rates derived from the US Treasury yield curve have also increased beyond ten years (see Chart 20). This suggests that other factors also contributed to the rise in long-term bond yields. Market commentators have noted that two supply-side considerations were likely to have been influential. First, there was a strong rise in corporate bond issuance in 2001 Q1 (see discussion below). And second, the US administration's tax-cutting proposals, combined with its intention to raise spending on the Strategic Defence Initiative, may have led to expectations of an increase in the supply of US Treasuries in the longer term, and thus contributed to the rise in yields.

Chart 20
One-month forward rates derived from US Treasuries(a)



(a) Derived using the Bank's VRP curve-fitting technique.

In addition, the rise in long-dated US Treasury yields may have been accentuated by an unwinding of the hedging of mortgage prepayment risk by investors in mortgage-backed securities. Such hedging strategies

were thought to have contributed to the decline in bond yields between October 2000 and February 2001 (see page 9 of the Spring *Quarterly Bulletin* for details).

The US developments discussed above were said by market participants to have had a significant effect on gilt and Bund yields, as well as on US Treasuries. Daily changes in ten-year yields on US Treasury, Bunds and gilts showed a higher correlation than in the previous quarter. This view was reinforced by the fact that the turning points in equities and ten-year government bond yields in the United States, the United Kingdom and Germany occurred at approximately the same time. This suggests that fluctuations in medium-term government bond yields were dominated by international cyclical considerations.

Beyond the ten-year horizon, however, correlations between the movements in US, UK and German government bond yields were somewhat weaker. Long-term gilt yields rose by more than either US Treasury or Bund yields. At twenty years' maturity, gilt yields rose by about 50 basis points, compared with increases of about 45 and 35 basis points in the United States and Germany respectively. This, and the fact that one-month forward rates derived from the gilt yield curve rose at maturities beyond ten years, suggest that other (non-cyclical) factors specific to the United Kingdom affected long-term gilt yields.

In particular, long-term gilt yields increased following the announcement of the abolition of the Minimum Funding Requirement (MFR) by the Chancellor on 7 March. The MFR is to be replaced with a scheme-specific funding standard. In contrast to the universal standard approach of the MFR, the new system will allow a much greater degree of flexibility for defined-benefit pension fund managers to determine the adequacy of their assets to meet their expected liabilities. In future, each pension fund will have to prepare its own Funding Statement setting out the funding objectives for the scheme, the fund's investment policy and projected return on assets, its assumptions for projecting liabilities, and a contribution schedule agreed by the trustees and the employer. No timetable has been announced for the implementation of the new proposals.

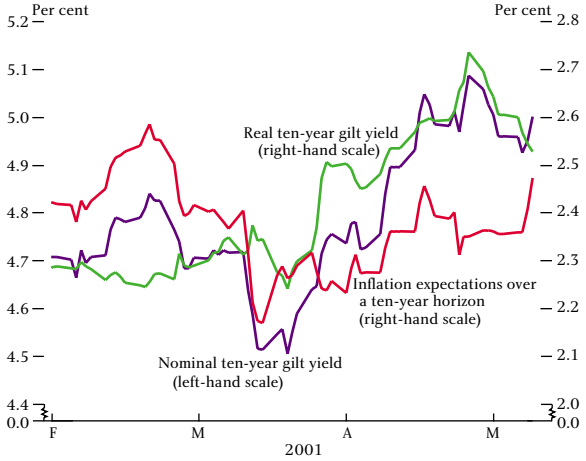
Even without an announced timetable, market participants concluded that the adoption of the new arrangements would lead pension funds to reduce their demand for long-dated gilts. Consequently, the prices of long gilts fell and yields rose. Between 5 and 9 March, the thirty-year yield increased by around 15 basis points, while the ten-year yield was virtually unchanged. However, the impact of the announced abolition of the MFR is unlikely to have been concentrated on the announcement date. Rather, it may well be extended over a longer period since institutional investors could take some time to adjust their portfolios. In addition, the strong increase in demand for sterling-denominated non-government bonds since the summer of last year suggests that the abolition of the MFR had been partly anticipated.

Moreover, the announcement by British Telecommunications in April that it will no longer offer a defined-benefit pension option to new employees may have also contributed to the disinversion of the gilt yield curve. Given that BT operate the largest occupational pension scheme in the United Kingdom, this development may have led to expectations that other firms will adopt a similar approach, thereby potentially lowering future demand for long-dated gilts from pension funds.

The issuance of £2 billion of gilts maturing in 2032 (see below) may have added to the upward pressures on very long-dated gilt yields during the period. More generally, however, the indications of future gilt sales announced in the 7 March Budget were broadly in line with market expectations and had little impact on gilt yields.

Between 1 February and 11 May, real interest rates implied by index-linked gilts rose by about 25 basis points at the ten-year maturity (see Chart 21), compared with a rise in nominal gilt yields of 30 basis points. This suggests that the reductions in interest rates decided by

Chart 21
Ten-year gilt yields and inflation expectations



the MPC during the period had little effect on UK inflation expectations.

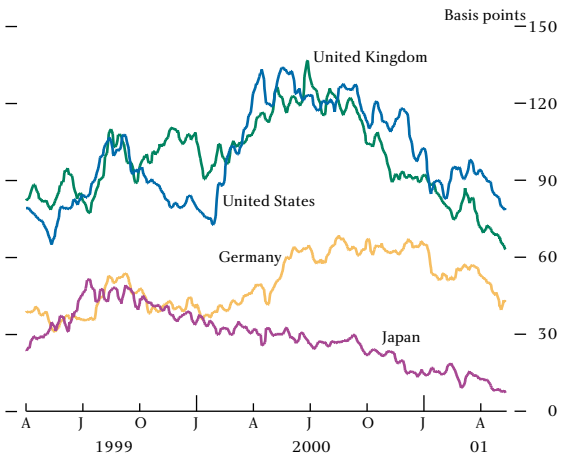
As already noted, long-term government bond yields rose by less in the euro area than in the United States and the United Kingdom. In the earlier part of the period, up to 22 March, long-term Bund yields fell by less than comparable US Treasury yields, reflecting a market view that the economic slowdown would be less pronounced in the euro area than in the United States. Similarly, after 22 March, when market confidence in the resumption of stronger growth recovered, government bond yields rose by less in Germany than in the United States.

Japanese government bond yields fell by between 12 and 37 basis points out to fifteen years' maturity, and were little changed at the longest maturities, leading to a steepening of the yield curve. In addition to equity market developments and a reassessment of the US economic slowdown, domestic factors affected Japanese government bond yields. In particular, the shift in the Bank of Japan's monetary operations target from the overnight call rate to the aggregate of current account balances held at the Bank of Japan contributed to the fall in yields.

Swap and corporate bond spreads

Ten-year sterling and euro-denominated swap spreads (the difference between swap rates and government bond yields) continued to narrow during the period, declining by around 15 and 10 basis points respectively. In contrast, dollar swap spreads ended broadly unchanged from their level at the start of February (see Chart 22). In part, the recent narrowing in sterling and euro swap spreads may have reflected reduced credit concerns, particularly as equity markets recovered after 22 March. The greater reduction in sterling swap spreads in recent months is likely to have been related to the announcement that the MFR is to be abolished. Although generally expected by market participants, this decision may have increased the number of pension funds switching away from holding long-dated gilts in favour of holding long-dated non-government bonds. This in turn may have put upward pressure on gilt yields, helping to narrow sterling swap spreads.

Chart 22
Ten-year swap spreads(a)

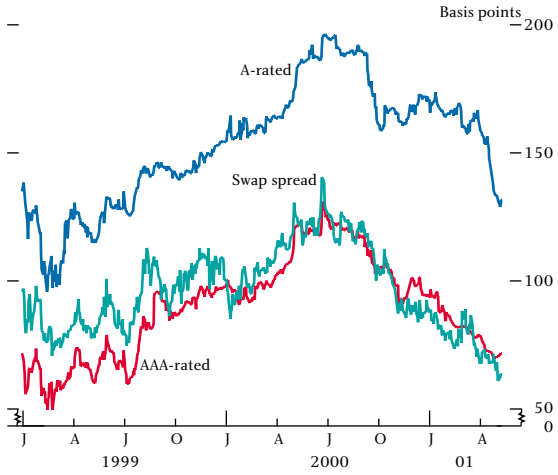


Source: Bloomberg.

(a) Five-day moving averages of yield differences between ten-year swap rates and ten-year government bond yields.

A and BBB-rated UK corporate bond spreads over gilt yields narrowed sharply in the second half of April, ending the period about 35 basis points lower (see Chart 23). Similarly, the spreads of A and BBB-rated sterling corporate bonds over corporate bonds of AAA and AA ratings decreased over the period. Telecommunications companies typically have A-ratings or below, and the large fall in A and BBB-rated spreads may have come in response to recently announced plans by several telecoms firms to restructure their business operations and to reduce their debt levels. In particular, the yields of BT bonds fell sharply following the announcement of their plans for asset disposals.

Chart 23
Ten-year sterling bond spreads(a)



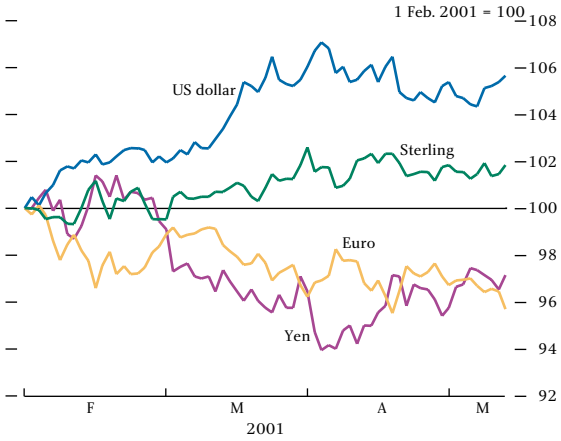
(a) All spreads shown relative to ten-year gilt yields derived using the Bank's VRP curve-fitting technique.

The spreads of A and BBB-rated corporate bond yields over swap rates also decreased during the period. This may have partly reflected reduced credit concerns following interest rate reductions, the increases in equity prices from late March, and the plans for restructuring by telecoms companies.

Foreign exchange markets

Among the major currencies, the most notable movement during the period was the further appreciation of the US dollar. Between 1 February and 11 May, the dollar trade-weighted exchange rate index (ERI) appreciated by 5.7%. The euro and yen ERIs both fell over the same period, depreciating by 4.2% and 2.9% respectively. Sterling moved within a narrower range than the G3 currencies; its ERI rose by 1.8% over the period as a whole (see Chart 24).

Chart 24
Effective exchange rate indices



The appreciation of the US dollar has been broadly based, and in effective trade-weighted terms the dollar has recently reached a fifteen-year high (see Chart 25). During the period, it rose by 7.3% against the euro, by 4.1% against sterling, and by 6.0% against the yen; it also reached record highs against the Australian dollar and the South African rand. However, the dollar's recent appreciation has occurred at a time when the US economy has been slowing. Furthermore, both official rates and short-term money market interest rates declined by more in the United States than in other industrial countries during the period. These considerations would generally have been expected by market participants to lead to a depreciation of the dollar, rather than an appreciation.

Chart 25
US dollar effective exchange rate index

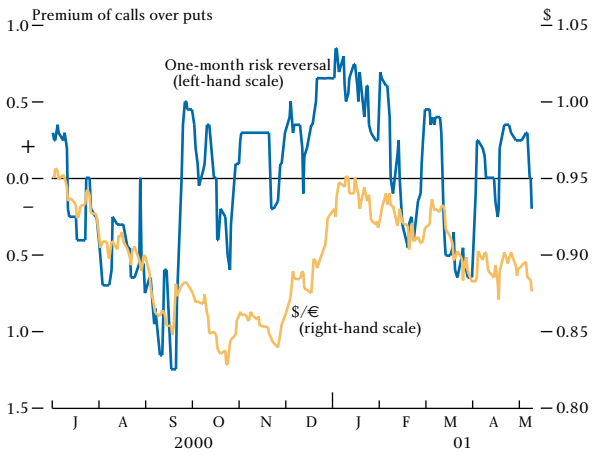
Foreign exchange market participants have therefore found it difficult to rationalise recent movements in dollar exchange rates. A number of potential explanations have, however, been put forward. In particular, many commentators have highlighted that although uncertainties over the extent and breadth of the US economic slowdown have persisted, the consensus in the foreign exchange market has increasingly shifted toward an expectation that the slowdown will be relatively short-lived and that growth prospects for the US economy in the medium term remain robust.

Another suggestion is that there have been large 'safe-haven' flows into the United States reflecting the uncertainties surrounding the global economic outlook. In support of this view, there is some evidence of net capital flows into US equities from Europe and elsewhere during the first quarter of this year. This may have reflected an increased preference on the part of US investors to hold US stocks during a period of uncertainty in the global economy.

Currency flows related specifically to mergers and acquisitions (M&A) are well below the peak levels seen during 1999 and the early part of 2000, and have not been widely regarded as a significant explanation of currency movements over recent months. This decline in M&A activity may have encouraged some hedge funds to return to the foreign exchange markets in the past year (see the box on pages 158–59 for further details).

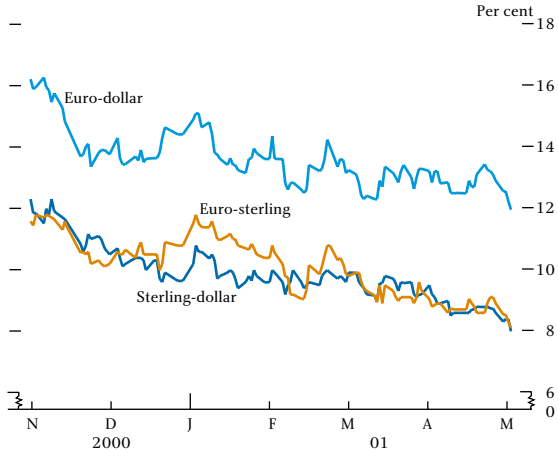
The lack of a definitive and convincing explanation for the dollar's appreciation has led some market commentators to talk of the dollar's 'irrational strength'. This may indicate that downside risks to future movements in dollar exchange rates have increased. However, there seems to be little evidence of this in the current configuration of market prices. For example, skew statistics derived from options on eurodollar futures contracts (one-month risk reversals) were broadly neutral at the end of the period (see Chart 26). This suggests that there was little or no price premium associated with the prospect of an appreciation of the euro against the dollar. Nonetheless, uncertainty about future movements in the euro-dollar exchange rate remained at relatively high levels during the period and

Chart 26
Euro-dollar spot exchange rate and risk reversals



at much higher levels than those for sterling against the euro and the dollar (see Chart 27). Looking slightly further ahead, Consensus Economics' mean market forecast is for the dollar to depreciate gradually against the euro over the coming 18 months (see Chart 28). This view is broadly consistent with forward rates out to two years for the dollar against the euro.

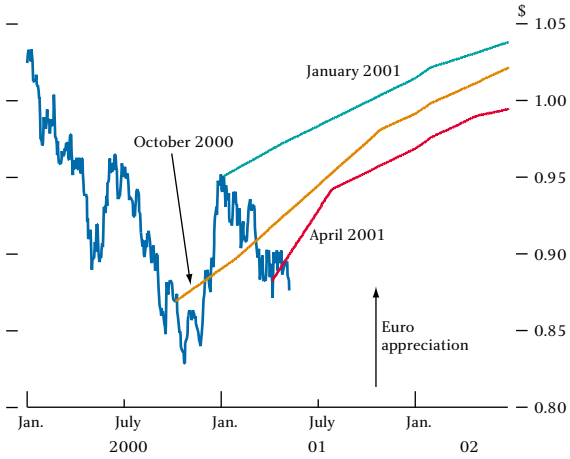
Chart 27
Exchange rate uncertainty(a)



(a) One-month implied volatilities derived from options on foreign exchange futures contracts.

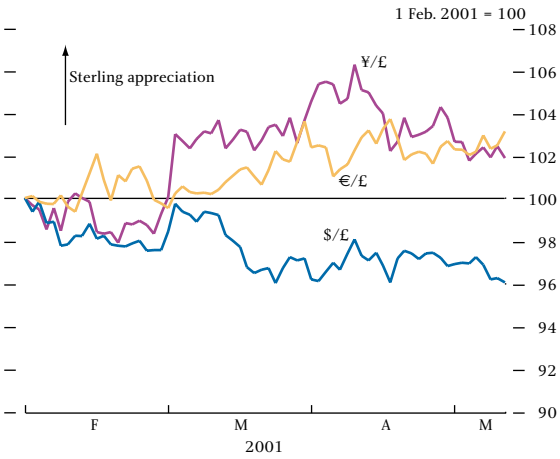
Movements in sterling bilateral exchange rates during the period have generally reflected developments outside the United Kingdom rather than domestic news. In effective terms sterling appreciated by 1.8% over the period; a 3.9% depreciation against the generally strong dollar was more than offset by appreciations of 3.1% and 1.9% against the euro and yen respectively (see Chart 29). Sterling's movement against the euro was broadly in line with the euro's more general depreciation against other currencies, while the appreciation against

Chart 28
Forecasts for euro-dollar exchange rate



Source: Consensus Economics.

Chart 29
Sterling bilateral exchange rates



the yen largely reflected the political and economic uncertainties in Japan during March. Implied volatilities derived from one-month sterling-dollar and euro-sterling option contracts continued to fall during the period (see Chart 27). This suggests that uncertainty about future short-term movements in these exchange rates diminished. There has also been a slight increase in the one-month expected correlation between sterling and the euro against the dollar. Consequently, sterling is implicitly expected to move in line with the euro against the dollar to a greater extent than at the start of the period.

The sterling money market

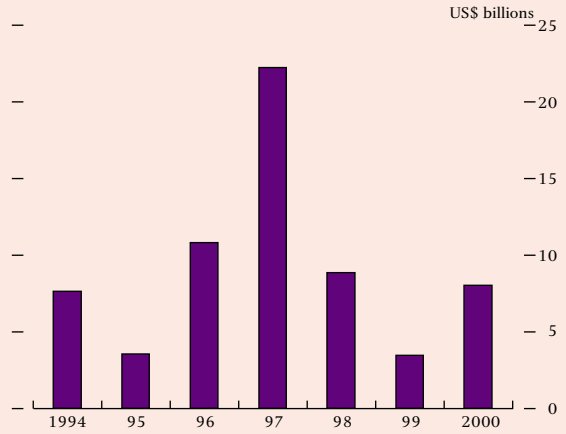
The sterling money market(1) grew sharply in 2001 Q1, increasing by £35 billion (7%) relative to Q4. This strong growth followed a period of little change in the second half of last year (see Table E). The main

(1) The sterling money market is defined for this purpose as the sum of the outstanding amounts in the interbank, certificate of deposit, Treasury bill, eligible bank bill, local authority bill, commercial paper, gilt repo, stock lending and sell/buy-back markets.

Hedge fund activity in the foreign exchange market

Recently released data suggest that investors' net flows into hedge funds increased in 2000 (see Chart A). This followed declines in net inflows seen in 1998 and 1999 after the turbulence in financial markets in the autumn of 1998 related to the collapse of Long Term Capital Management (LTCM) and the rescheduling of some of the Russian government's debt. Separately, market commentary so far this year suggests that hedge funds have also increased the proportion of their funds under management that they allocate to speculation about future foreign exchange rate movements. For much of the 1990s, hedge funds were often cited as an important influence on exchange rates, although they are reported to have been less active since 1998. This box examines the extent to which hedge fund activity in the foreign exchange market has changed, the reasons behind this and its implications for exchange rate movements.

Chart A
Annual investor flows into hedge funds



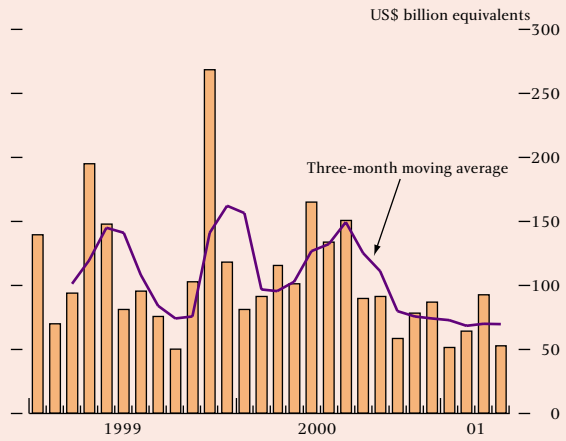
Source: TASS Research/Tremont.

At least two explanations for the recent increase in hedge fund activity in foreign exchange markets have been offered by market participants.

First, it is suggested that the decision by hedge funds to increase their asset allocation to foreign exchange markets may have reflected declining returns in equity markets, in particular technology stocks. The returns of technology-based hedge funds have declined since 1999 Q4 (even before the sharp fall in the NASDAQ) and were negative in 2000 Q2 and Q4 and 2001 Q1. According to this view, hedge funds have become less active in equity markets and have looked to other markets to maintain the high return that their investors expect.

Second, it is suggested that increased hedge fund activity in the foreign exchange market may be partly related to slowing cross-border mergers and acquisition (M&A) activity. The average monthly volume of announced M&A deals in the first four months of 2001 was significantly below the average monthly volumes recorded in 1999 and 2000 (see Chart B). Some of these deals were structured in a way that led to large flows in the foreign exchange market. So, in certain currencies and at certain times, these flows may have dominated considerations related to economic fundamentals in the determination of exchange rates. Moreover, M&A flows are generally difficult to predict. Given hedge funds' relatively short investment horizons, this may have discouraged them from choosing to express a macroeconomic view via exchange rates. On this view, the more recent decline in M&A activity may have encouraged increased activity in currency markets, including by hedge funds.

Chart B
Value of announced cross-border M&A deals



Source: Thomson Financial Securities Data.

The implications of any increase in hedge fund activity are difficult to predict. In principle, reduced M&A flows may be associated with greater activity of both momentum traders and hedge funds. Momentum traders are often thought to add to the volatility in exchange rates. In contrast, greater activity by hedge funds may increase the heterogeneity of trading styles and investment horizons, thereby increasing market liquidity and reducing volatility.

It is nonetheless important to note that hedge fund activity in the foreign exchange markets has not returned to levels approaching those of the period before summer 1998. As a result of the events of that period, the financing available to hedge funds has been reduced and more disclosure to creditors is required. Increased hedge fund activity in the foreign exchange market is said partly to reflect the establishment of new funds, often with $50 million–$200 million under management. These funds are small in comparison with the size of some high-profile funds a few years ago, some of which no longer exist or are smaller and less active than in 1998. They are also small in comparison to gross flows in foreign exchange markets. The leverage that hedge funds have access to is also reported to be lower. Both factors will tend to reduce the size of positions taken, and perhaps also the period over which they are run.

Looking forward, hedge funds may have more of an influence in the foreign exchange market than in the past few years, particularly in the context of recent structural changes in the market including suggestions of reduced market-making and the consequent changes in the nature of liquidity.

components of the rise were a £20 billion increase in the size of the unsecured interbank deposit market (which rebounded after an £11 billion decline in the previous quarter), an £11 billion rise in certificates of deposit (CDs) issued by banks, and a £5 billion increase in stock lending. In addition, the eligible bank bill market, which had been contracting gradually since the start of 1998, grew by £2 billion over the quarter. These gains were partly offset by a £2 billion decline in the size of the gilt repo market and a £3 billion fall in sell/buy-backs.

With little evidence of substitution away from other money market instruments, the large increases in the interbank and CD markets may have been related to two other considerations. First, CD rates with maturities greater than one month have been falling since the summer of 2000. Consequently, banks may have held back their CD issuance in the second half of last year in anticipation of cheaper funding opportunities in 2001. During the course of Q1, many market participants came to the view that CD rates out to twelve-month maturities were close to their troughs. This led banks to increase their issuance of CDs, particularly of longer-dated CDs, in an attempt to lock in relatively low financing costs. The corollary of this increase in issuance by banks is likely, in the first instance, to have been higher lending in the unsecured markets. A second consideration highlighted by market participants is that the weakness of equity markets may have encouraged some fund managers to liquidate their equity holdings and temporarily to invest the proceeds from these sales in money market instruments.

Growth in so-called 'bank-on-bank' bills contributed to the first quarterly increase in the overall size of the bill market since the second half of 1997. Bank-on-bank bills are bills of exchange that are drawn by one bank and accepted by a second bank whose sterling acceptances are eligible for discount at the Bank of England. Such bills became eligible to be used in the Bank's open market operations on 1 March 2000 and now represent more than a quarter of the size of the overall eligible bill market. In addition to their use in the Bank of England's operations, these bills are increasingly seen as an attractive form of liquidity since they are also eligible in the Financial Services Authority's sterling stock liquidity regime.

The absence of growth in the gilt repo market may have been related to the growth in unsecured instruments in Q1 (noted above) and a more general growth in off

Table E
Sterling money markets

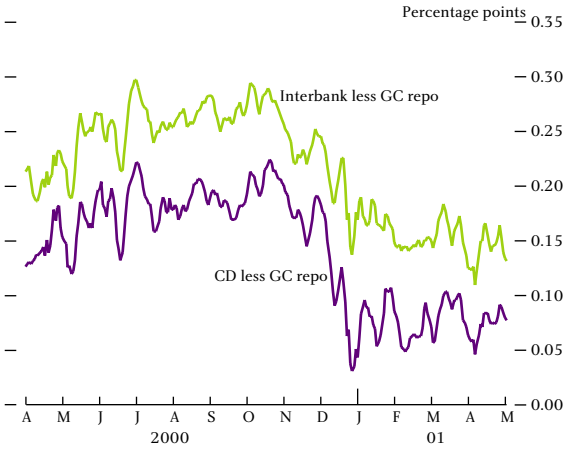
Amounts outstanding: £ billions

		Interbank (a)	CDs (a)	Gilt repo (b)	Stock lending (b)	Eligible bills (a)	Commercial paper (a)	Other (c)	**Total**
1998		150	122	95	35	19	10	4	**435**
1999		146	142	99	49	14	14	7	**471**
2000	Q1	156	132	100	51	14	15	6	**474**
	Q2	159	135	124	54	12	16	7	**507**
	Q3	162	125	127	53	12	16	7	**502**
	Q4	151	130	128	62	11	18	9	**509**
2001	Q1	171	141	126	67	13	19	7	**544**

(a) Reporting dates are quarter-ends.
(b) Reporting dates are end-February for Q1, end-May for Q2, end-August for Q3, end-November for Q4 and end-year.
(c) Treasury bills, sell/buy-backs and local authority bills.

balance sheet instruments. In particular, swap transactions in which the floating rate component settles against the sterling overnight interest rate average (SONIA) provide an alternative to gilt repo for interest rate hedging and position-taking and are noted by market participants to have grown strongly over the past year. Along with this reduced demand for gilt repo relative to the interbank and CD market, spreads between these instruments have narrowed somewhat over the quarter and compared with their levels in the second half of 2000 (see Chart 30).

Chart 30
Spreads between six-month unsecured and secured interest rates(a)



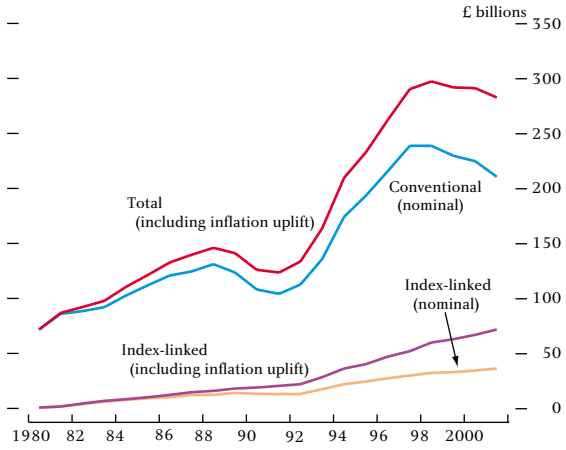
(a) Interbank is the offer rate, CD and GC repo are the bid rates. Five-day moving averages.

The specials market continues to be dominated by those gilts that are deliverable into the long gilt futures contracts. While such gilts have traded at a premium to general collateral (GC) repo this year, there has been only one occasion when the premium was large enough to warrant a request by the market to open the Debt Management Office's (DMO) standing repo facility.

Sterling bond issues

The outstanding stock of gilts increased by £2 billion during the period, after decreasing in Q4. The main reason for this was the auction of £2 billion of the 4¼% Treasury Stock 2032 on 28 March, combined with the auction of £0.4 billion of the 2½% index-linked Treasury Stock 2011 on 25 April. Partly offsetting these increases in supply, £0.4 billion of the 8½% Treasury Stock 2007 was bought back in a reverse auction on 22 February. Despite this recent increase, the amount of conventional gilt stock outstanding at the end of March 2001 was lower than a year earlier. This was the fourth consecutive annual fall in the outstanding stock of conventional gilts (see Chart 31). By contrast, the

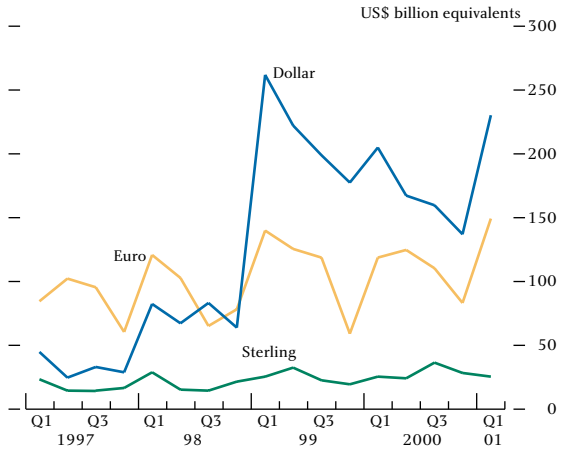
Chart 31
Gilt-edged stock outstanding



amount of index-linked gilts outstanding at the end of March continued the annual increases seen since 1991.

Issuance of non-government bonds was strong in Q1. Dollar and euro-denominated corporate bond issuance rose relative to Q4 by 81% and 68% respectively (see Chart 32). A number of larger UK-based firms have issued bonds in the euro and dollar markets, sometimes swapping the proceeds back into sterling. In Q1, euro-denominated bond issuance by firms resident in the United Kingdom rose by 75% on a quarter earlier. However, dollar-denominated bond issuance by UK-based firms more than halved. While gross sterling-denominated non-government bond issuance was quite high by historical standards, it was broadly unchanged from Q4. Total issuance was £18 billion in Q1 (see Chart 33), 80% of which was in fixed-rate bonds. Floating-rate borrowing declined to £3.6 billion in Q1, with most issuance taking place at short

Chart 32
Gross non-government bond issuance by currency of denomination



Source: Capital Data.

Chart 33
Sterling-denominated non-government bond issuance

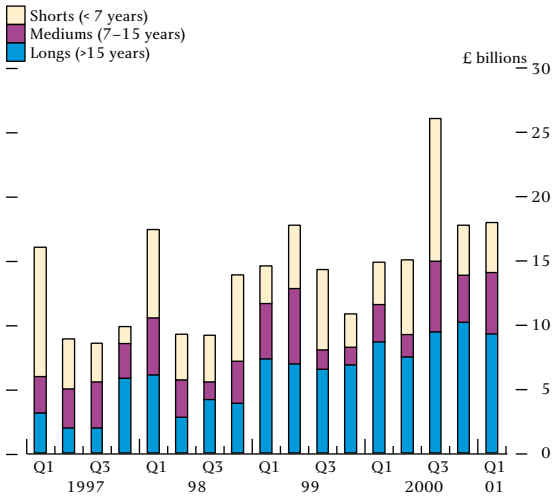
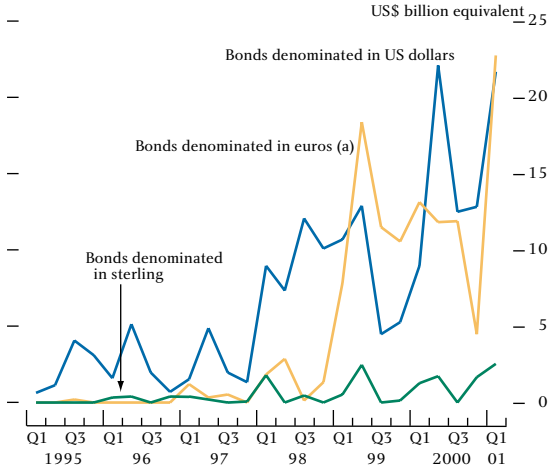


Chart 34
Gross bond issuance by telecoms firms



Source: Capital Data.

(a) Euro-area legacy currencies used prior to 1999.

maturities. In contrast, the majority of fixed-rate issuance continued to take place at long maturities.

In Q1, the share of total sterling-denominated issuance accounted for by AAA-rated firms fell to about 40%, compared with around 65% in the previous quarter. This partly reflected a £2 billion decline in issuance by supranationals, as a narrowing of their swap spreads reduced the opportunities to obtain cheap foreign currency funding by issuing in sterling and swapping the proceeds. In addition, issuance of bonds by firms with credit ratings of AA and below increased sharply (see Table F). This shift partly reflected record issuance by telecoms firms (see Chart 34). In Q1, sterling-denominated bond issuance by telecoms firms accounted for 10% of total sterling non-government bond issuance. Reflecting these developments, issuance by UK corporates increased from £1 billion in Q4 to more than £3 billion in Q1.

Open market operations

Between February and April, the stock of notes in circulation averaged around £28 billion. This is a liability on the Bank of England's balance sheet and is principally matched by two assets, the government's Ways and Means advance (which was frozen at £13 billion on 31 March 2000) and the stock of money market refinancing (which is made up of the short-term assets acquired by the Bank in its open market operations). During the review period, the stock of refinancing held on the Bank's balance sheet averaged £17 billion (see Chart 35). Given that the size of the government's Ways and Means advance has been fixed

Table F
Sterling bond issuance in 2001 Q1

DMO gilt auctions (£ millions)

Reverse	Date	Amount purchased	Stock
	22 Feb.	13	7¾% Treasury Stock 2006
	22 Feb.	411	8½% Treasury Stock 2007
Conventional	Date	Amount issued	Stock
	28 March	2,000	4¼% Treasury Stock 2032

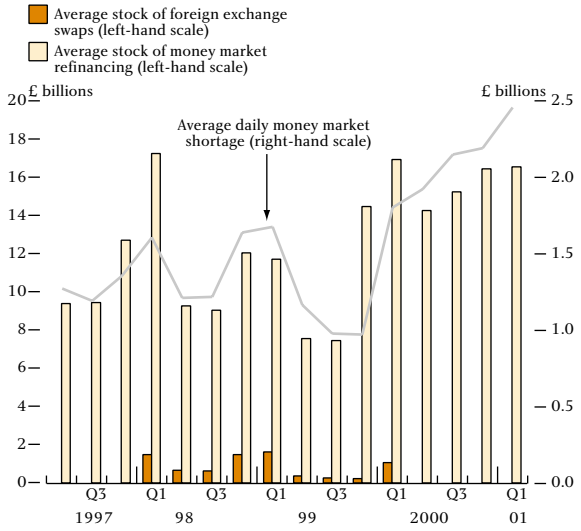
Non-government issuance		Amount (£ billions)			
			By credit rating:		
	Number of issues	Total (a)	AAA	AA/A	BBB and lower
Fixed-rate issues					
UK corporates	23	3.2	0.2	2.3	0.7
UK financials	15	2.8	1.1	1.1	0.6
Supranationals	15	1.7	1.7	0.0	0.0
Overseas borrowers	43	6.8	3.3	3.4	0.1
Total (a)	**96**	**14.4**	**6.2**	**6.9**	**1.3**
FRNs					
UK corporates	2	0.1	0.0	0.1	0.1
UK financials	24	2.5	1.1	1.1	0.4
Supranationals	0	0.0	0.0	0.0	0.0
Overseas borrowers	10	1.0	0.4	0.6	0.0
Total (a)	**36**	**3.6**	**1.4**	**1.7**	**0.4**

Sources: Bank of England, Debt Management Office, Moody's and Standard and Poor's.

(a) Totals may not sum exactly due to rounding.

since the transfer of Exchequer cash management to the DMO in April 2000, the principal counterpart of the growth in the note circulation has been the growth in the stock of refinancing.

Chart 35
Stock of money market refinancing and daily shortages



The note issue creates a liquidity shortage in the sterling money market that is refinanced daily in the Bank of England's open market operations (OMOs). Given that the Bank typically undertakes two-week (ten working days) reverse repo transactions, roughly one tenth of the repo loans that make up the stock of refinancing mature each day. During the review period, daily money market shortages averaged £2.4 billion (see Table G), somewhat larger than one tenth of the stock of refinancing. As well as reflecting the growth of the stock of refinancing on the Bank's balance sheet, the change in the size of the shortage is also influenced by the rate of turnover of the stock of refinancing. Although most of the Bank's open market operations are conducted via two-week reverse repo transactions, the average rate of turnover of the stock in recent months has actually been around $7^1/_2$ working days. This reflects the fact that counterparties can also choose to obtain refinancing by selling bills with less than a two-week residual maturity

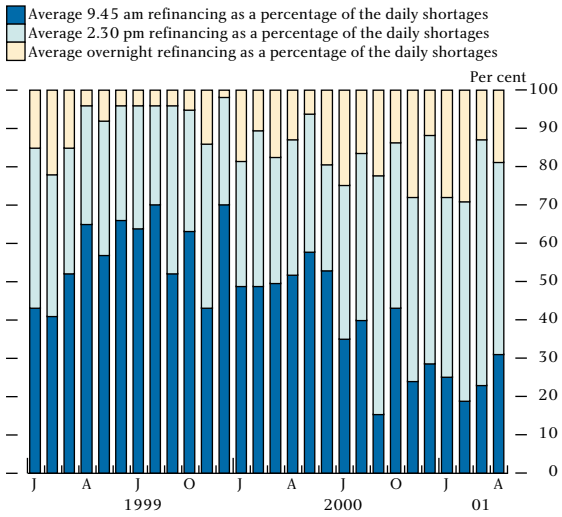
Table G
Average daily money market shortages

£ millions

1996	Year	900
1998	Year	1,400
2000	Year	2,000
2001	Jan.	2,500
	Feb.	2,900
	Mar.	2,000
	Apr.	2,300

on an outright basis, or can obtain overnight repo refinancing at a rate above the official two-week repo rate. Over the period, the Bank's OMO counterparties refinanced some 80% of the daily money market shortages at the 9.45 am and 2.30 pm rounds of operations (which largely have a two-week maturity) and some 20% at the late rounds, on an overnight basis (see Chart 36). Consequently, the average size of the daily shortages increased.

Chart 36
Refinancing provided in the Bank's open market operations

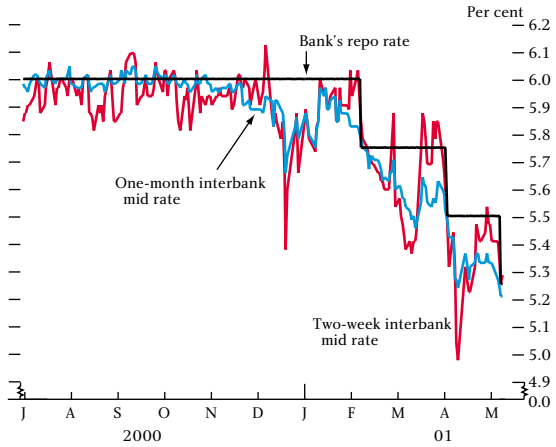


In advance of the reduction in the Bank's repo rate on 8 February, the Bank's counterparties chose to take refinancing from the Bank largely on an overnight basis (at a higher interest rate), in preference to taking refinancing at a two-week maturity (at the Bank's repo rate), because they expected the MPC to reduce the official rate. This led to a number of large daily shortages as refinancing was rolled over from day to day. Overnight market interest rates therefore traded above normal levels immediately prior to the expected repo rate reduction. A similar (though less marked) pattern occurred in advance of the repo rate cuts on 5 April and 10 May. More generally, however, interbank market rates at a two-week and one-month maturity have tended to trade below the Bank's repo rate since December (see Chart 37) and have been a little more volatile than usual.

There were two money market surpluses during the period, on 12 March and 30 April. This was the first time that the Bank had needed to absorb liquidity since the transfer of Exchequer cash management to the DMO.(1) The Bank's method of operating when there is a

(1) See page 132 of the May 2000 *Quarterly Bulletin* for a summary of the changes introduced when Exchequer cash management was transferred to the DMO.

Chart 37
Sterling interest rates



surplus is to absorb it by a gilt repo, executed by a competitive rate tender.

HM Treasury and Bank of England euro issues

The Bank of England continued to hold regular monthly auctions of euro-denominated bills during the period. Each month, €1 billion of bills were auctioned, comprising €200 million of one-month, €500 million of three-month and €300 million of six-month Bank of England bills. The stock of euro bills outstanding was therefore maintained at €3.5 billion throughout the period. Each monthly auction continued to be oversubscribed, with auctions being covered an average of five times the amount on offer, and bids were accepted at average yields of Euribor minus 9.5 to 15.8 basis points.

On 17 April, the Bank reopened (for the first time) the Bank of England Euro Note maturing on 29 January 2004 with a further auction of €500 million, raising the total of this note outstanding with the public to €1 billion. The auction was covered 2.1 times the amount on offer and accepted bids were in a range of 4.55% to 4.61%.

Further auctions of Bank of England Euro Notes are scheduled for 17 July and 16 October 2001.

UK gold auctions

The programme of gold auctions held by the UK government continued in the period under review. Twenty five tonnes of gold were sold at the auction on 14 March. A price of $266.00 was achieved and the auction was covered 2.2 times. Twenty tonnes of gold were sold at the auction on 15 May; a price of $268.00 was achieved and the auction was covered 3.7 times. The next auction in the programme is planned for 11 July 2001.

The Bank of England inflation attitudes survey

As part of a new regular series, the market research agency NOP undertook a survey of public attitudes to inflation for the Bank of England in February. The results show that, given a choice between higher interest rates or higher inflation, four times as many people would prefer interest rates to go up, rather than prices. Other results suggest that most people are aware that the Bank, rather than the Government, now sets interest rates. 55% are satisfied with the way the Bank is doing its job; just 10% are dissatisfied. Most people are aware that inflation is low, but only one in three knows that it is currently between 1% and 3%. However, very few expect inflation to rise sharply in the year ahead.

Introduction

The Bank of England believes that the new monetary policy framework established in 1997 will be most effective if it is accompanied by wide public understanding and support, both for the objective of price stability and for the methods used to achieve it. So one of the key strategic objectives for the Bank set by Court (the Bank's board of directors) is 'to build public support for price stability, and public understanding of the Monetary Policy Committee's approach to its remit'.

MPC members use a variety of methods to explain themselves to the public, including the publication of minutes of their monthly meetings, the quarterly *Inflation Report*, speeches and lectures, research papers, appearances before parliamentary committees, interviews with the media, visits to the regions, and an education programme that includes the 'Target 2.5' schools competition.

One way to quantify the impact of the Bank's efforts to build general public support for price stability is to use sample surveys of public opinion and awareness. Following a recommendation by the Treasury Committee of the House of Commons, the Bank has been trialling a national poll to explore the evolution of public opinion and general understanding of monetary policy matters.

The inflation attitudes survey

The trial questions, devised in collaboration with the market research agency NOP, were tested in four quarterly surveys from November 1999 to August 2000. The testing ensures that the questions are understood and that the answers give meaningful information. The results of the first four polls showed that the trial questions all worked satisfactorily, except for one question that proved to be confusing and so was rewritten and tested again in November 2000.

Using this and other feedback from the first year's trials, the Bank agreed a final version of the poll, which was carried out by NOP in February 2001. The results of the survey are described below. As some of the answers do not vary much from quarter to quarter, it was decided to do a full survey with all 14 questions once a year each February. But 9 of these questions, where the answers are more likely to vary over short periods, will be asked every quarter. The results of the full annual surveys will be reported each summer in the *Quarterly Bulletin*, and the results of the quarterly surveys will be published in a quarterly news release. In both cases, the full data will be available on the Bank's web site.(1) The table on page 168 summarises the results of the five trials up to November 2000.

The range of questions, as well as seeking information on public knowledge, understanding and attitudes towards the MPC process, also covers expectations of interest rates and inflation.

The five annual questions cover perceptions of the relationship between interest rates and inflation, and knowledge of who sets interest rates. The nine quarterly questions, which are also asked in the annual survey, cover expectations of price and interest rate changes, perceptions of the impact of inflation and interest rate

(1) The Bank's web site is at www.bankofengland.co.uk

changes on both the economy and the individual, and satisfaction/dissatisfaction with the way the Bank of England is doing its job of setting interest rates in order to control inflation.

The surveys are carried out by NOP in its regular Omnibus surveys using a random location sample designed to be representative of all adults in Great Britain, and interviewing is carried out in homes, face to face. In the February 2001 survey, NOP interviewed a quota sample of 3,901 people aged 15 and over in 350 randomly selected enumeration districts between 15 and 27 February. The raw data were weighted to match the demographic profile of Great Britain as a whole.

The sample size for the quarterly surveys (which will take place after the May, August and November *Inflation Reports*) is 2,000, about half the number for the annual February survey. The sample sizes chosen allow only a broad regional breakdown. Details of the survey methodology are available on the Bank's web site along with the results.

There are risks in drawing conclusions from polls about public perceptions of monetary policy over short periods. For example, public reaction to interest rate movements is likely to be influenced by other factors in the national mood and by the fact that rises are typically reported as bad news and falls as good news. *Question 14* of the survey finds that the proportion satisfied with the way that the Bank 'is doing its job to set interest rates in order to control inflation' climbed to 55% in February 2001 from 41% in February 2000. But this rising approval rating may be driven by the fact that interest rates remained stable and then fell slightly up to the survey date, and by the fact that the economic environment for most of last year was exceptionally stable. The Bank believes that approval ratings for its actions are likely to be affected quite strongly in the short term by the direction of movements in interest rates and perhaps exchange rates, so this part of the survey will be most valuable when studied over more than one cycle, and short-term results need to be interpreted with care.

Knowledge and expectations questions

Inflation

The February survey indicated that most people are aware that inflation is low, but only one in three responded correctly by saying that it is between 1% and 3%. Some of the variation in the answers may be because respondents are thinking about inflation as it relates to their own patterns of spending. Few people expect inflation to rise sharply in the year ahead.

Respondents were asked (*Question 1*) to say how much prices had changed in the previous 12 months by selecting from eight banded options on a card. Among the 87% who made a selection, the median response was 2.2%.(1) However, this median conceals a wide variation, from 22% who thought prices had fallen or not risen at all, to 29% who thought they had risen by more than 3%. Just 32% of responses chose either the 1%–2% band (12% of respondents) or the 2%–3% band (20%), both of which encompass inflation figures seen in the recent past. Figures for predicted future inflation (*Question 2*) are similar to those for perceived current inflation; the median figure is 2.1%. The questions do not specify particular measures of inflation. These figures have fluctuated very little during the past 12 months; variations have fallen well within sampling error. Only the first survey, conducted in November 1999, produced significantly different figures, when the median levels for current and predicted inflation were both 1.5%.

In answer to *Question 2*, 'how much do you expect prices to change over the next 12 months?', 15% of respondents were notably pessimistic, expecting prices to rise by 4% or more in the next 12 months; but two thirds of this group thought that prices had climbed by 4% or more in the *past* 12 months. In other words, they believed that inflation was already high, not that it was likely to increase.

Equally, two thirds of 'inflation optimists' (those expecting prices over the coming year to rise by 1% or less) thought that inflation was this low already. The pattern has been constant through all six surveys in the series. Very few people thought that inflation was likely either to rise or decline sharply.

Interest rates

(*Questions 5 and 6*) For the first time in the six surveys, more people (36%) thought that interest rates had fallen in the previous 12 months than thought they had risen (22%). The rest thought either that rates had remained about the same or had no idea. The survey took place

(1) For the purposes of calculating the median, responses are assumed to be evenly distributed within each band.

shortly after the MPC decision to reduce interest rates in February.

Of AB respondents (professionals, managers and their adult dependents), 50% said rates had fallen; among DE respondents (semi-skilled and unskilled workers and those living on state benefits) the figure was just 22%. Indeed, slightly more DE respondents thought that interest rates had risen rather than fallen.

Opinion was evenly divided on whether interest rates would rise (28%) or fall (26%) in the coming 12 months; almost half the sample either did not know (20%) or expected no change (26%). These figures for February were very different from those in previous surveys. The 'net rise' figure of +2 compares with +35 in November and an average of +53 between November 1999 and August 2000.

The Bank of England

Asked, unprompted, who sets Britain's 'basic interest rate level' (*Questions 11 and 12*), 37% said either the Bank of England (32%) or the Monetary Policy Committee (5%). 6% gave other answers, while 57% said 'don't know'. These figures have fluctuated little over the six surveys.

Respondents were then prompted with a show card containing four options, and asked again who sets interest rates. With this question, most people were aware that the Bank of England, rather than the Government, now sets interest rates. The proportion saying 'the Bank' climbed to 66%, while 15% plumped for 'government ministers', 3% for 'high street banks' and 3% for 'the European Central Bank'. Again, these figures have remained fairly steady throughout the series.

In response to *Question 13* about the nature of the MPC, 62% believe that the Committee is an independent body. This total is made up of 38% who know that the MPC is an independent body, partly appointed by the Government, and a further 24% who think that it is completely independent, meaning in this context no government role in appointments. 11% regard the MPC as 'part of the Government'.

Attitude questions

Inflation

(*Question 3*) Asked whether Britain's economy would be stronger, weaker or little changed by faster inflation, 47% believed that Britain's economy would end up weaker if prices started to rise faster than they do now. Just 7% thought that it would end up stronger, 26% thought that it would make little difference, and 20% had no idea. Over the six polls, the proportions have remained steady, at 7% ±1% saying stronger, 47% ±3% saying weaker, and 25% ±3% saying little difference. Public attitudes to this issue have been tested only during a period of low inflation, falling unemployment and steady economic growth, so these answers may not be a guide to how the public might react if economic circumstances were different. But the number of those believing that inflation is damaging for economic performance, even in a time of low inflation, suggests considerable support for price stability.

Told that the Government has set an inflation target of 2½% (*Question 4*), 58% thought this 'about right', while 22% thought it too high and 6% too low; 14% had no opinion. In no regional or demographic group did the percentage saying 'too low' reach double figures. Among respondents aged under 35, 31% said that the target rate was too high. Among respondents aged over 55 the proportion declines to 15%. This might reflect the fact that older respondents have clear memories of the inflation of the mid-1970s.

Interest rates

Public opinion continues to be divided over what should happen to interest rates over the next few months (*Questions 7 and 8*). 34% thought that it would be best for the British economy for rates 'to stay where they are', 28% thought that rates should go down, and 8% thought that they should go up. The remaining 30% either did not know or did not think it would make any difference. Views varied little from one region to another.

Asked what would be best for them personally (*Question 8*), 33% opted for lower interest rates, 18% for higher interest rates, and 17% for rates to remain where they are. Demand for lower interest rates was greatest among mortgage-payers (53%), 25–44 year-olds (49%) and working people (48%). Desire for higher rates was strongest among people who own their homes outright (42%) and those aged 55 and over (35%). Among the latter two (overlapping) groups, many more people favoured higher rather than lower interest rates for themselves; however, asked about the economy as a whole, the same people were inclined to lower rather than higher rates.

Inflation versus interest rates

Question 9 was designed to test peoples' understanding of how interest rate changes affect inflation, but in its original version it was not well understood by respondents. One possible source of—quite understandable—confusion in this area is that, in the short term, RPI rises when interest rates are increased, because it includes mortgage interest rates, while RPIX, the MPC's target measure, excludes mortgage rates. An alternative linked pair of questions, designed to focus attention separately on the short and medium-term impact of interest rate changes, was trialled last November and the results of this further test have been incorporated as a new *Question 9*.

NOP asked what people thought the impact would be of a rise in interest rates: (a) in the short term (say a month or two), and (b) in the medium term (say a year or two). In the short term, just over one person in three (34%) agreed that 'a rise in interest rates would make prices in the high street rise more slowly', while 22% disagreed. As many as 44% responded 'neither agree nor disagree' (19%), or 'don't know' (25%). The figures for the medium term are only slightly different: 37% agree, 17% disagree, 19% neither agree nor disagree, 27% don't know. However, there is more encouragement from *Question 10*: 'if a choice had to be made, either to raise interest rates to keep inflation down, or to keep interest rates down and allow prices in the shop to rise faster, which would you prefer?' When a trade-off is suggested, most people would accept higher interest rates rather than higher inflation. The margin is almost four to one: ie 62% compared with 16%. Clear majorities in every region and demographic group—including mortgage-payers—would prefer higher rates.

In other words, most people share the Bank's (and the Government's) priorities, but there is much less clarity about the link between rates and prices that underpins its decisions.

The Bank of England

Respondents were asked to assess the way that the Bank of England was 'doing its job to set interest rates to control inflation' (*Question 14*). 55% were 'very' (8%) or 'fairly' (47%) satisfied, while just 10% were 'fairly' (7%) or 'very' (3%) dissatisfied. This gives a satisfaction index (satisfied minus dissatisfied) of +45, virtually the same as that recorded three months earlier (+44), but higher than that found in earlier surveys.

As noted above (see page 165), responses to this question seem to reflect interest rate decisions. The lowest net satisfaction score, +24, was recorded in February 2000 at a time when rates were rising, while the latest survey followed a cut in rates. The satisfaction index is higher among men (+50) than women (+37), and higher among AB respondents (+61) than DE respondents (+31). In all the surveys, net satisfaction is lower in Scotland (+28) than in England and Wales (+46). The Bank's net satisfaction rating is currently positive, by a large margin, in every part of Britain and among every demographic group.

Public attitudes to inflation

Per cent

Question 1
Which of these options best describes how prices have changed over the past 12 months?

	1999 Nov.	2000 Feb.	2000 May	2000 Aug.	2000 Nov.	2001 Feb.
Gone down	11	7	5	8	6	7
Not changed	18	12	10	12	14	15
Up by 1% or less	7	5	4	7	5	6
Up by 1% but less than 2%	12	11	12	12	13	12
Up by 2% but less than 3%	16	17	18	20	18	20
Up by 3% but less than 4%	7	11	13	13	13	11
Up by 4% but less than 5%	4	8	7	5	6	6
Up by 5% or more	9	12	13	10	11	12
No idea	17	17	17	12	13	13
Median (%)	1.5	2.4	2.6	2.2	2.3	2.2

Question 2
How much would you expect prices in the shops generally to change over the next 12 months?

	1999 Nov.	2000 Feb.	2000 May	2000 Aug.	2000 Nov.	2001 Feb.
Go down	10	7	4	6	4	5
Not change	14	8	9	9	9	11
Up by 1% or less	10	7	7	10	8	9
Up by 1% but less than 2%	16	15	14	15	16	16
Up by 2% but less than 3%	17	21	21	19	21	20
Up by 3% but less than 4%	6	12	10	12	12	11
Up by 4% but less than 5%	3	7	7	6	6	5
Up by 5% or more	8	10	11	9	11	10
No idea	16	13	16	13	12	13
Median (%)	1.5	2.2	2.4	2.2	2.3	2.1

Question 3
If prices started to rise faster than they do now, do you think Britain's economy would...

	1999 Nov.	2000 Feb.	2000 May	2000 Aug.	2000 Nov.	2001 Feb.
End up stronger	8	8	8	6	8	7
Or weaker	44	48	47	50	49	47
Or make little difference	28	23	22	23	25	26
Don't know	20	21	23	21	18	20

Question 4
The Government has set an inflation target of 2½%. Do you think this target...

	1999 Nov.	2000 Feb.	2000 May	2000 Aug.	2000 Nov.	2001 Feb.
Is too high	19	27	23	22	23	22
Or too low	6	7	7	8	6	6
Or about right	51	50	52	54	58	58
No idea	24	16	18	16	13	14

Question 5
How would you say interest rates on things such as mortgages, bank loans and savings have changed over the past 12 months?

	1999 Nov.	2000 Feb.	2000 May	2000 Aug.	2000 Nov.	2001 Feb.
Risen a lot	7	18	19	13	10	6
Risen a little	35	37	37	36	29	16
Stayed about the same	18	12	13	20	26	20
Fallen a little	17	8	7	10	12	33
Fallen a lot	4	3	2	2	3	3
No idea	19	21	22	19	21	21
Total saying 'risen'	42	55	56	49	39	22
Total saying 'fallen'	21	11	9	12	15	36
Net risen	21	44	47	37	24	-14

Question 6
How would you expect interest rates to change over the next 12 months?

	1999 Nov.	2000 Feb.	2000 May	2000 Aug.	2000 Nov.	2001 Feb.
Rise a lot	7	16	10	8	6	4
Rise a little	52	50	46	47	39	24
Stay about the same	19	12	19	23	27	26
Fall a little	4	4	5	6	10	25
Fall a lot	1	1	1	0	0	1
No idea	18	17	20	16	17	20
Total saying 'rise'	59	66	56	55	45	28
Total saying 'fall'	5	5	6	6	10	26
Net rise	54	61	50	49	35	2

Question 7
What do you think would be best for the British economy—for interest rates to go up over the next few months, or to go down, or to stay where they are now, or would it make no difference either way?

	1999 Nov.	2000 Feb.	2000 May	2000 Aug.	2000 Nov.	2001 Feb.
Go up	12	12	11	11	9	8
Go down	21	27	29	27	24	28
Stay where they are	40	33	28	35	42	34
Make no difference	7	10	10	9	11	10
No idea	20	18	23	17	15	19

Question 8
And which would be best for you personally, for interest rates to...

	1999 Nov.	2000 Feb.	2000 May	2000 Aug.	2000 Nov.	2001 Feb.
Go up	17	19	16	17	17	18
Go down	30	35	33	36	36	33
Stay where they are	22	15	16	18	19	17
Make no difference	17	22	22	19	20	22
No idea	14	10	13	10	8	10

Question 9
How strongly do you agree with the following statements?

(a) A rise in interest rates would make prices in the high street rise more slowly in the short term—say a month or two.

	1999 Nov.	2000 Feb.	2000 May	2000 Aug.	2000 Nov.	2001 Feb.
Agree strongly					2	2
Agree					35	32
Neither					16	19
Disagree					25	20
Disagree strongly					2	2
Don't know					21	25
Total agree					37	34
Total disagree					27	22
Net agree					10	12

(b) A rise in interest rates would make prices in the high street rise more slowly in the medium term—say a year or two.

	1999 Nov.	2000 Feb.	2000 May	2000 Aug.	2000 Nov.	2001 Feb.
Agree strongly					2	2
Agree					39	35
Neither					16	19
Disagree					21	16
Disagree strongly					1	1
Don't know					22	27
Total agree					41	37
Total disagree					22	17
Net agree					19	20

Question 10
If a choice had to be made, either to raise interest rates to try to keep inflation down, or to keep interest rates down and allow prices in the shops to rise faster, which would you prefer:

	1999 Nov.	2000 Feb.	2000 May	2000 Aug.	2000 Nov.	2001 Feb.
Interest rates to rise	51	58	52	57	63	62
Prices to rise faster	17	19	16	15	19	16
No idea	31	24	31	28	18	22

Question 11
Each month, a group of people meets to set Britain's basic interest rate level. Do you know what this group is?

	1999 Nov.	2000 Feb.	2000 May	2000 Aug.	2000 Nov.	2001 Feb.
Monetary Policy Committee	7	4	5	6	5	5
Bank of England	39	29	33	38	29	32
The Government	4	2	3	2	3	3
The Treasury	1	1	1	1	1	1
Parliament	1	*	*	*	1	*
Other	1	2	1	2	1	2
Don't know	47	62	57	51	60	57

Note: * indicates less than 0.5%.

Question 12
Which of these groups do you think sets the interest rates?

	1999 Nov.	2000 Feb.	2000 May	2000 Aug.	2000 Nov.	2001 Feb.
Bank of England	67	63	63	69	65	66
Government ministers	14	15	12	13	16	15
High street banks	3	4	3	2	4	3
European Central Bank	2	3	3	3	3	3
No idea	13	14	18	12	12	13

Question 13
In fact, the decisions are taken by the Monetary Policy Committee of the Bank of England. Which of these do you think best describes the Monetary Policy Committee?

	1999 Nov.	2000 Feb.	2000 May	2000 Aug.	2000 Nov.	2001 Feb.
Part of the Government	11	11	9	10	12	11
A quango, wholly appointed by the Government	8	8	8	8	9	8
An independent body, partly appointed by the Government	38	39	37	42	37	38
A completely independent body	23	20	22	20	24	24
No idea	20	21	24	20	17	19

Question 14
Overall, how satisfied or dissatisfied are you with the way the Bank of England is doing its job to set interest rates in order to control inflation?

	1999 Nov.	2000 Feb.	2000 May	2000 Aug.	2000 Nov.	2001 Feb.
Very satisfied	7	4	5	6	7	8
Fairly satisfied	41	37	38	45	48	47
Neither satisfied nor dissatisfied	26	28	27	25	26	25
Fairly dissatisfied	7	12	9	9	8	7
Very dissatisfied	4	5	4	4	3	3
No idea	16	14	17	12	9	11
Total satisfied	48	41	43	51	55	55
Total dissatisfied	11	17	13	13	11	10
Net satisfied	37	24	30	38	44	45

The London Foreign Exchange Joint Standing Committee: a review of 2000

This article gives an overview of the role of the London Foreign Exchange Joint Standing Committee, and reviews the work undertaken by the Committee during 2000.

Introduction and overview

The London Foreign Exchange Joint Standing Committee was established in 1973 under the auspices of the Bank of England, largely as a forum for the different participants in the foreign exchange market to discuss issues of common concern.

The Committee met seven times in 2000. The Committee's key focus during the year was its work on the London Code of Conduct for non-investment products, in conjunction with its sister committees in the London gold and sterling deposit markets. There have also been discussions on other issues such as e-commerce, liquidity and the Continuous Linked Settlement Bank.

At the start of the year, the Committee's membership increased from 8 to 20, partly reflecting its new responsibilities in relation to the London Code. The Committee now includes senior staff from 11 of the major banks that operate in the foreign exchange market, as well as voice and electronic-brokers and the Financial Services Authority (FSA). In addition, the Committee strengthened its already close ties with the British Bankers' Association and the Wholesale Market Brokers' Association by including representatives of these associations as members. A representative from the Association of Corporate Treasurers is also now a member, reflecting the importance of corporates in the foreign exchange market. The Bank of England continues to provide the Committee's Chairman and Secretary.

The Committee's work in 2000

Code of conduct for non-investment products

Until 1987, the Committee was responsible for maintaining the London Code of Conduct, which provides guidelines on good practice in the foreign exchange market. Changes introduced as a result of the Financial Services Act 1986 meant that responsibility for maintenance of the Code shifted to the Bank of England and, more recently, to the FSA. However, 'non-investment products' (NIPs)—ie transactions conducted in the sterling, foreign exchange and bullion wholesale deposit markets, and in the spot and forward foreign exchange and bullion markets—will fall outside the FSA's regulatory coverage when the Financial Services and Markets Act comes into force towards the end of 2001. The FSA's market consultation on the future regulation of inter-professional business in October 1999 found that there was broad support for the development of a separate code of conduct for NIPs, along much the same lines as the London Code but produced by the market as a guide to good practice.

The Bank of England agreed to facilitate the production of the new code, working with individuals with experience in the relevant markets. Much of the Committee's work in 2000 therefore related to producing the code, in conjunction with the management committee of the London Bullion Market Association and the Bank of England Money Market Liaison Group, representing the bullion and sterling deposit markets respectively. The Committee also considered enhancements to the code suggested by other groups, both in the United Kingdom and overseas, to reflect market developments.

At the end of November 2000 a draft of the code was published for public consultation, available both in hard copy and on the Bank of England's web site.(1) The consultation period ended on 22 December 2000, and the Committee has spent the early months of 2001 finalising the code in the light of comments received.

(1) At www.bankofengland.co.uk/markets/nips.htm

E-commerce

Developments in e-commerce and their potential impact on the foreign exchange market were another major part of the Committee's work in 2000. The Committee discussed two main aspects of e-commerce: the implications for regulation, and the development of Internet-based trading platforms.

The effects of e-commerce on regulation

David Strachan of the FSA was invited as a special guest to a Committee meeting to discuss the effects of e-commerce (particularly new trading platforms) on regulation. From the FSA's perspective, the key challenge posed by electronic trading platforms, as a component of the market's infrastructure, was how far they should be regulated, and whether entities that provided similar functions and services in the same market or products (eg exchanges and brokers) should be regulated in significantly different ways. Both the FSA and other regulatory bodies abroad were working hard to resolve this issue. There were a number of related issues, including whether any switch in trading to the new platforms would require greater transparency or market monitoring. This depended partly on whether the trading platforms obtained a significant market share such that the transparency of the market was undermined, and whether they might represent a threat to the stability of the financial system. In addition, recent initiatives had largely been aimed at the wholesale markets, which raised different regulatory issues compared with systems that admitted retail participation.

Use of the Internet as a foreign exchange trading platform

In discussions early in the year, the Committee identified trading via the Internet as a possible driver of structural change in the foreign exchange (FX) industry. Subsequently, consortia that included many of the largest global FX market players announced the development of two large multilateral FX trading platforms for customers, FXall and Atriax. The Committee suggested that the main business driver of trading with customers on the Internet was cost reduction: both for banks in providing FX prices to corporates, and to corporates in executing their FX business. Looking further forward, the growth of trading with customers on the Internet was thought likely to lead to further globalisation of the market: increasingly, transparent prices would be available instantaneously to customers across the world. It was difficult to tell whether Internet-based trading would reduce or increase market concentration. At one level, the technology might mean that a bank would not necessarily have to be a major market player in order to obtain business. On the other hand, it was possible that the major banks could deliver, individually or collectively, Internet-based services that met customers' requirements, in which case market concentration could increase.

Liquidity in the foreign exchange market

The Committee discussed this topic at a number of meetings in 2000. There was general agreement that the structure of the foreign exchange market had changed markedly over the past decade. However, opinions differed as to whether recent sharp market movements were a reflection of those changes, or were examples of the volatility that had always existed in foreign exchange markets. There had been a number of changes to the structure of the market, including the greater influence of options-related trading on price formation, as well as concentration of liquidity and reduced market-making. The majority of Committee members thought that these changes meant that the likelihood of other extended price movements would increase in future. However, it remained difficult to generalise about levels of liquidity in the foreign exchange markets, which had become more volatile: at times, it was surprisingly easy to transact a large order with very little effect on the price. While the fall in liquidity might be partially explained by the reduction in hedge fund activity, and a reduction in risk appetite more generally with fewer firms acting as market-makers, liquidity often varied depending on the timing of the transaction, the currency pair being traded, and the currency product being traded.

Settlement of spot foreign exchange on T+1

The Committee discussed this topic at its meetings in February and March, on the latter occasion reviewing a paper produced by one of its sub-committees. The discussions were prompted by the statement in late 1999 by the Securities and Exchange Commission that US securities settlement systems should reduce settlement cycles to T+1 by 2002. This led some to question whether the foreign exchange market could and should alter the convention for spot FX trades to T+1 (from T+2 currently).

Settling spot foreign exchange would reduce the length of time for which firms were exposed to counterparty credit risk. However, the consensus of the Committee was that shorter deadlines for confirming and matching trades would increase firms' operational risk, possibly increasing the overall risk to which they were exposed through foreign exchange dealing. Most large banks could reduce settlement for spot to T+1 relatively easily for most currency pairs; however, for transactions involving currencies such as the yen and the Australian and New Zealand dollars, time-zone differences mean that these would be more difficult. Moreover, banks could currently trade for T+1 settlement on demand from customers: it was possible that demand for T+1 settlement would increase if the settlement cycle for equities was reduced to T+1, but that this could be accommodated without altering the settlement convention. Given this, any change in the convention for spot was likely to be led by the market: if the majority of foreign exchange trades were settled on T+1, rather than on T+2, the market would call trading for settlement on T+1 'spot'.

Continuous linked settlement

The Committee had several discussions during the year on the impact on front offices of the forthcoming introduction of continuous linked settlement (CLS). The Committee assessed the cost-benefit aspects of CLS and related initiatives, including the impact on settlement risks and systems issues. The main issue identified was the management of liquidity required to meet the deadlines imposed by the CLS system, and the possible ways that this could be achieved. By the end of the year it became clearer that 'inside-outside swaps' would be used by CLS members as their liquidity management tool, at least temporarily. (This involves CLS settlement members undertaking intra-day FX swaps between themselves to allow members to swap currencies they are short of in CLS for currencies in which they are long.) This implied the reintroduction of a small amount of settlement risk, although perhaps only temporarily if these swaps were used as part of the transition to more effective intra-day liquidity provision.

Looking ahead: 2001

The focus of the Committee's work in the first half of 2001 is likely to remain the London Code of Conduct for non-investment products. The FSA has published the Inter-Professionals Conduct Chapter of its Handbook, and the Committee will deal with any issues arising on the interaction between this and the NIPs code. The code will become operational once the Financial Services and Markets Act comes into force towards the end of 2001.

The Committee will continue to monitor Internet-based trading platforms, changing patterns of liquidity, CLS, and any other challenges and issues in the foreign exchange market that arise in 2001.

In recent years, representatives of the Committee have attended meetings of the foreign exchange committees run by the Federal Reserve Bank of New York and the European Central Bank (ECB), and visitors from the ECB and the Bank of Japan have attended the Committee's meetings; the Chairman and the Secretary have also met their opposite numbers from several other committees. The Secretary circulates 'key points' from each meeting to the counterpart committees overseas, and debriefs the Committee on developments in these counterpart committees. The Committee is keen to maintain and strengthen its links abroad in 2001.

Over-the-counter interest rate options

By Richhild Moessner of the Bank's Gilt-edged and Money Markets Division.

The Bank of England's Monetary Policy Committee uses market expectations of future interest rates to inform its policy decisions. Interest rate expectations can be inferred from a range of financial instruments, including interest rate options. This article surveys the structure and use of the over-the-counter (OTC) interest rate option market.(1) *It discusses what information OTC interest rate options may contain about market interest rate expectations, additional to that available from products traded on exchanges. It also considers the linkages between OTC interest rate option markets and the markets in the underlying assets.*

Options are financial instruments that are linked to an underlying asset, and whose payoffs depend on movements in the price of that underlying asset. Because of the asymmetric nature of their payoff profile, options provide information about the probability distribution of market participants' expectations of the price of the underlying asset. The Bank of England uses options to derive indicators of uncertainty about future interest rates, exchange rates and equity markets, in order to inform monetary policy and to identify potential financial stability risks.(2) For example, the *Inflation Report* uses exchange-traded option prices to derive the probability distribution of market expectations of UK short-term interest rates.

The Bank has made relatively little use, however, of the information available from interest rate options that are traded in the OTC market. The OTC market contains a range of financial products not traded on exchanges. However, less information is publicly available about OTC markets than about exchange-traded markets. So discussions with market participants are particularly important in gaining an understanding of the market structure and the use of OTC interest rate options, the information content of their prices, and their interrelationships with other financial markets.

This article discusses the information that OTC interest rate options may contain, additional to that available from exchange-traded products, given the wider range of products traded in the OTC market. The article begins with an introduction to derivatives and interest rate options. The differences in the sizes and other features of OTC and exchange-traded derivative markets are discussed. Later sections, which are based partly on information from market participants, consider the main applications of interest rate options, the usefulness of OTC interest rate options for inferring sterling interest rate expectations, and the relationship of the interest rate option markets with the markets of the underlying assets, such as government bonds and swaps. A glossary of terms is provided on page 181.

Introduction to derivatives and basic concepts

A 'derivative' is a financial contract whose value depends on the future value of one or more underlying asset. Originally, the underlying assets were commodities, such as cotton and rice, but many different financial instruments are now used, including interest rates, exchange rates, equities and commodities. Derivatives allow the contract holders to expose themselves to price changes in the underlying asset without having to purchase the asset. There are two main types of derivative instrument:

- *Outright contracts:* These are instruments with a linear payoff profile, ie they provide symmetric payoffs to upward and downward movements in the price of the underlying contract. Examples of such derivatives include interest rate futures,

(1) This article is based partly on interviews with staff from Barclays Capital, the Chase Manhattan Bank, Credit Suisse First Boston, Goldman Sachs, JP Morgan, the Royal Bank of Scotland, Tullett & Spuetz Capital Markets AG, UBS Warburg, and Westdeutsche Landesbank. Full details of this study are given in Moessner (2001), available at www.bankofengland.co.uk/ccbs/publication/otcoptions.htm

(2) See Clews, Panigirtzoglou and Proudman (2000), and Bank of England (2000).

forward-rate agreements (FRAs), and interest rate swaps (see the glossary on page 181).

- *Options:* These are instruments with a non-linear payoff profile. They provide payoffs that depend asymmetrically on changes in the price of the underlying contract.

Many derivatives are either pure outright contracts or pure options contracts, but there are also a large number of more complex derivatives that are a combination.

Interest rate options are option contracts that settle against interest-bearing securities such as money market interest rate futures, interest rate swaps and government bonds. A 'call option' gives the buyer the right, but not the obligation, to buy an underlying interest rate contract at a point in the future at a pre-determined price (the 'strike price'). 'Put options' give the right to sell the underlying contract. Options can be traded at a variety of strike prices, which may be at-the-money (ATM), out-of-the-money (OTM), and in-the-money (ITM).

Interest rate options can be divided roughly into the following categories: plain vanilla options, exotic options, and structured products. Plain vanilla options use standardised contracts and market conventions, and are traded in generally liquid markets. The main kinds of 'plain vanilla' OTC interest rate options are interest rate caps, floors and swaptions (see the box on pages 176–77). Exotic options are more complex contracts; and structured products are made up of several components, including outright derivative contracts, options, and the underlying contracts, such as bonds.

Information contained in option prices

A call option is valuable only if there is a chance that the price of the underlying contract will exceed the strike price when the option is exercised. By comparing the prices of traded options with different strike prices, it is therefore possible to infer the probabilities that market participants attach to various levels of the price of the underlying contract.(1) Interest rate option prices can be used to infer so-called 'implied volatilities' (see the glossary on page 181), which provide a measure of market participants' uncertainty about future interest rate movements.

The price of an option is sensitive to the dispersion of expected future prices of the underlying contract, since options have an asymmetric payoff profile. Call options are more expensive the greater the dispersion of future prices expected by the market, ie the greater the uncertainty. This is because greater uncertainty increases the probability that the price of the underlying contract will move further above or below the strike price at the expiry of the option, leading to a greater payoff to the holder, while the loss to the holder is still limited to the option premium. Similarly, options are cheaper when the market is more sure about future outcomes. Interest rate options therefore provide valuable information about the distribution of future interest rates expected by market participants.

OTC and exchange-traded derivatives

Derivatives contracts can be traded on organised exchanges or in over-the-counter markets. OTC interest rate options can be tailored to a user's specific requirements, since they are direct contracts between counterparties without an exchange acting as an intermediary. The main advantage of OTC contracts is therefore their greater variety and flexibility (see the table overleaf). The greater variety is also a disadvantage, however, since as a consequence individual OTC interest rate options contracts tend to be less liquid than the more standardised exchange-traded contracts. The main disadvantage of OTC contracts is that they involve greater counterparty credit risk than exchange-traded contracts.

The main kinds of outright OTC interest rate derivatives are interest rate swaps and FRAs. Interest rate options traded in the OTC market comprise a wider range of products than those traded on exchanges, and include options with much longer times to expiry, options on swaps, many kinds of exotic options, and structured products (see the box on pages 176–77).

The OTC derivatives market is almost exclusively a wholesale market. End-users of OTC derivatives are for the most part institutional investors, corporate treasurers (especially of large or multinational companies), governments, and other professionals. Providers of OTC products are mainly banks and securities houses. Brokers also play an important role in OTC derivative markets, acting as agents between the potential counterparties.

(1) See Clews, Panigirtzoglou and Proudman (2000).

Exchange-traded and OTC derivatives

	Exchange-traded	OTC
Trading practices	Central market place. Trading under defined rules and regulations. Access is only via exchange members.	Direct contracts between counterparties, often via brokers.
Transparency	Exchanges provide continually updated information about prices and volumes of contracts traded.	Very little publicly available information about the prices of recently agreed contracts. Indicative prices are often posted on brokers' screens.
Credit risk	Minimal credit risk since the exchange clearing house acts as the counterparty to all trades. Most exchanges insist on initial margin deposits and daily marking to market. Netting different positions is easy.	Counterparty credit risk is an important consideration. Margins, regular revaluation and posting of collateral can be agreed, but are not obligatory. Similarly, there is no netting of positions with different counterparties, but netting of positions with the same counterparty can be agreed.
Contract types	Standardisation of contracts and expiry dates. There are a small number of contract types, and individual contracts are of small and fixed size. Maturities, and times to expiry of options, are shorter on average than for OTC markets.	Products are flexible and can be tailored to users' specifications. There is a proliferation of contract types, but there are also 'plain vanilla' contracts, which are more standardised.
Liquidity	Liquidity created by standardisation of contracts, a wide range of market participants, and a concentration of contracts at short maturities.	OTC contracts are more often held to maturity than exchange-traded contracts.
Market participants	Wide range of market participants.	Almost exclusively a wholesale market.

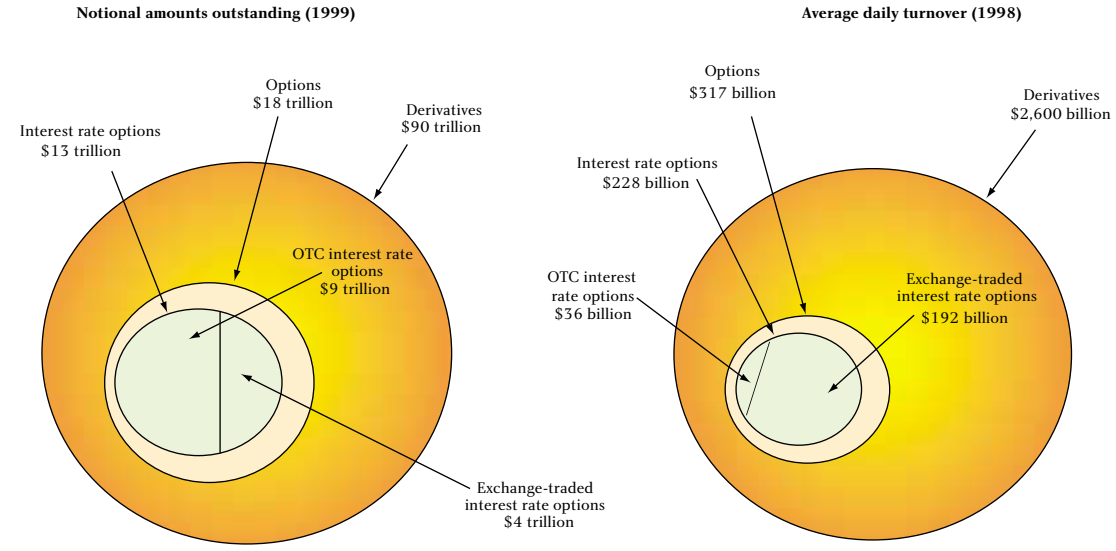
Sources: Ward (1993), Reuters Ltd (1998), and discussions with market participants.

Sizes of the derivative and interest rate option markets

OTC interest rate options accounted for approximately 15% of the notional amount outstanding of the global OTC interest rate derivative markets at end-1999; options also accounted for approximately 15% of market turnover in April 1998 (see Bank for International Settlements (1999a and 2000a)).(1)

Chart 1 illustrates the size of the global OTC interest rate option markets in relation to other derivative markets.(2) As the chart shows, the notional amounts of OTC interest rate options outstanding worldwide significantly exceed the size of the exchange-traded interest rate option market. At $9.4 trillion, the former accounted for about a half of the global option market and one tenth of the total derivative market at the end of 1999. The importance of OTC interest rate options is smaller when measured by turnover, however. In April 1998, average daily turnover in OTC interest rate options was only $36 billion, about 1.4% of the total daily turnover in derivatives contracts. The combination of relatively low turnover and relatively high notional

Chart 1
Global OTC and exchange-traded derivatives markets



Sources: FOW TRADEdata; Futures Industry Association; various futures and options exchanges; Bank for International Settlements (1999a and b, 2000a and b).

(1) Notional amounts outstanding are the absolute gross nominal or notional principal value of all deals concluded and not yet settled at a certain point in time. Turnover is the absolute gross notional value of all deals concluded during a certain period, measured in terms of nominal or notional principal value of the contracts.

(2) Included in total notional amounts outstanding of derivatives are forward, swap and option contracts for OTC interest rate, foreign exchange, and equity-linked contracts; and exchange-traded interest rate, currency and equity-index futures and options contracts. However, the figures exclude commodity and credit derivatives. Turnover data include the same contracts, except for equity derivatives. Data on the global options market include the options elements of the contracts mentioned above. For exchange-traded derivatives, turnover for 1998 Q2 was converted to average daily turnover assuming 61 trading days in the quarter. Results from the next central bank survey of derivative market turnover will be available in autumn 2001.

amounts outstanding of OTC interest rate options is partly explained by OTC interest rate options displaying, on average, longer times to expiry than exchange-traded interest rate options, and partly by OTC interest rate options contracts being more commonly held to maturity than exchange-traded contracts.

Uses of interest rate options

To interpret developments in interest rate option markets, it is important to know the purposes for which these options are traded. This and the following sections are based partly on information from market-makers.

If an interest rate option contract is used primarily for speculation about the levels of future interest rates, and if it is traded in liquid markets, its price should normally be a good reflection of market participants' interest rate expectations. On the other hand, if an option contract is used primarily for risk management and traded in rather illiquid markets, its price is more likely to contain a risk premium (in addition to the credit risk premium) and so it is less likely to give an accurate reflection of the market's true interest rate expectations. This section outlines the main applications of interest rate options reported by market participants.

Speculation

Interest rate options can be used to speculate on both the direction and the volatility of future interest rate movements. Hedge funds and the proprietary desks of investment banks frequently engage in such activity. If speculators buy call options, they will profit if the price of the underlying contract rises sufficiently above the strike price. By buying and selling certain combinations of call and put options and outright contracts, trades can be arranged whose payoffs are sensitive (over a short period of time) to changes in the volatility of interest rate movements, but not to the direction of interest rate changes. Such trades are not possible without using options. An important example is a straddle trade, which consists of the purchase of a call option and the sale of a put option with the same strike price and expiry date. The buyer of the straddle profits if interest rate movements are large, no matter in which direction.

Market-makers report that interest rate options with a shorter time to expiry, especially three months, are used for speculation to a greater extent than longer-dated options. The exchange-traded short-term interest rate option market is generally deemed to be more liquid than the OTC market, and is consequently used more for speculation. Among OTC contracts, short-dated swaptions (see the box on pages 176–77) are used to the greatest extent for speculation. In particular, ATM swaption straddles with three months to expiry are used to speculate on changes in the volatility of interest rates. Speculation using OTC interest rate options is reported to have declined in relative importance in recent years. This partly reflects past losses and partly consolidation in the banking industry, which has left fewer globally active banks.

Risk management and yield enhancement

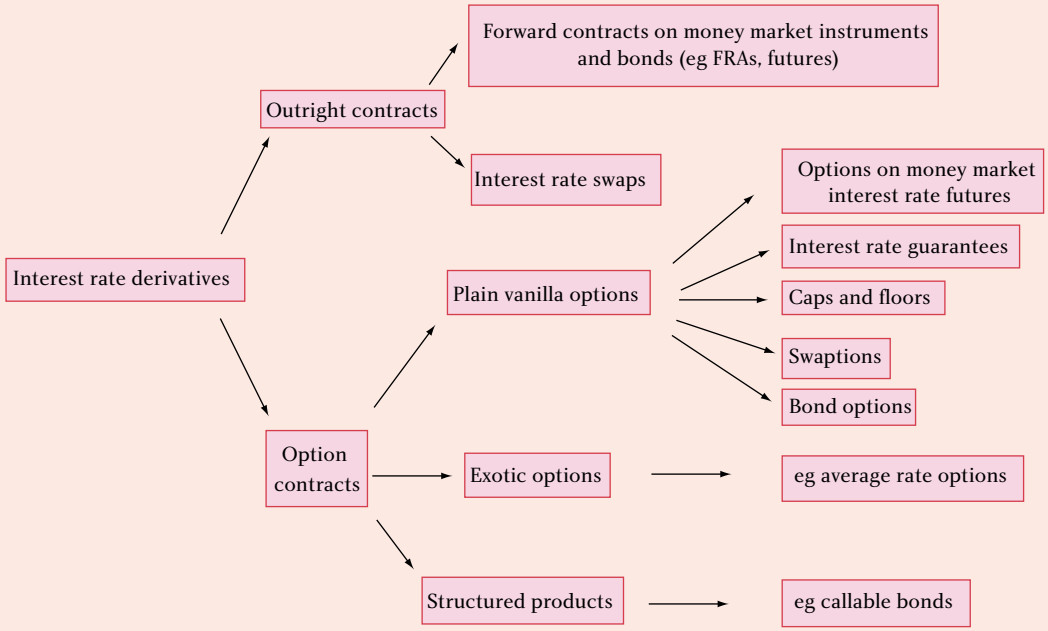
One of the attractions of interest rate options is that investors can use them in combination with outright contracts to alter the risk and return attributes of their investments. The purchase of an outright contract allows the holder to benefit fully from a price rise, but the holder is also fully exposed to downside risk if the price falls. In contrast, the downside risk from buying a call option is limited to the option premium. The option, in effect, provides insurance, as the worst possible outcome is known in advance. Thus derivatives, including interest rate options, allow companies and banks to manage the risk profile and cash flow structures of their assets and liabilities (see Cavalla (1993)). In particular, corporate treasurers can use interest rate options to match liabilities (for example their maturity profile) against their assets, and fund managers can use derivatives to match assets against their liabilities (eg pensions). Corporates, fund managers and banks use interest rate options for hedging existing or anticipated risk exposures. Such hedging involves buying protection against unfavourable interest rate movements. Interest rate options are ideally suited for hedging claims whose occurrence, timing, and size are uncertain, but have particular probabilities attached to them. If the claim materialises, the option used to hedge that claim can be exercised. Interest rate options are also used to manage existing risk exposure. In this process, some return from favourable interest rate movements is surrendered in order to limit the loss from unfavourable interest rate movements.

Two examples of the risk management applications of interest rate options are the following. First, banks and building societies that offer fixed-rate mortgages and variable deposit rates are faced with potential losses if the variable deposit rate that they pay rises above the fixed mortgage rate that they receive. By buying interest

Types of interest rate option

Chart A illustrates the different types of interest rate derivative.

Chart A
Interest rate derivatives



Plain vanilla options

Options on money market interest rate futures

Options on money market interest rate futures contracts are traded on exchanges. Examples include the options on short sterling futures traded on the London International Financial Futures and Options Exchange (LIFFE). They give the holder of the option the right to buy (or sell) an interest rate futures contract at a pre-determined price when the option expires. The most actively traded options on short sterling futures are those with times to expiry of up to one year.

Interest rate guarantees, caps and floors

Options on forward-rate agreements (FRAs) are only traded over-the-counter and are known as interest rate guarantees (IRGs) or interest rate caplets. A call option on an FRA, or 'borrower's IRG', gives a floating-rate borrower the right to lock in a known maximum future borrowing rate. A put option on an FRA, or 'lender's IRG', allows a lender to lock in a known minimum lending rate.

A strip of caplets, one maturing after the other, is called an interest rate cap. Such contracts allow the buyer to establish a maximum interest rate (the strike rate) for floating-rate borrowing over a certain period, for example at the three-month Libor rate over a period of three years. If at the rollover of the loan, three-month Libor is above the strike rate, the borrower is compensated for the difference between these two rates. A cap is not a single option, but rather a strip of individual call options on three-month forward Libor rates, with each option expiring three months after the previous one. Each caplet within the cap is exercised only if the floating interest rate rises above the strike rate in that period (see Kolb (2000)). An interest rate floor is similar to a cap, but it sets a minimum level to be paid on floating-rate borrowing.

Swaptions

Swaptions are options on interest rate swaps and are traded over-the-counter. A swaption gives the buyer the right, but not the obligation, to enter into an interest rate swap at a specific date in the future, at a particular fixed rate (the 'strike rate'), and for a specified term. A particular swaption contract is specified by the option's expiry date, at which point a swap is entered into or the option is cash settled, and by the maturity (or 'tenor') of the forward swap rate.

Bond options

Bond options give the holder of the option the right to buy (or sell) the underlying bond at a pre-determined price at the expiry of the option. They are traded both over-the-counter and on exchanges. Options in the OTC market exist on government and corporate bonds.

Exotic options

There is a wide variety of exotic interest rate options in existence, but only some of them are commonly used. One of the more commonly used types is an average-rate option on a variable interest-bearing security. These are options that relate to the average of the variable rate holding over the life of the option. They are cheaper than plain vanilla options on the underlying rate, since the volatility of the average of a rate is smaller than the volatility of the rate itself, and the price of an option increases with the expected volatility of the underlying contract.

Structured products

Structured products are made up of several components, including outright derivative contracts, options, and the underlying contracts, such as bonds. They frequently take the form of conventional debt instruments that contain embedded swaps and options (eg callable and puttable bonds). The payment flows can be linked to one or more underlying asset.

rate caps with a strike rate related to the fixed mortgage rate offered to customers, these institutions can cap the interest cost of their floating-rate liabilities at a maximum rate related to the fixed rate that they receive from their mortgage customers. Second, issuers of, and investors in, callable and puttable bonds (see glossary) can use swaptions to hedge against changes in cash flows arising from the early redemption of these bonds.

The income from writing options can enhance the yield of investments, or lower the cost of funding. For example, a fund manager with a portfolio of bonds can write a call option on a bond, at a strike price for the call option above which he or she thinks the price of the bond will be unlikely to move. If the bond price remains below the strike price, the option will not be exercised and the fund manager earns the option premium, thereby enhancing the yield of the bond portfolio. Investors can also enlarge the yield on their bond portfolios by buying callable bonds, which provide the bond issuer with an early redemption option. Similarly, bond issuers can reduce their funding costs by issuing puttable bonds, which provide investors with an early repayment option.

The long-dated OTC interest rate option market is said by market-makers to be used mainly for risk management and yield enhancement. Trades are often direct responses to customer demand. These customer flows are often linked to structured products, such as callable bond issues. Caps are said to be used mainly for hedging, especially by corporates, who use them to hedge their floating-rate liabilities, and by mortgage banks, who use them to hedge their capped-rate mortgages.

Market-makers report that their customers typically buy out-of-the-money (OTM) OTC interest rate options for risk management purposes. However, the liquidity of OTM options is generally poor, so that market-makers cannot easily sell on positions they have taken from customers. An integral part of the business of an active options dealer is therefore to manage the risk of at-the-money (ATM) versus OTM option positions.

What can OTC options tell us about interest rate expectations?

As noted above, interest rate option prices can be used to derive implied volatilities. These provide a measure of the market's uncertainty about future interest rate movements. This section reports market-makers' perceptions of the information that sterling OTC interest rate options may contain about market interest rate expectations, additional to that available from exchange-traded products.

Market-makers report that the demand for and supply of OTC interest rate options by their customers is driven mainly by factors other than pure expectations about future interest rates. In particular the demand for and supply of OTC interest rate options is often strongly related to customers' risk management and yield enhancement practices. These considerations can generate imbalances in the demand for and supply of interest rate options, so option prices may no longer accurately reflect market participants' true interest rate

expectations. However, interest rate expectations are thought to influence choices about risk management and yield enhancement to some extent. Such expectations are likely to affect customers' decisions on which particular risk exposures to hedge and which to leave unhedged, and which kinds of interest rate contracts, including options, to choose as hedges.

An example of this effect is that the interest rate option contracts that are used by customers mainly for hedging rather than speculation can have prices and implied volatilities that exceed their fair values based solely on future interest rate expectations. Customers are prepared to pay a premium for obtaining insurance by holding these options, and market-makers demand a premium for providing such insurance. In particular, prices of longer-dated OTC interest rate options are said to be affected significantly by customer flows related to hedging and yield enhancement.

Short-dated interest rate options, especially with up to one year to expiry, are thought to reflect the market's interest rate expectations better than long-dated options, since they are more liquid, and are used more for speculation. Short-dated options also match speculators' time horizons more closely. Among short-dated options, exchange-traded contracts are thought to reflect the market's interest rate expectations better than OTC contracts, partly since exchange-traded markets are more transparent than OTC markets, enabling better price discovery. This helps to explain why the exchange-traded contracts are more widely used to derive information about interest rate uncertainty.

However, in order to interpret the information content of the more liquid exchange-traded option contracts, it may still be useful to understand developments in the OTC interest rate option markets. Some market participants arbitrage the prices of OTC interest rate options against those of exchange-traded interest rate options, and use exchange-traded options to hedge OTC option positions. Due to these arbitrage and hedging linkages, for example between prices of interest rate caps and short sterling futures options, distortions in the prices of OTC interest rate options, due to their use for risk management and yield enhancement, may affect the exchange-traded markets.

Among OTC interest rate options with short periods to expiry, market participants believe that three-month options on two, five and ten-year swaps reflect the markets' future interest rate expectations better than other swaption contracts, caps, or OTC gilt options. Information about the uncertainty of expected future swap rates is available only from the OTC interest rate options market. However, OTC options involve greater counterparty credit risk than exchange-traded options, so their prices may contain larger credit risk premia.

Most of the exotic interest rate option trades carried out by market-makers are said to respond directly to customer demand; there is very little interbank trade in these products, and they are therefore not thought likely to reflect the market's interest rate expectations accurately.

Interrelationship with the underlying markets

Interest rate options markets may also affect the prices of the underlying contracts. Understanding these linkages may help in interpreting price movements in the underlying contracts.

The risk management of interest rate option positions establishes an interrelationship between the interest rate options markets and the markets for the underlying contracts such as government bonds and interest rate swaps. These interrelationships may make markets more efficient by establishing arbitrage links between different markets. In illiquid markets, however, the hedging of interest rate options positions may increase the price volatility of government bonds and swaps.

An interest rate option can be hedged initially against directional price movements of the underlying interest rate contract, by buying or selling an appropriate fraction, delta, of the underlying contracts. Delta is the rate at which the value of an option changes as the price of the underlying contract changes. This process is called delta-hedging. As the price of the underlying contract rises, a call option moves deeper into-the-money and becomes more likely to be exercised, and its delta increases. The sellers of the options therefore have to buy additional underlying contracts if they want to hedge this exposure. Similarly, if the price of the underlying contract decreases, the sellers may choose to sell some of them to re-establish the delta hedge. In rebalancing the delta hedge, sellers therefore 'buy high and sell low'. Consequently, rebalancing the delta hedge may increase the price volatility of the underlying interest rate contract, especially if the size of the option position is large in relation to the size of the underlying market, and assuming that the holders of the

options conduct no delta-hedging of their own, perhaps because the option itself has been bought as a hedge against pre-existing risk exposure.

If the liquidity of the underlying asset market is poor, any such rehedging is likely to be expensive. As the liquidity of the underlying contracts decreases, their bid-offer spreads (ie the difference between the prices at which one can buy and sell these contracts) tend to widen, and it becomes more costly to hedge an option position by buying and selling underlying contracts. When rehedging an option position whose size is large in relation to the size of the underlying market, the price of the underlying asset may move against the seller of the option.(1)

If the underlying asset is illiquid, the greater cost and difficulty of hedging an option position will make it more costly and more risky, and therefore provide a disincentive for entering into option contracts. In this way, lack of liquidity in the government bond or interest rate swaps market can, in turn, help to reduce the liquidity in the interest rate options market.

Market-makers confirm that the liquidity of the market for the underlying interest rate contracts has an important effect on the liquidity of the related interest rate options market. A frequently cited example of this link is the reduction in the past few years in the liquidity and size of both the exchange-traded and OTC gilt option markets. Market participants attribute this development largely to a reduction in the liquidity of the gilt market.

There is less agreement, however, about causal linkages from the interest rate option markets to the underlying asset markets. Some market participants argue that activity in the interest rate option markets has little, if any, impact on activity in the market of the underlying asset. Others, in contrast, believe that interest rate option markets also have an effect on the underlying market, both on activity and price volatility, partly due to the linkages generated by hedging. Depending on the circumstances, liquidity in the interest rate option market could either enhance or impair liquidity in the underlying market. Provided that the underlying market is already liquid, and price movements are not too large, option positions could add to that liquidity due to the use of the underlying market for rehedging. But if there are large price realignments, or if interest rate option positions are large in relation to the size of the underlying market, liquidity in the underlying market could be adversely affected, due to demand from rehedging, which could be very much one-way. For example, activity in the long-dated sterling swaption market was thought by some market-makers to have affected the long-dated sterling swap market and to have increased the price volatility of the gilt market in 1999, when swaptions were sold by investment banks to insurance companies, as a hedge for insurance companies' guaranteed annuity liabilities.(2) It was suggested, however, that the effect of options on the price volatility of the underlying market is generally larger for foreign exchange options than for interest rate options.

Conclusions

Given the wider range of products traded in the OTC interest rate options market, OTC interest rate options may be useful for investigating longer-term interest rate expectations. Among sterling OTC interest rate options, market-makers believe that three-month at-the-money options on two, five and ten-year interest rate swaps reflect the market's interest rate expectations to the greatest extent. Information about the uncertainty of expected future swap rates is available only from the OTC interest rate option market, since options on swaps are not traded on exchanges.

Market participants generally believe that in the sterling OTC interest rate options market, option contracts with more than one year to expiry do not accurately reflect the market's future interest rate expectations, since their prices are mainly affected by other considerations. In particular, OTC interest rate options in sterling with long periods to expiry are said to be used mainly for risk management and yield enhancement, rather than interest rate speculation. Moreover, OTC options involve greater counterparty credit risk than exchange-traded options, so their prices may contain larger credit risk premia.

Exchange-traded interest rate option contracts on short sterling interest rate futures with up to a year to expiry are thought by market participants to provide a better guide to near-term market interest rate expectations than

(1) A model that shows how delta-hedging can influence and move the market in the underlying contract is presented in Wilmott (2000).
(2) These products guarantee a minimum annuity rate at retirement. They are, in effect, options since they allow policyholders to choose the higher of the annuity rate available in the market and the guaranteed rate when they retire.

OTC interest rate options, since they are more liquid and used more for speculation. However, in order to interpret the information content of the more liquid exchange-traded option contracts, it may still be useful to understand developments in the OTC interest rate option markets, since price distortions in the OTC markets may affect exchange-traded interest rate option markets due to arbitrage and hedging linkages between them.

Market participants generally believe that the liquidity of the underlying market has a profound effect on the liquidity of the related option market. However, there is less agreement about the causal linkages from the OTC interest rate option markets to the underlying markets. Some suggest that the OTC interest rate option markets affect the price volatility and liquidity of interest rate swaps and government bonds, while others argue that there is little, if any, effect.

Glossary of terms

At-the-money (ATM)—Options contracts that give the right to buy or sell the underlying asset at a strike price equal to the current forward price of the underlying asset.

Callable bond—A bond that gives the issuer of the bond the right to redeem the bond before its maturity date. The issuer pays a higher yield to the investor for this right.

Call option—A call option gives the buyer the right, but not the obligation, to buy an asset at a predetermined strike price when the option expires. The buyer of a call option profits if the price of the underlying asset rises above the strike price.

Forward-rate agreement (FRA)—A contract for the exchange of fixed versus floating interest rate payments calculated from a notional principal amount. FRAs are only traded over-the-counter.

Implied volatility—This is the volatility of the underlying asset price of an option implied by the Black-Scholes option pricing model, expected over the lifetime of the option (see, for example, Kolb (2000)). It is a non-linear transformation of the option price.

In-the-money (ITM)—Call options with a strike price lower, and put options with a strike price higher, than the current forward price of the underlying contract.

Interest rate swap—An agreement between two parties to exchange fixed versus floating interest payments on a certain notional principal amount at the start of each of a number of successive periods. An interest rate swap is like a strip of FRAs, each one beginning once the previous one has matured. Interest rate swaps are only traded over-the-counter.

Out-of-the-money (OTM)—Call options with a strike price higher, and put options with a strike price lower, than the current forward price of the underlying contract.

Put option—A put option on an asset gives the buyer the right, but not the obligation, to sell the asset at the strike price at the time of expiry of the option. The buyer of a put option profits if the price of the underlying asset falls below the strike price.

Puttable bond—A bond that gives the investor the right to sell back the bond to the issuer before its maturity date. The investor accepts a lower yield in return for this optionality element.

Short sterling future—A sterling interest rate futures contract, which settles on the three-month Libor rate prevailing on the contract's delivery date. Contracts are standardised and traded between members of LIFFE. The most liquid and widely used contracts trade on a quarterly cycle with maturities in March, June, September and December. Similar interest rate futures contracts exist on dollar, euro and yen Libor rates.

Strike price—The pre-determined price at which an option can be exercised, ie at which the underlying contract can be bought or sold at expiry of the option.

Volatility—The standard deviation of daily percentage changes in the price of a financial instrument or an interest rate.

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Explaining the difference between the growth of M4 deposits and M4 lending: implications of recent developments in public finances

By John Power and Peter Andrews of the Bank's Monetary Assessment and Strategy Division.

The growth of sterling lending by UK monetary financial institutions to the UK private sector has substantially exceeded the growth of UK private sector sterling deposits over the past two years. This article considers the possible influence on this growth differential of two events in the past financial year: the unexpected extent of the Government's cash surplus; and the assumption by the Debt Management Office of responsibility for government cash management. The article also describes how the gap between sterling lending and deposits was financed over the past two years.

Introduction

Although monetary aggregates are no longer officially targeted for monetary policy purposes, analysis of these quantities plays an important role in the Bank's regular assessment of the outlook for inflation.(1) Hence it is important to analyse when and how monetary aggregates are influenced by institutional changes and events that could affect the interpretation given to their growth rates.

Bank deposits and bank lending are ultimately determined by banks and their customers. Deposits are determined by private agents' demand to hold such deposits and the banking sector's willingness (expressed through the deposit rates offered) to accept them. Bank lending is determined by the demand for bank credit, given the interest rates at which banks are prepared to lend and the risks they are prepared to accept. Moreover, lending and borrowing decisions are interrelated through their impact on banks' balance sheets; for example, if banks face strong and profitable demand to lend, they may have to bid interest rates up to attract the required deposits, whether from the UK private sector or from other sources. And bank lending may lead directly to a parallel creation of bank deposits, as additional expenditure by borrowers results in higher bank balances elsewhere in the economy.

In its regular monetary policy analysis, the Bank primarily examines the banking sector's sterling liabilities and assets with the UK private sector. These quantities, known as M4 deposits (M4) and M4 lending (M4L) respectively, constitute a sub-section of the banking sector's overall balance sheet. The Bank focuses on M4 and M4L in particular (rather than the overall levels of banking sector deposits and lending) because, given that these quantities are country and currency-specific, they would be expected to relate closely to UK economic activity.

As part of this analysis, the Bank also studies movements in the full set of the banking sector's assets and liabilities (including loans to, and deposits, from the public sector). This is because, through the balance sheet accounting identities set out below, M4 and M4L are linked to other 'counterpart' banking sector assets and liabilities.

Over the course of 2000/01, M4L grew much more rapidly than M4, and the public sector counterpart accounted for a significant part of the difference. This article considers the possible influence on the public sector counterpart of two developments within the public sector. First, in April 2000, the Debt Management Office (DMO) assumed responsibility for Exchequer cash management. Second, during the course of the financial year, the Government's cash surplus turned out much greater than expected. These developments changed the background against which the borrowing and lending decisions of both bank and private sector agents were made.(2)

(1) See 'Monetary monitoring ranges and the UK monetary framework', November 1997 *Inflation Report*, pages 8–9.
(2) For a discussion of the wider economic significance of the government's budget position and the way in which it is financed, see Kuttner, K and Lown, C (1999), 'Government debt, the composition of bank portfolios, and the transmission mechanism of monetary policy', in K Alec Chrystal (ed), 'Government debt structure and monetary conditions' (Bank of England). More recently, there has also been some interest in the specific effects of the 2000/01 government cash surplus on the monetary aggregates. See, for example, *Lombard Street Research Monthly Economic Review*, December 2000, pages 8–9.

The first section of this article sets out the formal definition of M4 and its accounting relationship with the banking sector's balance sheet counterparts. The second section outlines how the new government cash management arrangements could affect the monetary statistics. The third section details the Government's cash surplus in 2000/01 and its monetary implications. The fourth section accounts for the difference between M4 and M4L growth in 2000/01.

M4 and its counterparts

M4 comprises sterling notes and coin and sterling deposits at, and money market paper issued by, UK monetary financial institutions (MFIs) and held by the UK non-bank private sector (known as the M4 private sector—M4PS). The MFI sector is made up of the Bank of England and other banks and building societies. Transactions that affect M4 must therefore involve an MFI and an agent in the M4 private sector. Data on M4 deposits are obtained from the liability side of MFIs' balance sheets. Table A gives a simplified breakdown of the other components of the banks' balance sheets—the counterparts to M4.(1) Reflecting its claims on other economic agents, the banking sector's assets are composed mainly of its loan book, while its chief liabilities comprise other agents' deposits with the sector. 'Other assets' include any non-lending assets such as the sector's physical assets, while 'other liabilities' include items such as retained profits, capital issues of maturity of more than five years, and reserves.

Table A
MFI sector's balance sheet

Assets		Liabilities	
M4L	Sterling lending to the private sector	**M4**	Sterling deposits from the private sector
FCL	Foreign currency lending to the private sector	**FCD**	Private sector foreign currency deposits
PSL	Lending to the public sector	**PSD**	Public sector deposits
OSL	Lending to overseas residents	**OSD**	Overseas residents' deposits
OA	Other assets	**OL**	Other liabilities

Given that total assets must equal total liabilities, the following identity always holds:

$$M4L + FCL + PSL + OSL + OA \equiv M4 + FCD + PSD + OSD + OL \quad \textbf{(1)}$$

When analysing M4 counterparts, the Bank often looks at the net position of a particular counterpart. So, for example, the public sector counterpart refers to public sector deposits minus public sector lending, PSD-PSL.

Identity **(1)** can be rearranged as follows:

$$M4L - M4 \equiv (FCD - FCL) + (PSD - PSL) + (OSD - OSL) + (OL - OA) \quad \textbf{(2)}$$

That is, the gap between M4 lending and M4 deposits is financed by the sum of the net positions of all the other counterparts.(2)

Implications for monetary aggregates of the transfer of cash management to the DMO

The DMO was established as an executive agency of HM Treasury (HMT) in April 1998. Its function is to carry out the Government's debt management policy of minimising financing costs over the long term (taking account of risk), and to manage the aggregate cash needs of the Exchequer in the most cost-effective way. The DMO assumed responsibility for gilt issuance when it was established, and in April 2000 it assumed responsibility for Exchequer cash management.

Prior to the transfer of responsibility for cash management, changes in the government's day-to-day cash position were typically accommodated through the government's overdraft account at the Bank of England (Ways and Means account (W&M)), and the effect on the market was offset within the Bank's open market operations. For example, a government cash surplus of £100 million would, other things being equal, reduce the W&M account by £100 million and increase the day's money market shortage(3) by the same amount.(4) It would also have been conceptually possible to conduct operations in other short-term assets to manage the cash position (for example through central government cash

(1) The counterparts are published in Table A3.1 of the Bank's monthly publication *Monetary and Financial Statistics*.
(2) Identity **(2)** can be rearranged so that movements in M4 are presented in terms of the public sector net cash requirement (PSNCR), M4 lending and, broadly, the balance of payments. Given that the PSNCR is financed by sterling borrowing, debt sales to M4PS, and other foreign currency and external flows, it follows that the sterling component of lending to the public sector in **(2)** can be replaced with the PSNCR minus its other financing components. The link to the balance of payments is achieved by bringing together all the other external (non-resident and foreign currency) flows. This alternative version is published in Table A3.2 of *Monetary and Financial Statistics*.
(3) That is, the market's need to borrow from the Bank in its daily open market operations (OMOs).
(4) The W&M balance would also have been affected when the Bank advised HMT to raise or lower the issuance of Treasury bills; but such advice reflected overall money market conditions rather than the Government's cash position specifically.

deposits), but changes in these assets were generally small and not planned.

After the transfer of responsibility for cash management, there were two major changes in the management of short-term public finances. First, the level of the government's W&M overdraft at the Bank was fixed at its end-March 2000 level (with subsequent changes possible on agreement between HMT and the Bank).(1) Second, the DMO could conduct its own transactions in the market (typically by entering into sale and repurchase or 'repo' agreements) with its own set of counterparts. In practice, this meant that the DMO could trade in assets similar to those eligible for the Bank's open market operations (selected commercial bank bills, repos of UK and selected European government debt etc), but at market interest rates and at a wide range of maturities. In autumn 2000, this set of securities was widened to include selected certificates of deposit (CDs), selected commercial paper, and other short-term debt issued by high-quality issuers.(2)

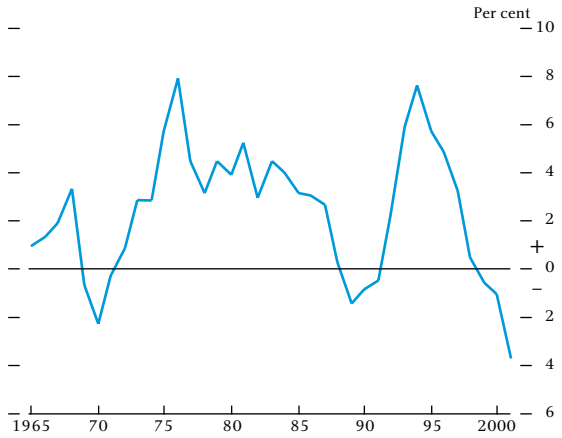
The box illustrates how the cash flows associated with a government receipt of £100 million have changed between the old and new cash management arrangements.

As the example shows, the *net* effects on the M4 system of the transfer of cash management to the DMO are minimal. There is no structural change to the M4/M4L aggregates themselves;(3) given that the DMO is not part of the M4 private sector its operations do not directly affect M4. However, there could be changes in the *composition* of the public sector counterpart, with fluctuations in both lending and deposit components possible under the new arrangements. The DMO can use a combination of both sides of its balance sheet to accommodate any particular position. One possible consequence of this is that the *total* assets and liabilities of the banking system could be greater than they would otherwise have been. However, assuming that DMO trade with MFIs exactly substitutes for the Government's previous use of the W&M account at the Bank, the *net* position of the public sector, and of the banking system, should remain unaffected.(4)

Implications of the Government's unanticipated cash surplus(5)

In the 2000 Budget the Government forecast an overall central government net cash requirement (CGNCR) of -£4.1 billion for the financial year 2000/01. But the actual cash requirement for that year proved to be far lower, standing at -£35.2 billion (3.7% of GDP) at the end of March 2001. Of this extra cash, £19.5 billion arose from proceeds of the 3G auction(6) (the original estimate of proceeds at the time of the 2000 Budget was £3 billion; the outturn was £22.5 billion), with the rest owing to a generally more favourable fiscal position than expected. As Chart 1 shows, the magnitude of this surplus reached a historical high in 2000/01.

Chart 1
CGNCR as a proportion of nominal GDP(a)



(a) Annual flows at financial year-end. A negative CGNCR denotes a surplus.

Faced with this surplus, there were a number of options open to the Government: it could cut back on its gilt issuance programme (projected at £12.2 billion for 2000/01); or through the DMO it could use its short-term cash management instruments to accommodate the extra cash by holding some other assets. Given that the level of projected gilt issuance was already quite low while market demand for long gilts

(1) It was also agreed that the DMO would hold a £0.2 billion cash deposit at the Bank.
(2) See the DMO screen announcement dated 9 November 2000 (available on the DMO's web site at www.dmo.gov.uk) for details of the additional instruments adopted by the DMO.
(3) The pattern of day-to-day flows into and out of M4L could change as a result of changes in the daily money market shortage. As mentioned in the box, transactions to clear the daily shortage can affect M4L when the Bank carries them out with an OFC. Following the DMO's assumption of responsibility for government cash management, the money market daily shortage is no longer influenced by changes in the government's cash position. Although this could affect day-to-day OMOs between the Bank and OFCs, it should not result in a permanent change in the level of M4L.
(4) In practice the DMO also trades with non-MFIs.
(5) The cash surplus itself could well be associated with other macroeconomic effects (for example via the fiscal stance), but here we are concerned only with further effects coming via the monetary aggregates.
(6) The Government's auction of third-generation mobile telecommunications licences.

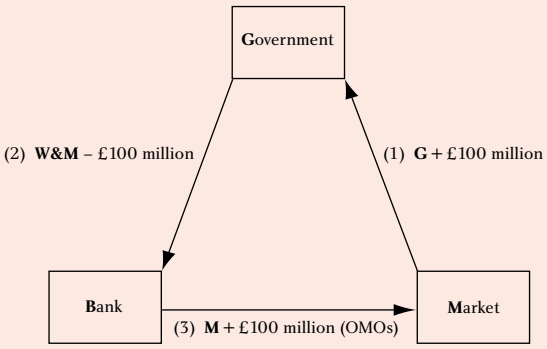
The cash flows involved in a government receipt of £100 million under both cash management arrangements

We consider flows between three agents—the market (which includes all private sector agents: commercial banks, other financial institutions etc), the government, and the Bank of England.

Old arrangements

Chart A illustrates three distinct cash flow stages involved under the old arrangements.

Chart A



(1) The government receives £100 million from the market (eg from taxes or through the proceeds of gilt issuance). To the extent that private agents run down their bank deposits to pay for the gilts or taxes, there is an effect on M4. This effect is independent of the cash management arrangements.

(2) The government's receipt is accommodated by reducing its overdraft at the Bank (W&M account). As this transaction involves an MFI (Bank of England) and the government, the public sector counterpart is directly affected. **A reduction in the W&M account reduces the lending component of the public sector counterpart.**

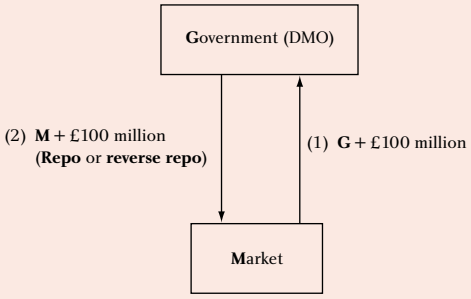
(3) As a result of the initial transfer of cash from the market to the government, the shortage increases by £100 million, requiring the Bank to conduct additional OMOs.

The Bank's OMOs directly affect M4L only when the counterpart is an 'other financial corporation' (OFC),[1] as operations between the Bank and other banks do not score in the M4 system. Typically, however, the Bank conducts OMOs with both bank and OFC counterparts to clear any particular shortage. Subsequently it is difficult to identify whether movements in OFCs' M4L reflected a specific government position. **Moreover, the ultimate impact of OMOs on either M4 or M4L is impossible to quantify as after the initial shortage is cleared, M4 could be affected by subsequent transactions within the market.** (For example, after clearing the shortage with the Bank, an OFC could lend the funds on to another bank, increasing M4, or repay a debt to a bank, reducing M4L.)

New arrangements

Chart B illustrates two distinct cash flow stages under the new arrangements.

Chart B



(1) The first-stage transaction remains the same under the new arrangements—the government (DMO) receives £100 million from the market. As under the previous arrangements there is an effect on M4 to the extent that private agents draw down bank deposits to make the payment.

(2) However the DMO can now use these funds in the market either to reduce the government's short-term debt (through reverse repo operations) or increase its deposits (by increasing repo assets). **These transactions would affect either the lending or the deposit components of the public sector counterpart respectively if the trades are carried out with an MFI.**

There is no third stage between the Bank and the market as the original shortage created by the government is accommodated through the DMO's own market transactions.

(1) Other financial corporations comprise investment institutions, such as insurance companies and pension funds, and other companies such as securities dealers. These financial intermediaries are considered to be part of the M4 private sector. As a result, OFCs' asset and liability positions with banks and building societies enter the M4 and M4L statistics while their positions *vis à vis* other members of the M4 private sector do not.

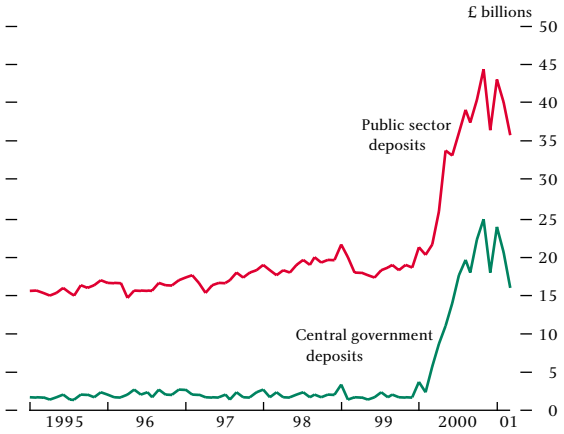
(particularly from institutional investors) was strong, the Government decided to reduce gross gilt issuance only moderately. Indeed, HMT had already decided on a number of contingency measures in the 2000 Budget in the event of a bigger cash surplus. These measures included: reducing the Ways and Means overdraft at the Bank; cutting back the target year-end level of Treasury bill stock; pre-financing foreign currency debt due to mature in 2000/01; as well as buying back gilts from the market. However, the extent of the cash surplus could not be accommodated by the measures initially proposed (although they were increased over the course of the year). At the time of the November Pre-Budget Report, and subsequently reiterated in the 2001 Budget, the Government decided that the rest of the surplus would be maintained as a short-term liquid asset position to be run down over the following three financial years. Table B illustrates how HMT's projection of the Government's cash requirement fell over the financial year and the instruments used that would accommodate the extra cash.(1)

Table B
Development of the 2000/01 CGNCR projection from Budget 2000 to Budget 2001

Change in the CGNCR projection	-28.4
Accommodated by:	
Reductions in long-term debt and increase in reserves	-10.0
Contingencies	
Repayment of Ways and Means account	-3.6
Reductions in Treasury bill stock	-6.5
Short-term cash position (increase)	-11.7
Residual and other factors	+3.4

As Chart 2 shows, central government deposits (and overall public sector deposits) with MFIs increased sharply over the course of 2000/01. This was largely as a result of DMO activity in the repo market, and reflected the build-up of the short-term cash position.

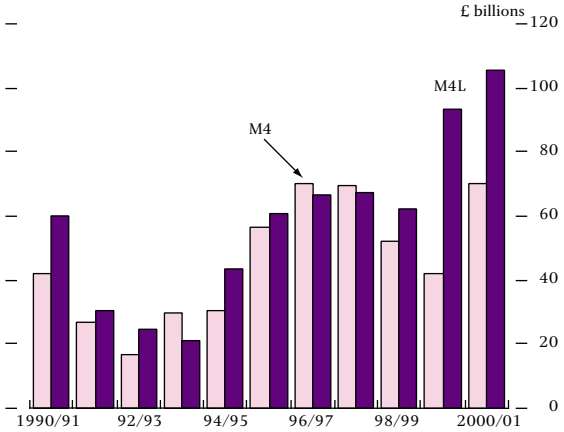
Chart 2
Public sector and central government deposits with MFIs



The gap between M4 deposits and M4 lending

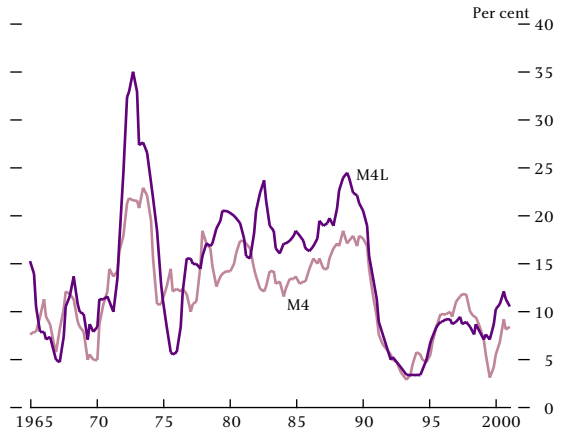
Chart 3 shows that the flows into M4L have substantially exceeded those into M4 since 1999. This has meant that a gap has opened up between the growth rates of M4 and M4L (see Chart 4).(2)

Chart 3
Annual flows into M4 and M4L(a)



(a) Annual flows are on a financial-year basis.

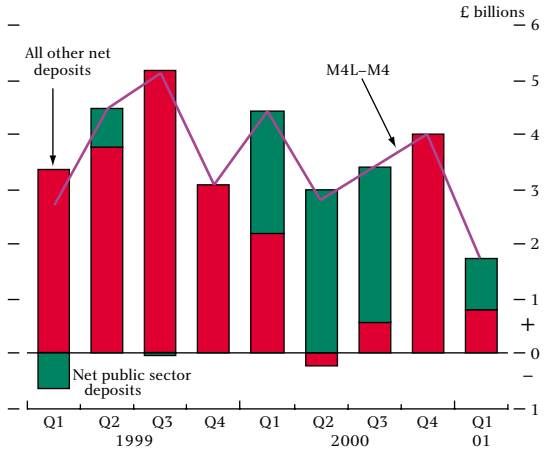
Chart 4
Annual growth rates of M4 and M4L



Given that flows into M4L were greater than flows into M4 over the past two years, by definition (and as implied by identity **(2)** above) there must have been a net inflow of deposits from (or a reduction in lending to) the other counterparts to account for the gap. Chart 5 decomposes the gap between M4 and M4L flows into the public sector counterpart contribution and all other net

(1) For a fuller description, see Table 3 of the *Debt and Reserves Management Report 2001–02* (HMT).
(2) The flows gap between M4 and M4L does not directly translate to the growth rates gap, as the levels of M4 and M4L are not the same. However, in the Bank staff's regular briefing on monetary conditions to the MPC, the growth rates of both aggregates are presented to illustrate the trends in both aggregates, which helps to inform the analysis of inflationary pressures and the outlook for demand.

Chart 5
Financing the gap between M4L and M4(a)



(a) Average monthly flow in each quarter.

counterpart contributions since the gap started to appear in 1999.

Net inflows into public sector deposits accounted for a substantial part of the gap between M4 and M4L flows for the first three quarters of 2000. This is consistent with a substantial part of the Government's cash surplus in 1999/2000 and 2000/01 having been accommodated in net public sector deposits. But the chart suggests that other counterparts have also accounted for a material part of the gap. Table C draws together a more detailed map of how the gap between M4 and M4L was financed over the past two financial years by presenting the contribution of each of the counterparts outlined in Table A.

Table C
Explaining the gap between M4 deposits and M4 lending(a)

£ billions

	1999/2000	2000/01	Difference
M4 lending	93.2	105.7	+12.5
M4 deposits	42.2	69.9	+27.7
'Gap'	*51.0*	*35.8*	*-15.2*
Financed by: (b)(c)			
Net deposits from public sector	+8.5	+20.0	+11.5
Net fc deposits from M4PS	-7.2	+0.2	+7.4
Net £ deposits from non-residents	+22.1	+14.0	-8.1
Net fc deposits from non-residents	+13.1	-23.6	-36.7
Net other liabilities	+14.5	+25.2	+10.7

(a) Annual flows.
(b) £ and fc refer to sterling and foreign currency respectively.
(c) Positive numbers mean a rise in banks' net deposits from that sector.

In isolation the £20 billion rise in net deposits from the public sector in 2000/01 made a significant contribution to financing the 'gap' of £35.8 billion. But the contribution from net other liabilities was also very strong. These factors, which both increased the gap, were partially offset in an accounting sense by a rundown in net foreign currency deposits from non-residents. During 1999/2000 the main financing counterpart was net non-resident sterling deposits.

Conclusion

The new cash management arrangements allow fluctuations in both deposit and lending components of the public sector counterpart. The net position of the counterpart should, however, remain unchanged compared with the old arrangements. The build-up of public sector deposits resulting from the Government's cash surplus contributed positively to financing the gap between M4 and M4L in 2000/01, but other factors have also been important. This illustrates that we cannot draw simple inferences from the behaviour of individual counterparts in Table C as, ultimately, bank deposits and bank lending are determined by the interrelated behaviour of banks and their customers. If the Government's cash surplus had not occurred (and consequently if the public sector counterpart had been much lower), the gap between M4 and M4L would not necessarily have been smaller; other counterparts could have changed to finance the gap.

Using surveys of investment intentions

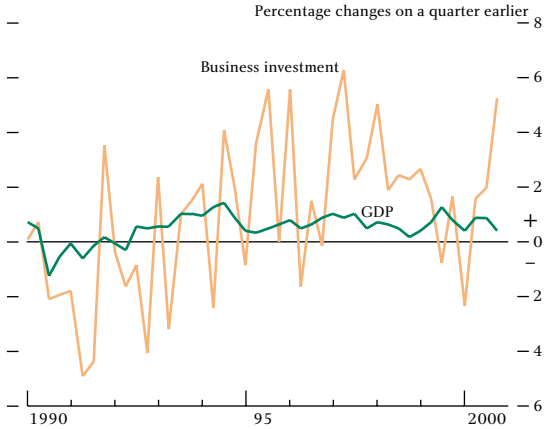
By Jens Larsen of the Bank's Monetary Assessment and Strategy Division and Rain Newton-Smith of the Bank's Structural Economic Analysis Division.

Business investment is an important component of aggregate demand in the UK economy. But it is volatile and difficult to predict. Surveys of investment intentions provide a timely and useful source of information on future investment plans, and can be used to forecast changes in business investment. This article describes a model that uses surveys of investment intentions to forecast business investment, and compares its forecast performance with the business investment equation in the Bank of England's macroeconometric model.

Introduction

'Business investment' is an important component of aggregate demand, accounting for around 14% of GDP in 2000. But as Chart 1 indicates, business investment is volatile; and it is difficult to predict its quarterly growth path. So any extra evidence that can be brought to bear is potentially valuable. Surveys, which provide a direct and timely indication of firms' investment intentions, are one potential source of such evidence.

Chart 1
Growth in business investment and GDP



This article examines the information that surveys of investment intentions can provide about the future growth of business investment in the UK economy. The first section looks at the components of business investment in detail. The second section outlines the main economic determinants of investment growth. The third section explores surveys of investment intentions, and describes a model of investment that uses these surveys. The fourth section examines the forecast performance of this survey model, and finds that the model provides a useful source of additional information about future business investment.

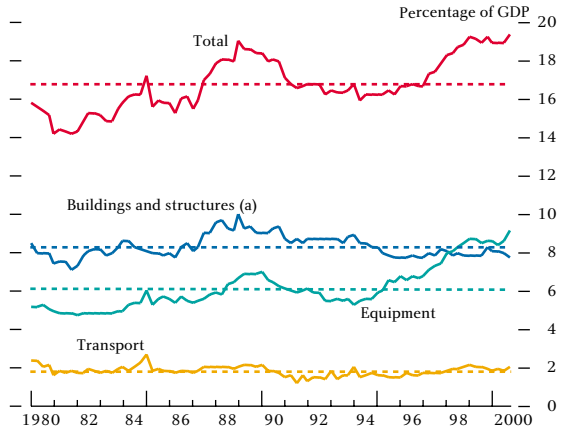
Components of business investment

'Business investment' accounted for 75% of 'whole-economy investment' in 2000, with the other main components being private dwellings investment (14%) and government investment (7%). Business investment comprises spending by firms on different assets. The three main asset categories are machinery and equipment (denoted in Chart 2 as equipment), buildings and structures, and transport equipment. But an asset breakdown of investment is available only for whole-economy investment. Chart 2 shows the ratio of whole-economy investment to GDP by asset; as the chart illustrates, the share of equipment investment in the total has increased steadily over much of the past decade.

Chart 3 shows the breakdown of business investment by sector.(1) Service sector investment is the largest component of business investment, and has been growing in importance, reflecting the growth in the share of activity accounted for by the service sector. Manufacturing investment as a proportion of GDP has declined slightly since 1994. The importance within

(1) Some of the increase in the ratio of business investment to GDP since 1994 will reflect a shift of investment expenditure from the government to the private sector via the Private Finance Initiative (PFI). Non-dwelling investment by public corporations is also included in business investment.

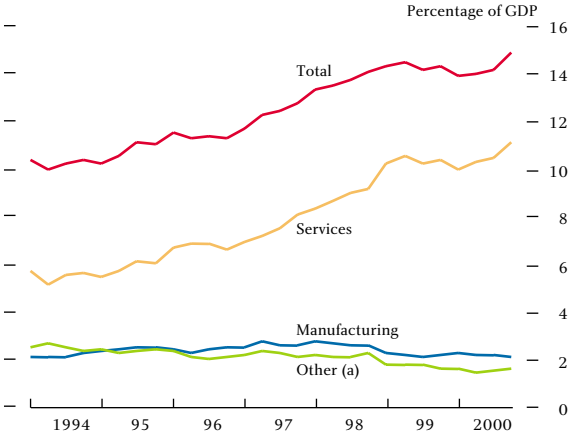
Chart 2
Whole-economy investment/GDP by asset (at constant prices)



Note: Dashed lines show the mean for the period.

(a) Includes private dwellings investment.

Chart 3
Business investment/GDP by sector (at constant prices)



(a) Other includes investment by construction companies, 'other production', and non-manufacturing public corporations. 'Other production' includes agriculture, mining and utilities.

business investment of 'other sectors', which include construction companies, mining and utilities, has declined since 1994.

Modelling business investment

The outlook for business investment is an important element of the relative balance between demand and supply pressures in the economy and hence the outlook for inflation. One approach to forecasting the outlook for business investment is to model the behaviour of firms in the economy. The Bank of England's macroeconometric model (MM), for example, can be used to analyse how firms' investment will respond to changes in the economic environment. The model assumes that firms invest to achieve their desired stock of capital.(1) The flow of gross investment depends on how rapidly existing capital needs to be replaced, ie the rate of depreciation, as well as how much additional capital, if any, firms wish to acquire. The demand for new capital is assumed to depend, in turn, on the productivity of capital and the cost of purchasing the new capital. How quickly firms will invest to reach their desired capital stock will depend on adjustment costs.

A model of investment based only on evidence of firms' past adjustment to an estimate of their desired capital stock is often an inadequate description of future investment behaviour. There are several reasons for this. One reason is that the simple characterisation in the MM is an incomplete description of the investment decisions that firms make in practice. Investment decisions are forward-looking and hence are subject to uncertainty about the future productivity of capital. Many investment decisions are also costly to reverse or are irreversible. There can be sunk costs of installing a new piece of capital equipment, and it may not be possible to resell the equipment in secondary markets.

One modelling strategy is to try to incorporate uncertainty and the irreversibility of investment decisions into a model of firm behaviour, but the cost of doing so is greater complexity. And more complex models may still fail to capture investment behaviour adequately. An alternative is to use a simple model based on the behaviour of firms and then to exploit information from other sources, such as surveys of investment intentions, to improve the model's performance. Surveys of investment intentions have the advantage that they are, by their nature, forward-looking.

Surveys of investment intentions

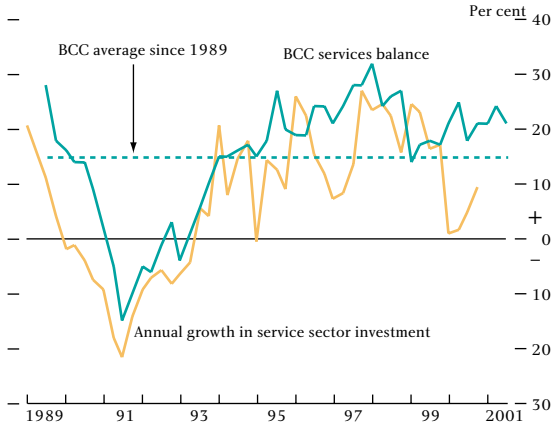
Unlike a model of business investment, surveys of investment intentions provide direct information on firms' plans for future investment. There are numerous surveys that ask firms about their investment intentions. These surveys are a useful and timely source of information.(2) Here we analyse two surveys: the British Chambers of Commerce (BCC) *Quarterly Economic Survey*, and the Confederation of British Industry (CBI) quarterly *Industrial Trends Survey*.(3)

(1) For further details of the business investment equation, see *Economic models at the Bank of England: September 2000 update*, available at www.bankofengland.co.uk/modcoupdate.htm
(2) See Britton, E, Cutler, J and Wardlow, A (1999) for a summary of how the Bank uses surveys to inform the MPC's economic assessment.
(3) There are other surveys that include questions on investment intentions, but we focus on these two surveys as they have large samples and have been conducted over a long time period. The BCC survey covers approximately 7,000 firms and the CBI's around 900 firms.

With regard to investment intentions, the CBI survey asks manufacturers: 'Do you expect to authorise more or less capital expenditure in the next twelve months than you authorised in the past twelve months?' The options presented to the firms are more, less, or the same. And the BCC's survey asks manufacturers and service companies separately: 'Over the past three months, which changes have you made in your investment plans for plant and machinery?' The possible responses are revised upwards, revised downwards or no change.

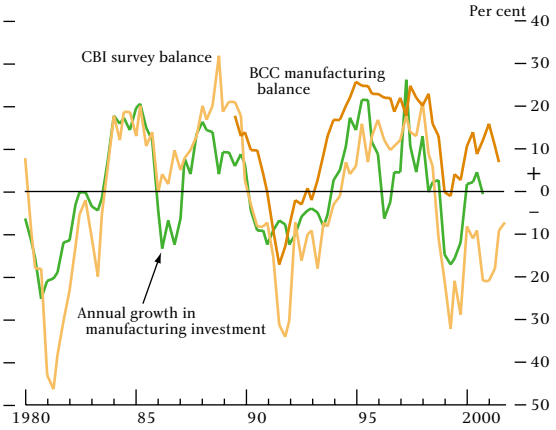
How do the qualitative answers to these questions relate to actual investment? The surveys are asking firms qualitative questions about their investment plans. A simple way of quantifying this information is to use the balance statistic—the difference between the percentage of companies reporting an increase and the percentage of companies reporting a decrease.(1) This balance can then be related to investment growth: a more positive balance suggests higher intended investment growth. Since the surveys relate to investment plans, lagged survey balances tend to have a higher correlation with current investment growth than do current survey balances. Charts 4 and 5 plot survey investment intentions for plant and machinery lagged by two quarters along with annual growth in sectoral services and manufacturing investment.

Chart 4
Services investment intentions



The BCC services balance statistic lagged by two quarters and the annual growth in service sector investment are highly correlated, though there are times when the relationship has diverged: notably in 1996 and in 2000. The annual growth in manufacturing

Chart 5
Manufacturing investment intentions



investment is also reasonably well correlated with both the CBI and the BCC manufacturing balance statistics. In terms of total business investment, the BCC services balance is more informative as service sector investment is the dominant component.

Building a survey-based model for business investment

The balance statistic can be made more directly comparable with actual investment by regressing investment for the relevant sector on the balance statistic. A similar approach is used at the Bank of England for quantifying other qualitative surveys, such as some inflation expectations surveys. But this simple approach does not fully exploit the informational content of the surveys. For business investment, we have developed a more complex model that generates projections for business investment growth over the next four quarters. It uses three sources of information: the BCC's *Quarterly Economic Survey*, the CBI's quarterly *Industrial Trends Survey*, and the 'construction new orders' series published by the Department of the Environment, Transport and the Regions. We match these three sources with investment data as follows. Manufacturing investment in 'other machinery and equipment' is matched with the CBI survey. For service sector investment, we match the BCC services survey with whole-economy investment in 'other machinery and equipment' minus manufacturing investment in 'other machinery and equipment'. This is because an asset breakdown of service sector investment alone is not available.(2) In addition to business investment in machinery and equipment, the other main asset

(1) See Cunningham, A (1997), which provides a detailed account of how qualitative surveys can be used to produce quantitative estimates for data series.
(2) This means that investment by government in plant and machinery will be included in this proxy for service sector investment.

category of investment is buildings and structures.(1) To obtain a projection for this component of business investment we use construction new orders. Construction new orders are the total number of future contracts signed by construction companies. So lagged construction new orders are related to construction output, and also to firms' expenditure on buildings and structures. We add together these three projections (one for the service sector, one for manufacturing, and one for buildings and structures investment) to produce a proxy for business investment.(2)

Modelling firm behaviour and creating a projection

We also make assumptions about the way in which firms form their investment plans.(3) Since the CBI question asks explicitly about plans over the next year, we lag it by four quarters when interpreting current investment trends. The BCC survey is also lagged by four quarters since it asks about plans, which, for the purposes of the model, we interpret as having a one-year horizon. For simplicity, we also lag construction new orders by four quarters. We then assume that firms' expressed investment intentions are accurate reflections of their investment plans. Firms report these plans as their investment intentions, and we make assumptions in order to relate the aggregate statistics reported by the BCC and CBI to plans made at the firm level. These assumptions can be used to estimate a model that generates a projection for investment four quarters ahead.(4)

But we also want to generate projections at shorter horizons—and at these shorter horizons, more information will be available. For example, assume that firms form plans at t–4 for investment in the period from t–4 to t. At time t–3, firms will have undertaken some of that investment and formed a new plan for investment up until t+1. This new plan may include revisions to planned investment for the remaining three quarters up to t. The new plan will be reported in the survey of investment intentions at t–3. We can use the relationship between the survey at t–3 and actual investment in t–4 to improve our forecast.(5) We formulate and estimate similar models for updating the investment projection for time t, using information from quarters t–2 and t–1, ending up with four empirically based models for projections of investment at one to four-quarter horizons.

Assessing the forecast performance

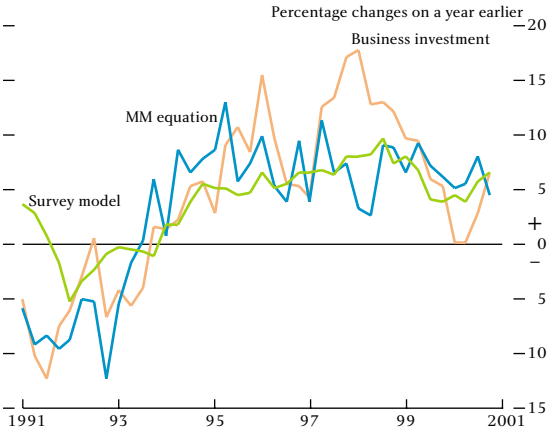
To assess the forecast performance of the survey model, we compare its projections at the one to four-quarter ahead horizons with the Bank's macroeconometric model (MM) equation for business investment.(6) Such a comparison is not straightforward however. The MM equation uses lagged values of GDP growth and the cost of capital to model firms' investment behaviour. Ideally, we should use the values of GDP and the cost of capital that were available at the time preceding each forecast. Also, for periods more than one quarter ahead, we should use predicted rather than actual values for these exogenous variables over the forecast period. For simplicity, however, we use the most current data for these variables. This gives the MM equation an informational advantage over the survey model.

Chart 6 compares the four-quarter ahead forecasts from the survey model and the MM equation with actual growth in business investment. We can see that both models perform reasonably well on average but both fail to capture the volatility of business investment growth. It is hard, however, to draw further conclusions on the relative forecast performance of the survey model and MM equation on the basis of the chart alone. It is helpful to look at some summary statistics of forecast performance.

In the table below we report the root mean square errors (RMSEs) of the model forecasts.(7) We find that the survey model does not outperform the MM equation at the one-quarter horizon (3.57 compared with 2.29), but it does so at the four-quarter horizon (4.03 compared with 4.46). The relative forecast performance of the

(1) For simplicity, we have not included investment by the business sector in vehicles in our model. This data series is available only for manufacturing and its weight is small; approximately 4% of total manufacturing investment. There is also no equivalent survey question on vehicle expenditure.
(2) This series is only a proxy for business investment; we have added together three components from the asset breakdown in order to proxy a component of the sectoral breakdown. But the proxy is highly correlated with business investment both in level and in annual and quarterly growth rates (correlation coefficients of 0.99, 0.90 and 0.79 respectively).
(3) See Larsen, J (1999) for a detailed description of the assumptions underlying the model.
(4) See Pesaran, H (1984) for a fuller discussion of modelling firms' expectations.
(5) See Cuthbertson, K (1996) for a formal derivation of this result.
(6) The comparisons presented here are based on internal work with John Power of the Bank's Monetary Assessment and Strategy Division.
(7) The root mean square error (RMSE) is the square root of the difference between the forecast value and the actual outturn for business investment. A lower RMSE indicates a superior forecast performance. Here the comparisons are based on the forecasts in log levels for the period 1991 Q1 to 2000 Q3.

Chart 6
Four-quarter ahead forecast comparison



survey model improves at longer forecast horizons, which could reflect the forward-looking nature of the surveys since they ask directly about investment plans. In other words, the survey model provides relatively more information for periods beyond one quarter ahead.(1)

Forecast comparisons: root mean square error (RMSE) (x 100)

	One quarter ahead	Four quarters ahead
Survey model	3.57	4.03
MM equation	2.29	4.46
Adjusted model	2.25	4.06

We also tested for the significance of the difference in forecast performance between the survey model and the MM equation. We calculated the probability of the models producing the difference between the RMSEs reported here when in fact the RMSEs are the same, ie they actually have the same forecast performance. The probability that the survey model and the MM equation have the same forecast performance one quarter ahead is fairly low at 12%. At the four-quarter horizon, however, it is much more likely, ie with a probability of 68%, that the two models perform equally well. Neither of the differences, however, is statistically significant.

Using survey information efficiently

Although at horizons of around a year the survey model outperforms the MM equation, it cannot replace it. First, since the survey model only uses data on investment intentions, we cannot use it to simulate how firms' investment behaviour will respond to changes in the economic environment. For instance, it cannot tell us how investment will respond to a change in interest rates. Second, for the survey model to produce a projection further than one year ahead, we would need to model firms' investment intentions. A model of investment intentions would in turn need to be based on the behaviour of firms, which would be similar to the current MM equation; the survey model can be a complement to the MM equation, but not a substitute. So does the survey model provide information that is not already contained within the business investment equation? And how can we adjust the MM equation forecast to incorporate information from the survey model?

To explore these questions, we regressed the level of business investment on both the levels of the survey model projections and the MM equation projections.(2) The resulting coefficients were used to weight together the two forecasts in order to produce an adjusted forecast for business investment using both these sources.(3) This forecast is called the adjusted model in the table.

We found two things. First, the weight that should be given to the survey model increased as the forecast horizon increased, eg a greater weight was given to the surveys at the four-quarter ahead horizon than at the one-quarter ahead horizon. This concurred with our previous results, which showed that the relative forecast performance of the survey model improved as the forecast period lengthened. This could reflect the fact that over longer periods, timing issues related to implementing investment plans are less influential. Second, we found that the forecast performance of the adjusted model using both sources outperformed the MM equation. This provides some evidence that the survey model contains different information from that contained within the MM equation, and adds value to the MM forecast. The incremental information of the survey model over the MM equation may reflect the forward-looking nature of the surveys. Again, the survey model cannot replace the MM equation, but our results provide evidence that the survey model is a useful (but not exclusive) source of information for a forecast of business investment.

(1) We also compared the survey model with a simple statistical model, which relies on past observations of the variable itself to generate short-run projections. Again, we found that the survey model outperformed the statistical model at the four-quarter horizon but not at the one-quarter horizon.
(2) Since the two models are forecasting the same variable, they should tend to move together over time.
(3) We did not restrict the OLS coefficients to sum to unity, since this weighted average technique has been shown to be inferior to an unrestricted model; see Granger, C and Ramanathan, R (1984).

Conclusion

This article outlines how the qualitative information from surveys of investment intentions can be used to forecast the growth of business investment. It describes how the Bank has constructed a model based on these surveys, and shows that the relative forecast performance of this model improves as the forecast period lengthens. It also provides evidence that the survey model contains useful information that is additional to the Bank's MM equation for business investment. The added value of the survey model may reflect the forward-looking nature of the survey balances.

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Can differences in industrial structure explain divergences in regional economic growth?

By Beverley Morris of the Bank's Conjunctural Assessment and Projections Division.

During the early to mid-1990s, the pace of economic growth in the South was broadly comparable with that in the rest of the United Kingdom. During 1996–98, however, the pace of activity in the South strengthened considerably relative to the rest of the country. This article investigates one possible explanation for divergences in growth between the two regions—namely differences in the relative importance of the manufacturing and service sectors. The results suggest that such differences in industrial structure do not account for the majority of the regional divergences in growth. Rather, it appears that they are explained mostly by a pick-up in population growth and stronger service sector activity in the South relative to that in the rest of the country over the period.

Introduction

The Bank of England has a responsibility to monitor regional and sectoral information for the purposes of formulating monetary policy. Examining the differences in economic activity between the regions can improve understanding of the nature of economic cycles, and of the transmission of policy changes through the national economy.

One possible explanation of any disparity in regional economic growth rates is that it reflects regional differences in industrial structure. This article assesses the extent to which such differences can explain observable differences in rates of regional economic growth.(1)

Regional GDP growth

Regional GDP data in current prices are published annually by the Office for National Statistics. Table A shows average annual growth of nominal GDP for Scotland, Wales, Northern Ireland and England's regions for 1990–99.(2)

Table A shows that nominal GDP growth in the southern regions of the United Kingdom was somewhat stronger than in almost all the other UK regions over the period. However, the data in the table conceal considerable variation in regional growth rates from year to year and how the relative performance of the regions has changed over time.

Table A
Nominal GDP

Average annual growth 1990–99; per cent

Northern Ireland	6.2
South East	6.2
London	6.0
East	6.0
South West	5.5
West Midlands	5.3
East Midlands	5.3
Scotland	5.3
Yorkshire and the Humber	5.2
Wales	4.9
North West	4.6
North East	4.2
United Kingdom	**5.5**

It is difficult to analyse and present a comparison of the twelve regions, so for simplicity we group them—in this case, into the 'South'(3) and the 'rest of the United Kingdom'.

Chart 1 shows nominal GDP growth for the two regional groupings over the 1990s.(4)

Regional GDP data are available only in current prices. So published GDP growth in a particular region

(1) This article does not address the related issue of regional differences in the level of GDP per capita and how they may relate to differences in economic prosperity across regions.
(2) A longer time series on a consistent basis is not currently available, following recent revisions to the regional accounts to bring the data into line with the new European System of Accounts 1995 (ESA95).
(3) The 'South' covers London, the South East and the South West—based on government office regions, as shown in Table A. It is worth noting, however, that any such grouping into regional areas is arbitrary. Alternative definitions of the 'South' (eg including the East, which includes sub-regions close to London) would give slightly different results.
(4) It is important to highlight the provisional nature of these data. Regional GDP data are revised on an annual basis, taking account of revisions to the UK total included in *UK National Accounts—The Blue Book*, as well as revised regional indicator data. In particular, regional estimates of wages and salaries for 1997 to 1999 are not yet available from the Inland Revenue. When available, these will replace the employment and earnings survey estimates currently being used for these years.

Chart 1
Nominal GDP growth

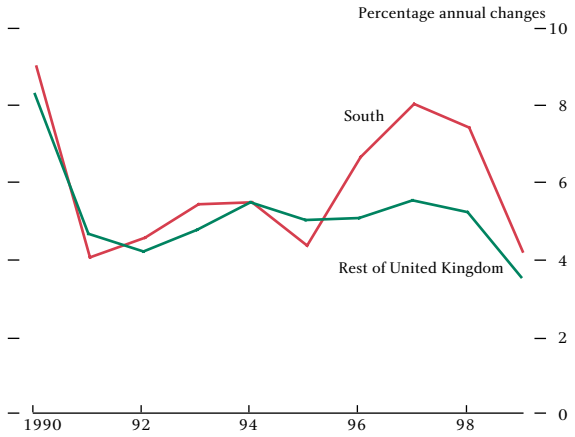
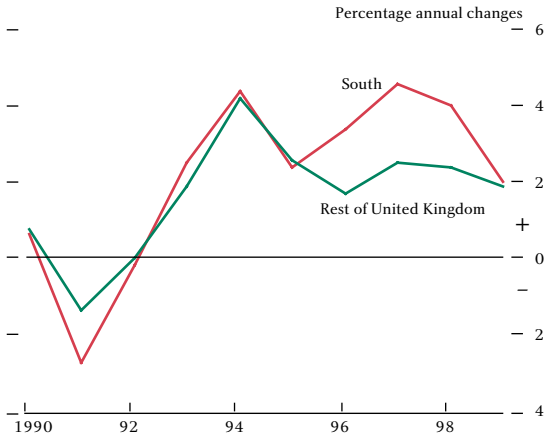


Chart 2
Estimates of real economic growth



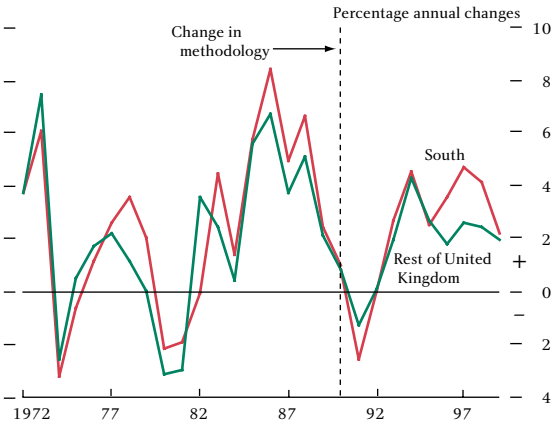
reflects not only an underlying increase in economic activity, but also any increase in prices during the period. To analyse trends in real activity (or 'economic growth'), we need to deflate the data to remove the effects of price changes.

There are, however, no regional price data, so the best we can do is construct proxy estimates from the available national data. There are national implied deflators for the different sectors (eg manufacturing and services);(1) weighting these together according to a particular region's industrial mix gives a crude proxy for the corresponding regional output price deflator.(2) This takes account of the different industrial mix in different regions, but makes the simplistic assumption that the rate of sectoral inflation is common across the country; for example, that the change in manufacturing prices is the same in all regions. Since there is no way of testing if the proxy is accurate, the conclusions of this article are necessarily qualified by the possibility that regional rates of output price inflation differ.

Chart 2 shows estimates of real economic growth for the two regional groupings, based on nominal GDP data deflated by the regional output price proxies.(3) Though the two regional groupings recorded similar rates of growth during the early to mid-1990s, activity diverged considerably during 1996–98—the average difference in annual growth during this period was around 2 percentage points. The pace of activity converged again in 1999 (the latest data available).(4)

Although not consistent with the published regional accounts series, an examination of previously published historical data suggests that the magnitude of the divergence during 1996–98 is not unprecedented (see Chart 3). Although growth in the two regions has tended to follow a very similar pattern, average growth in the South was higher than in the rest of the United Kingdom during the previous two decades as well.

Chart 3
Estimates of historical real economic growth



(1) Taken from the *UK National Accounts—The Blue Book, 2000 edition.*
(2) Any attempt to deflate o fficial nominal regional GDP data using national output price indices will necessarily be imprecise. As such, it is important to note that the resulting estimates of real economic activity should not be assumed to be of similar quality to the published official (nominal) regional data or to the data published by the ONS more generally. Consequently, the limitations of these estimates of real economic growth should be borne in mind when reading this article. These issues are discussed in more detail in the December 2000 issue of *Economic Trends*, in which the ONS provides a methodological guide to the published regional GDP data.
(3) It is worth noting that, despite taking into account regional variations in industrial structure, the constructed estimates suggest only small differences in movements of regional output price deflators during the 1990s.
(4) Clearly these regional groupings can conceal considerable intra-regional movements. Most of the regional divergence that began in 1996 was accounted for by a downturn in growth in Scotland, Wales, the West Midlands and Northern Ireland. Similarly, while all regions recorded lower growth in 1999 compared with 1998, a significant slowdown in growth in London was responsible for most of the convergence in growth between the two regional groupings.

Population

Differences in regional activity may reflect differences in the pace of population growth. The contribution from population growth can be removed by examining output per capita (see Chart 4).(1)

Chart 4
Estimates of real economic growth per capita

Estimates of real regional economic growth per capita follow a similar pattern to that shown in Chart 2. That is, economic growth per capita in the South strengthened compared with that in the rest of the United Kingdom during 1996–98. However, the differential is less marked than in Chart 2, suggesting that relative population growth contributed to part of the divergence. For example, stronger population growth in the South accounted for around 0.6 percentage points of the 2.1 percentage point differential in real economic growth between the two regions during the peak of the differential in 1997.

Industrial structure

Divergences in economic growth may also reflect regional differences in industrial structure. Table B compares the proportions of total value added accounted for by the various sectors in the two regional groupings. Clearly there are significant regional differences in the relative importance of the manufacturing and service sectors, though there is little difference in the importance of the 'other' sectors.(2)

Table B
Industrial share in 1998

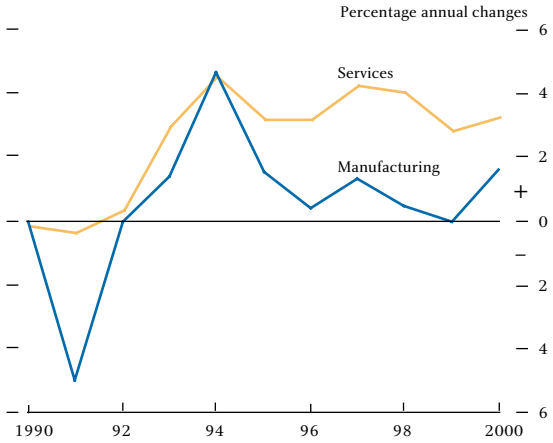
Percentage of total value added

	South	Rest of United Kingdom
Manufacturing	14.3	24.2
Services	77.6	65.6
Other	8.2	10.2
Total	**100.0**	**100.0**

Note: 1998 is the latest available year for regional data by industry.

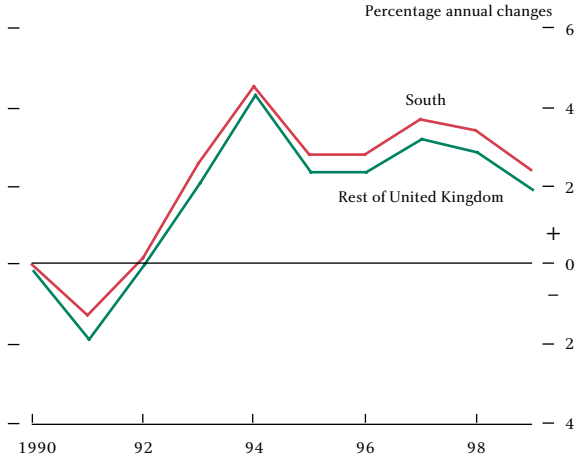
It is often suggested that the greater significance of the service sector in the South, together with the stronger aggregate performance of the service sector relative to the manufacturing sector (see Chart 5), may explain the relatively stronger economic growth in the South.

Chart 5
UK manufacturing and service sector growth



To assess the quantitative importance of this 'industrial structure' effect, we consider how the pattern of regional growth would change if divergences were explained purely by differences in the weights of the various sectors (notably manufacturing and services); ie assuming the same pace of sectoral growth in both regions. To do this we take national growth rates for the various sectors of the economy and weight them according to the industrial shares of individual regions to develop a proxy for regional economic growth.(3) The results are shown in Chart 6.

Chart 6
Proxies for regional economic growth



(1) Using published nominal GDP per capita data, deflated using an identical method to that used in Chart 2.
(2) The 'other' sectors include agriculture, mining, electricity supply and construction.
(3) Industry shares are for 1998, for which the data are the latest available.

The closeness of the lines on the chart suggests that the manufacturing/services split can account for only a small proportion of the divergence in growth rates seen in Chart 2. In fact, of the estimated 2.1 percentage point differential in real economic growth rates in 1997, only around a fifth is explained by broad sectoral differences in industrial structure.(1) So there must be other factors contributing to the regional divergence.

Intra-sectoral mix

Analysis of the intra-sectoral mix of each region may shed more light on the differences in regional economic performance.

(i) Manufacturing

The southern regions contain a higher proportion of the 'high-tech'(2) sectors of manufacturing (see Table C). These industries make up around 28% of manufacturing in the South, compared with only 22% in the rest of the United Kingdom. That may help to explain the relatively stronger activity in the South, since the divergence in the growth rates of the high-tech industries and the rest of manufacturing has widened in recent years (see Chart 7).

Table C
Shares of manufacturing in 1998

Percentage of manufacturing value added

	South	Rest of United Kingdom
'High-tech' manufacturing	28.0	21.9
Electrical and optical equipment	*17.4*	*11.7*
Chemicals	*10.6*	*10.2*
Rest of manufacturing	72.0	78.1

Using a similar technique to that in Chart 6, we consider how the pattern of regional manufacturing growth would change if divergences were explained by differences in the types of manufacturing industries across regions (see Chart 8).(3)

We find that regional differences in the mix of industries within the manufacturing sector provide little additional explanation for the divergences in regional activity during 1996–98.

Chart 7
UK manufacturing growth

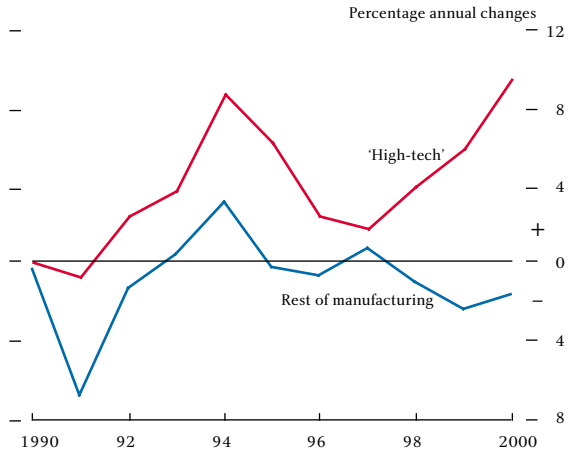
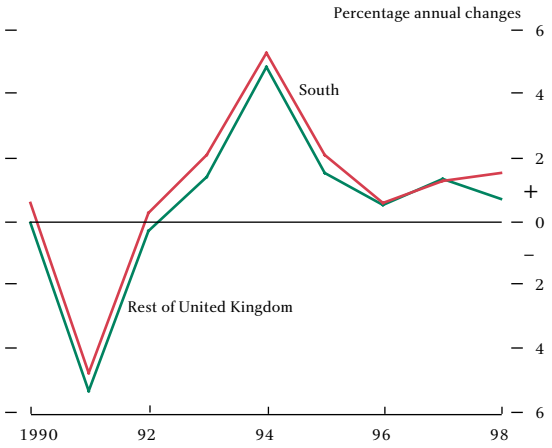


Chart 8
Proxies for regional manufacturing growth

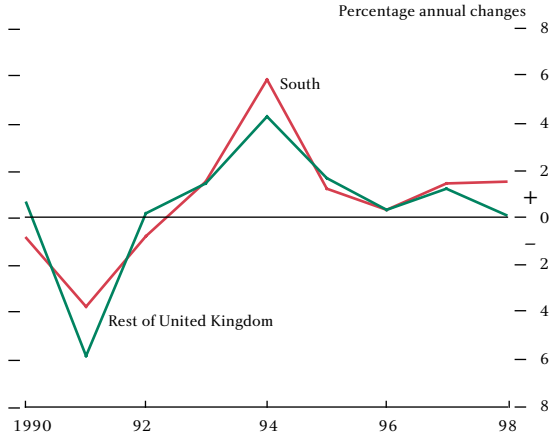


This pattern compares closely with estimated outturns of real manufacturing growth in the two regional groupings (see Chart 9).(4) It appears that there has been little difference in manufacturing growth in the two regions for most of the period. Moreover, a more detailed analysis of manufacturing performance shows little regional difference in average annual growth rates of the high-tech industries and the rest of manufacturing.

The higher proportion of high-tech industries in the South appear to have benefited overall manufacturing growth in the region in more recent years. The disparity between growth in the manufacturing industries began to widen in 1998 (see Chart 7), which coincided with stronger relative manufacturing growth in the South. But most of the benefit to the South from the

(1) Which incorporates a breakdown into manufacturing, services, agriculture, construction, mining and electricity supply industries.
(2) In this case, 'high-tech' includes the 'electrical and optical engineering' and 'chemicals' industries within the manufacturing sector.
(3) For this process, the most disaggregated level of data available for manufacturing sector activity by industry was used. Unlike Table C, this breaks the manufacturing sector down into 13 industries.
(4) Obtained using published nominal regional manufacturing output data, deflated using regionally weighted national manufacturing implied deflators at a highly disaggregated level. This is to take account of the differences in the mix of manufacturing industries between regions.

Chart 9
Estimates of real regional manufacturing growth



strengthening in high-tech industries is not yet captured in the regional accounts data because regional manufacturing growth figures are available only to 1998. It seems likely, however, that the further widening of the gap between high-tech growth and the rest of manufacturing in 1999 and 2000 will have benefited manufacturing growth in the South relative to the rest of the United Kingdom.

So there is little evidence to suggest that any of the regional divergence in the pace of activity during 1996–98 is explained by differences in manufacturing growth.

(ii) Services

Table D provides a breakdown of the service sector shares in each region. Of the main sectors, the South contains a smaller proportion of the slowest-growing service sectors—distribution, hotels and catering; and government and other services.[1]

Table D
Shares of services in 1998

Percentage of service sector value added

	South	Rest of United Kingdom
Distribution, hotels and catering	20.5	23.3
Transportation and communications	12.1	11.7
Business and financial services (a)	38.7	30.4
Government and other services	28.8	34.6
Total services	**100.0**	**100.0**

(a) Includes financial intermediation services indirectly measured (FISIM).

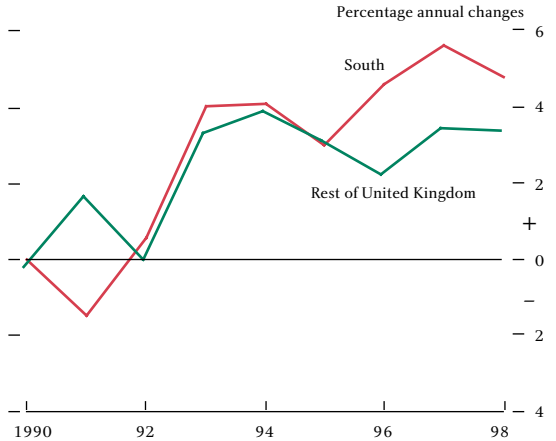
Using the same technique as before, we find that regional differences in the mix of industries within the service sector[2] are able to explain some additional part of the divergence in economic growth (see Chart 10).

Chart 10
Proxies for regional services growth

But although regional differences in the mix of industries, particularly within the service sector, can account for more of the divergence than the manufacturing/services split alone, much of the differential in regional economic growth rates is still to be accounted for.

Chart 11, showing estimates of real service sector growth in the two regional groupings, provides some explanation. It appears that the differential between service sector output growth rates in the South and the rest of the country is much greater than that explained by the types of firms located in each region. The series follow a similar pattern of regional growth to that in Chart 2—with weaker growth in the South in 1991, and relatively stronger growth during 1996–98.

Chart 11
Estimates of real regional services growth



Sectoral data are available only up to 1998, so it is not yet possible to establish whether service sector growth rates converged in 1999—as overall economic activity did. However, given the considerable weight of service

(1) Since 1990, these two sectors have recorded the slowest average annual growth.
(2) For this process, service sector activity is disaggregated into nine industries.

sector activity in the value added of both regional groupings, it appears likely that most of the convergence in regional economic growth rates in 1999 was driven by a convergence in service sector growth. Moreover, the likely strengthening of manufacturing growth in the South relative to the rest of the United Kingdom in 1999, discussed above, adds further support to this view.

So what accounts for the stronger service sector growth in the South during 1996–98? Table E, giving a regional breakdown of growth in the individual service sectors, provides more detail.

Table E
Service sector growth

Average annual real growth; per cent

	1993–95		1996–98	
	South	Rest of United Kingdom	South	Rest of United Kingdom
Distribution, hotels and catering	4.4	3.5	3.8	2.5
Transportation and communications	5.4	6.1	8.0	5.8
Business and financial services (a)	4.8	3.6	6.0	4.7
Government and other services	1.4	2.9	2.9	1.3

(a) Includes financial intermediation services indirectly measured (FISIM).

It appears that growth in the South was stronger than in the rest of the United Kingdom during 1996–98 in all of the major sectors of services activity.

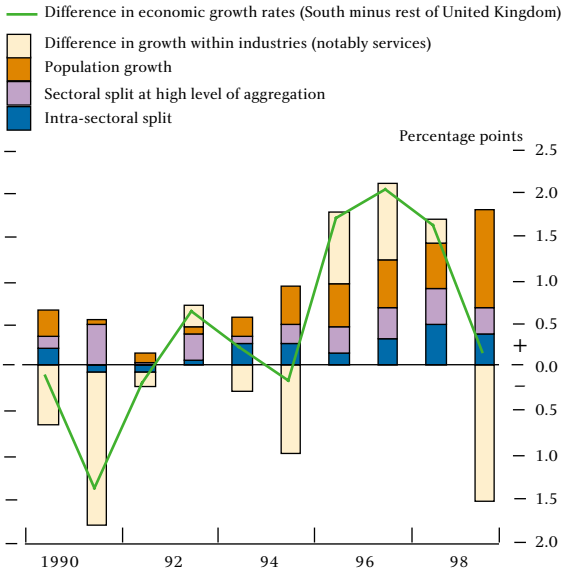
As Chart 10 shows, it appears that the South has benefited to some degree from having a relatively larger proportion (particularly in London) of faster-growing sectors such as business and financial services, which strengthened considerably during the second half of the 1990s. Moreover, during most of this period, growth in business and financial services activity in the South was somewhat stronger than in the rest of the United Kingdom (see Table E).

However, there is little evidence to suggest that regional differences in the pace of activity in these industries contributed to the regional divergence in activity in 1996–98. This is because the differential in business and financial services growth rates between the South and the rest of the United Kingdom during this period was similar to in earlier years. Most of the divergence appears to be due to a pick-up in growth in transport and communications and government and other services activity in the South relative to the rest of the country.

Contributions to divergences

To summarise these findings, Chart 12 provides estimates of the various contributions to the divergence

Chart 12
Estimated contributions to divergences in regional economic growth



in regional economic growth rates over the period. While it appears that differences in the proportions of manufacturing and service sectors (and the types of industries within these sectors) can account for some of the divergence in 1996–98 (explaining around one third on average), the majority of the divergence is explained by a pick-up in the contribution from population growth and stronger growth within service sector industries in the South.

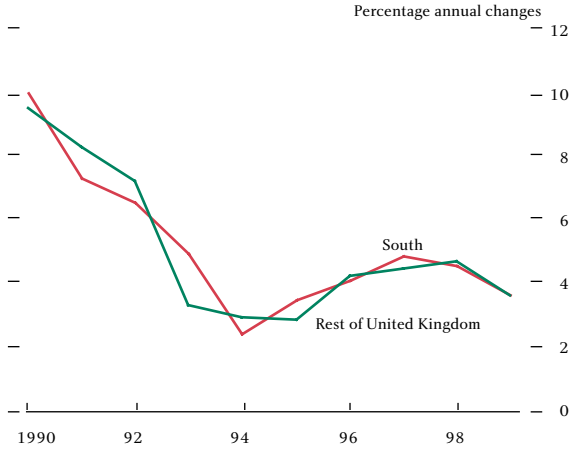
There are no clear-cut explanations for stronger service sector growth in the South. In particular, data limitations restrict our ability to draw any concrete conclusions.

One limitation of the above analysis is that the regional industry data are not sufficiently detailed, and may be concealing more significant differences at an even more disaggregated industry level. For example, Table E shows that there have been significant differences in the regional growth rates of the transport and communications sector. While the data show only a relatively small difference in the importance of the transport and communications sector to both regions, there may be significant mix differences that have also contributed to the regional divergence. For example, the South may have a relatively larger proportion of telecommunications firms, which have shown a particularly strong performance since the mid-1990s relative to the growth of transport activity.(1) This could imply that the contribution of industrial mix (seen in Chart 12) is being underestimated.

(1) During 1996–98, growth in UK telecommunications output was more than twice that recorded by the transport sector.

In addition, part of the stronger service sector growth may reflect a pick-up in service sector inflation in the South relative to the rest of the United Kingdom. That is, the assumption underlying the method used to deflate the nominal GDP data may not hold. As noted above, there is no definitive method of testing this proposition. But an examination of regional earnings growth may provide some indication. Chart 13 shows annual average earnings growth(1) for the two regional groupings over the period. The data show little difference in the pace of nominal regional earnings growth over the 1990s. This may provide some support to the view that inflationary pressures in the two regions are similar.(2)

Chart 13
Average weekly earnings growth



However, even if the divergence in regional economic growth could be established as a real strengthening as opposed to a price-related phenomenon, finding a convincing explanation for the stronger Southern service sector growth would remain difficult.

There is a growing economic literature on the relative performance of regions, and how firms that locate in a particular region may derive benefits (eg through lower production and distribution costs) from clustering with other similar firms (see Krugman (1991) for example). Bernat (1999) uses similar reasoning to explain stronger economic growth of the southern regions in the United States relative to other regions. He suggests that recent externalities related to innovation can explain key regional characteristics of stronger southern economic growth in the United States. In other words, if firms located close together adopt productivity-enhancing innovations before firms in other regions, they will grow faster.

The divergence in service sector growth in the southern regions of the United Kingdom during 1996–98 does not appear to reflect a pick-up in productivity growth relative to the rest of the country, as might be expected in the above scenario.(3) Average service sector productivity growth in the South was little different to that in the rest of the country during the period.(4)

Rather, it appears that the the relative pick-up in southern economic activity during 1996–98 almost entirely reflects stronger employment growth. As mentioned earlier, some of this pick-up in employment growth is likely to reflect relative movements in population growth. But the relative improvement in employment growth in the South more than accounted for any increase in labour force during the period. As a result, employment rates(5) in the two regional groupings diverged during the period.

Other explanations suggest that firms in some regions may benefit from natural geographical advantages (see Ellison and Glaeser (1999)) or other idiosyncratic benefits from their location (such as infrastructure or access to a more diverse labour force). However, such explanations would fit better with consistently stronger growth in the South.

Conclusion

The different industrial structures of the South and the rest of the United Kingdom do not explain the majority of the divergence in regional economic growth between 1996–98. Although the larger share of service sector activity (and larger share of strongest-performing services sub-sectors) in the South has contributed somewhat to stronger overall growth, most of the difference is explained by a relative pick-up in population growth and stronger growth in service sector activity in the South relative to the rest of the United Kingdom.

(1) Using New Earnings Survey data for average gross weekly earnings of full-time employees by government office region.
(2) This argument assumes that real earnings growth in the two regional groupings is also similar. Since there is no reasonable way of testing this, implications for relative regional inflation rates are qualified by the possibility of differences in real earnings growth.
(3) A caveat to this is the effect on productivity from the relative strengthening of southern population growth during the period, and its consequent impact on relative employment growth. In the short to medium run, this may dampen productivity in the South, until capital catches up. So it may be difficult to separate any population effect from other factors such as clustering that may be affecting productivity.
(4) Using regional employee jobs by industry data. It is also worth noting that whole-economy productivity growth was also similar in the two regional groupings.
(5) Defined as the number of employed persons as a percentage of all persons of working age.

References

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Has there been a structural improvement in US productivity?

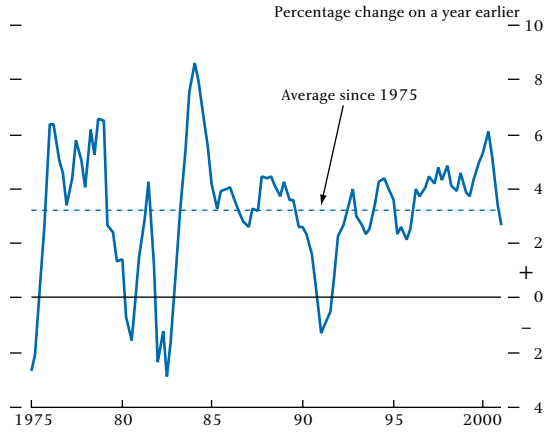
By Stuart Berry of the Bank's International Economic Analysis Division and David England of the Bank's Monetary Assessment and Strategy Division.

Annual labour productivity growth in the United States has averaged 2.8% a year since 1996, compared with an average rate of 1.6% during the preceding 25 years. This marked increase in productivity growth has been a key component of what many commentators have suggested is a 'new economy'. Given the US slowdown since the second half of 2000, a key question is the extent to which these gains reflect structural improvements, rather than cyclical factors. The evidence so far points towards a large role for structural improvements in productivity. If these gains prove to be more cyclical, however, this would have important implications for corporate performance, financial markets and, ultimately, output and inflation.

Recent developments

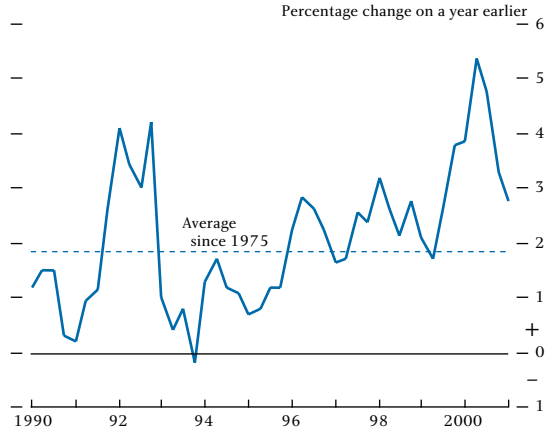
During the past five years, US GDP has grown at an average annual rate of 4.3%, significantly faster than over the preceding 20 years (see Chart 1). At the same time, inflation has remained subdued, suggesting that the supply capacity of the US economy has increased during this period. That has partly reflected strong growth in employment; unemployment has fallen to its lowest level since 1970. But rising levels of labour utilisation so far into a period of expansion are often associated with declining rates of labour productivity growth. In contrast, the past five years have seen a marked pick-up of US labour productivity growth (see Chart 2) so that labour productivity(1) rose in 2000 as a whole by 4.3%, its highest year-on-year growth rate since 1983. Productivity growth has eased somewhat, as GDP growth has slowed in recent quarters and was flat in 2001 Q1. A key issue for the US outlook is the extent to which there has been a structural improvement in US productivity performance.

Chart 1
US GDP growth



Source: Bureau of Economic Analysis.

Chart 2
US labour productivity



Source: Bureau of Labour Statistics.

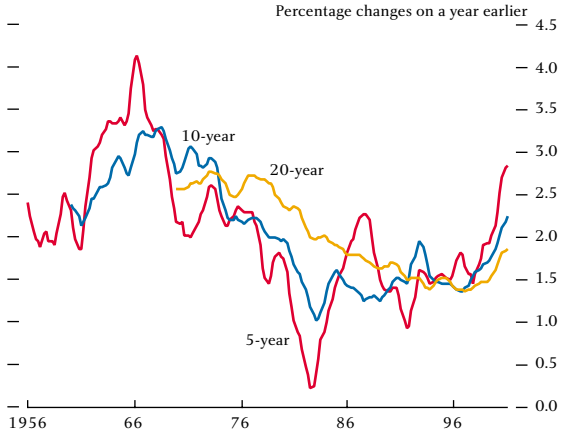
US labour productivity in a historical context

It is useful to start by examining US productivity growth over a longer period. One way of illustrating the recent improvement in productivity growth is to look at historical rolling moving averages of the growth rate over 5, 10 and 20-year windows since 1950. Until recently, these longer-term average growth rates were not unusually strong by historical standards. But the past two years show a different picture. For the 5-year and 10-year measures, the rolling trend of US labour

(1) Measured in terms of hourly non-farm business sector output.

productivity growth is now at its highest rate since the 1970s (see Chart 3).

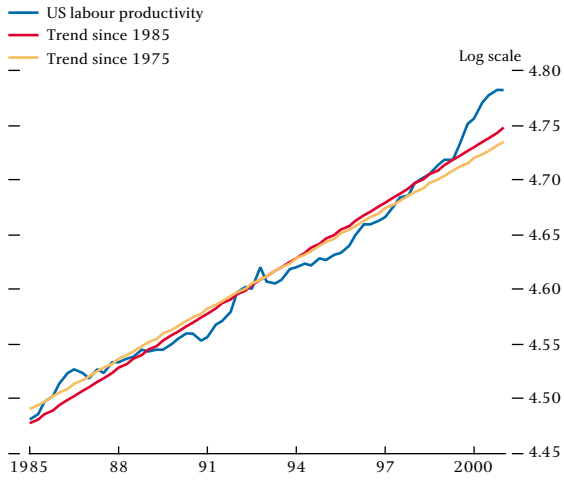
Chart 3
Rolling trend of US productivity growth



Source: Bureau of Labour Statistics.

Another way of illustrating the change in the behaviour of US productivity is to examine its level relative to some estimate of the trend. There are various ways of doing this: one simple method is to estimate a time trend, though this measure will be sensitive to the length of estimation period. Chart 4 shows that in recent years, US productivity has risen well above its recent trend, if that trend is measured since 1975 or since 1985.(1)

Chart 4
US labour productivity(a)



Source: Bureau of Labour Statistics.

(a) Measured as non-farm private business output per hour worked.

A decomposition of US labour productivity growth

An analysis of labour productivity alone would not identify the influence on labour productivity of capital intensity, ie the amount of capital available to workers. One way of assessing the contribution of capital to labour productivity is to use total factor productivity analysis, otherwise known as growth accounting. By assuming that output is a function of a combination of labour and capital inputs, it is possible to decompose output growth into three components:

- growth in labour inputs (measured by employment in hours);
- growth in the total capital stock; and
- a residual.

The residual reflects those increases in output that cannot be attributed to increases in inputs. Movements in the residual can arise from a variety of sources, some of which are temporary, such as cyclical changes in factor utilisation, and others which are permanent, such as technological advances that permit more efficient production techniques. The residual is usually referred to as total factor productivity (TFP), although some factors included within this component, such as cyclical factor utilisation, are distinct from the theoretical concept of TFP, which would generally include only the permanent factors and would therefore have different implications for the economy.

The key assumption used in the growth accounting approach to the decomposition of GDP growth is that factors of production are paid their marginal product. There are also some important measurement issues, particularly those associated with the accurate measurement of the productive capital stock. A number of academics have questioned the robustness of standard measures of these variables for the purposes of growth accounting, and have developed more sophisticated techniques for calculating these series. The results of these studies are reported in the next section.

Explaining the pick-up in labour productivity growth

A number of key pieces of academic research have been published during the past year or so on the pick-up in US productivity growth, and particularly on the role of information and communications technology (ICT). A summary of their findings is presented in Table A. These studies find a significant contribution from capital deepening (an increase in the amount of capital

(1) The time trends are estimated using a simple OLS estimation of a log-linear trend over two different sample periods, beginning in 1975 and 1985.

Table A
United States: sources of the acceleration in labour productivity, 1972–99[a]

	Jorgenson and Stiroh 1990–95/1995–98	Oliner and Sichel 1991–95/1996–99	Whelan 1974–95/1996–98	Gordon 1972–95/1995–99
	Study 1	Study 2	Study 3	Study 4
Acceleration in labour productivity	1.0	1.0	1.0	0.8 (b)
Of which:				
Capital deepening	0.5	0.5	n.a.	0.3
IT capital	0.3	0.5	0.5	n.a.
Other capital	0.2	0.0	n.a.	n.a.
Labour quality	-0.1	-0.1	n.a.	0.1
TFP	0.6	0.7	n.a.	0.3
IT production	0.2	0.4	0.3	0.3
Other	0.4	0.3	n.a.	0.0
Other factors	n.a.	n.a.	0.3	0.1 (c)
Memorandum:				
Per cent of acceleration in labour productivity related to IT	50	68	73	n.a.

n.a. = not available.

Sources: Study 1: Jorgenson and Stiroh (2000); Study 2: Oliner and Sichel (2000); Study 3: Whelan (2000); Study 4: Gordon (2000).

(a) In percentage point changes to average annual growth.
(b) Structural acceleration in labour productivity, which eliminates the increases associated with cyclical effects.
(c) Includes contribution of price measurement changes.

available to each worker), suggesting that strong investment, particularly in ICT capital, has raised the annual rate of growth of labour productivity by up to half a percentage point in recent years. But generally they find that the rise in TFP growth has explained a slightly larger part of the rise in labour productivity growth. For example, Oliner and Sichel find that capital deepening has contributed 0.5 percentage points to the 1.0 percentage point increase in annual labour productivity growth during the second half of the 1990s, while TFP growth has contributed 0.7 percentage points (the residual being largely a deterioration in labour quality). And Jorgenson and Stiroh find broadly similar effects.(1)

These studies all use essentially the same framework—the growth accounting methodology described earlier—but use different methods to estimate the capital stock. These techniques lead to different results at the aggregate level than using standard capital stock measures. They also allow the identification of the contribution from ICT to both capital deepening and, through ICT production, to TFP growth. In general, the studies find that ICT has accounted for at least half of the acceleration in labour productivity in the second half of the 1990s.

In particular, two factors related to capturing accurately changes in the stock of productive capital raise the contribution from capital (and the ICT component in particular), as measured in these studies, compared with using the standard wealth estimates.

A key measurement issue relates to the weights attached to different capital assets in calculating the total capital stock. The fact that prices for ICT equipment have been falling rapidly, together with shorter service lives, means that owners of these assets require a larger rental income in order to offset the loss in value. Hence, using the more appropriate rental values as measures of the marginal product of ICT assets leads to a higher weight within the overall capital stock. Given that the stock of ICT assets has risen very rapidly in recent years, this boosts the growth rate of the overall stock, and leads to a larger contribution from capital deepening to overall labour productivity growth.

The choice of depreciation profile is also important for the calculation of capital stocks. Wealth stocks are based on the current market, or replacement, value of assets, rather than their ability to produce. The value of assets will generally fall over time due to their lower remaining service life and the reduced income stream from the asset. For ICT goods, however, the equipment may remain almost fully productive until near the end of its service life. This is because the decline in value is more likely to reflect obsolescence (when more advanced products become available and replace the older equipment) than physical depreciation. As a result, depreciation profiles used in wealth estimates, which

(1) A more recent study by the Council of Economic Advisers (2001) finds a much larger contribution from TFP growth outside the IT sector. However, this study includes data for 2000 and because of the very strong growth of labour productivity in 2000 there is a larger increase to explain. It appears that neither capital deepening nor TFP growth in the ICT sector can account for the further acceleration in productivity, and so the increase in TFP in other industries is much greater.

often assume rapid depreciation early in an asset's life, may be inappropriate for ICT assets. Given the high levels of investment in ICT assets in recent years, using a less front-loaded depreciation profile for ICT assets would raise measures of both the level and the growth rate of the capital stock. Further, Whelan (2000) assumes that support costs associated with running ICT equipment reduce their service lives relative to standard measures, by allowing replacement to become profitable at an earlier stage. That would raise the contribution from ICT capital, but it does not lead to different results from, for example, Oliner and Sichel, because such effects are picked up within the assets' depreciation profile.

Whelan (2000) finds that allowing for such factors leads to a larger estimate of the productive capital stock than wealth-based estimates. Although the growth rates of the ICT component of the two series are found to be similar, the higher level of fast-growing ICT assets increases the growth contribution from capital deepening. Oliner and Sichel (2000) allow for some reduction in productive ability over time through, for example, reduced compatibility with the latest software, and this slightly reduces their estimated growth contribution of capital deepening.

Jorgenson and Stiroh (2000) find a slightly smaller growth contribution from ICT-related capital deepening than the other studies. But that reflects the wider definition of the sectors included in their analysis. All these studies exclude the government sector, but only Jorgenson and Stiroh include the flow of income from consumer durables and owner-occupied housing within their measures of private sector output and the stock of these assets in the capital stock. Because of their broader coverage of the economy, ICT has a smaller share, and therefore contributes a smaller amount to overall capital deepening.

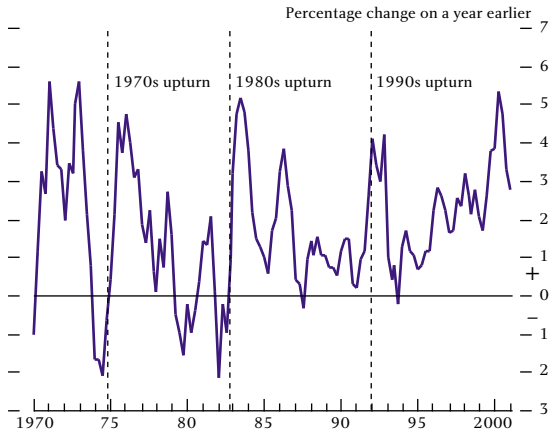
One common factor in these studies is that they all adjust for changes in labour quality, which might otherwise be picked up by the TFP term. However, this is estimated to have had little effect on productivity growth. In contrast to the other studies, Gordon (2000) focuses on the cyclical component of productivity growth (discussed later).

In the following sections, we look at the various explanations for the pick-up in productivity growth, and evaluate the evidence available from the data and from other recent work.

Cyclical factors

Productivity growth is likely to reflect both structural changes and cyclical factors. So to interpret the recent strength of productivity growth, we need to assess the normal cyclical behaviour of US labour productivity. Chart 5 shows that relative to the two previous expansions, recent US productivity growth has been unusually strong for the later stages of a cycle, particularly given the duration of the current upturn. This might suggest that the cyclical behaviour of labour productivity has changed. However, GDP growth over the most recent cycle has also been different; GDP growth has been smoother and more sustained than in the 1970s or early 1980s. Nevertheless, we might still expect that, at this late stage of the cycle, productivity growth would be falling, as firms are forced to recruit lower-quality workers to expand. In earlier cycles, similar periods of sustained above-trend productivity growth (such as in the early 1980s and late 1970s) have usually come more or less immediately after a recession. So overall there may have been some change in labour productivity growth compared with its normal cyclical pattern.

Chart 5
US non-farm business productivity



Source: Bureau of Labour Statistics.

In contrast to these arguments, Gordon estimates that procyclical productivity effects lie behind much of the strength of recent productivity growth. In his recent work (Gordon (2000)), he estimates that 0.5 percentage points of the rise in annual labour productivity growth since 1996 have been due to procyclical productivity effects. In fact, after cyclical adjustment, he continues to find no evidence of an increase in structural labour productivity growth outside the durables manufacturing sector (which includes the ICT sector). And after incorporating Oliner and Sichel's estimates of capital deepening effects, he finds that

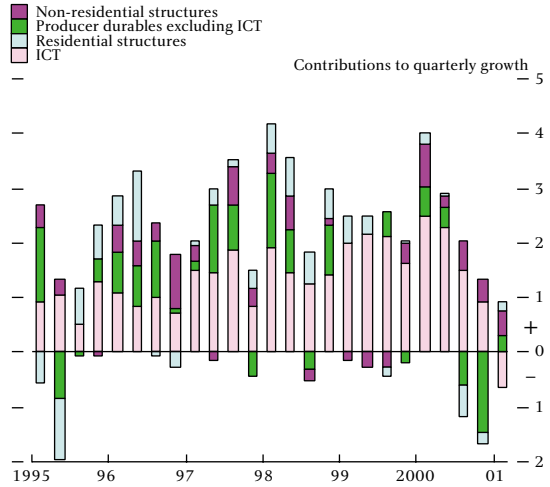
structural TFP growth has fallen by 0.3 percentage points since 1995 in the non-farm private business sector outside the durables production sector.

The role of the information and communications technology (ICT) sector

(i) Investment in ICT

US investment has been substantially stronger than most models would predict during the current expansion, leading some commentators to argue that it has been investment, especially in ICT, that has increased US labour productivity. In particular, there has been a change in the composition of investment and capital growth in recent years. Chart 6 shows that investment in ICT has accounted for a large part of overall investment growth. Falls in the price of computers relative to other investment goods have led to a strong shift into ICT investment. Consistent with this, the recent studies on US productivity generally find that most of the capital deepening in recent years reflects increased ICT capital (see Table A).

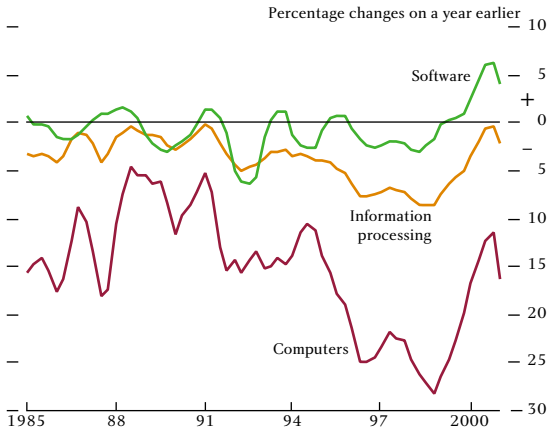
Chart 6
US investment components



Source: Bureau of Economic Analysis.

Calculations of capital deepening and TFP growth will depend on how real output and real capital are measured, an issue discussed recently by Gust and Marquez (2000). Output and investment spending data are usually collected on a nominal basis. The estimation of real measures requires the calculation of price indices, which can then be used to deflate the nominal measures to provide real (constant price) estimates. In the United States, computer prices have been calculated using 'hedonic pricing' techniques to adjust price measurement for quality changes in computers. This method attempts to quantify the quality component of a product's price by defining goods according to their characteristics and computing a quality-adjusted price based on those characteristics. In the case of computers, hedonic pricing derives a price for a bundle of computing power by estimating a relationship between the observed price and characteristics such as processor speed and memory size. With rapid increases in both these features of computers, hedonic price levels have declined rapidly (see Chart 7 for the computer price index).

Chart 7
ICT investment price inflation



Source: Bureau of Economic Analysis.

Landefeld and Grimm (2000) provide evidence that hedonic estimates are robust, and that they produce very similar price profiles to those generated by the more traditional 'matched-model' method used in some other countries. But that result requires that price changes in specific matched models are accurately tracked over time. A changing sample may mean that some quality improvements are not picked up, which could lead to an underestimate, relative to hedonic pricing, of both the real investment in and the capital stock of computers. But it is possible that the effects of quality improvements in reducing measured prices could lead to an overestimation of the productive capital stock. Although computing power has increased rapidly, certain aspects may not be fully utilised. If this is the case, then such improvements will increase the measured capital stock without increasing the true productive capacity of that stock.

(ii) TFP gains from ICT production: sectoral evidence

In contrast to Gordon's estimates, which identify a large role for cyclical factors, other studies (see Table A) find that there has been a pick-up of TFP growth both inside and outside the high-growth ICT sector. In fact, several

studies find that TFP growth outside the ICT sector has contributed more to the rise in TFP growth since 1996 than the pick-up in ICT productivity growth. This reflects the small size of the ICT sector relative to the rest of the economy. In simple growth terms, the pick-up of ICT productivity has been much stronger.

This result has been used to support the view that ICT investment has finally fed through into a pick-up of economy-wide productivity growth, as might be expected if ICT was viewed as a new 'general purpose technology'. But Jorgenson and Stiroh also estimate industry-level productivity growth over the period 1958–96 and find that in many industries, TFP growth has been flat or even negative. And this result is seen in a number of industries where computer investment has been very strong—financial and other services in particular. On the basis of these results, they find that 'the new economy view that the impact of information technology is like phlogiston, an invisible substance that spills over into every kind of economic activity … is simply inconsistent with the empirical evidence'.

But there are several caveats to Jorgenson and Stiroh's results. First, they find weak or negative productivity growth in those sectors where productivity measurement problems are accepted to be at their greatest, in particular in finance, insurance and real estate services, and in the general services category. Second, they look at data up to 1996—which will largely exclude the effects of the recent upturn in productivity growth.

And they find strong productivity growth in some areas that use ICT technology intensively: in particular wholesale and retail trade, which has contributed more than any other sector to the TFP growth seen over the period of their analysis. This pattern of productivity gains could be consistent with Federal Reserve Chairman Greenspan's observation that ICT has reduced the resources required for inventory control. Data from the US Census Bureau suggest that as the overall stocks to sales ratio has declined, there has been a substantial shift in inventory holdings away from the manufacturing sector, towards centralised inventory holdings in the wholesale and retail sectors. This shift may have reduced the overall resources dedicated to inventory control, increasing productivity in both the manufacturing sector and the economy overall.

Stiroh (2001) shows that the increase in labour productivity growth in the wholesale and retail trade sectors has been particularly marked. In this more recent study, Stiroh looks at industry-level data on labour productivity growth up to 1999, and finds that the gains are broadly based and extend well beyond the ICT sector, suggesting that productivity gains do not solely reflect gains in ICT production. Further, he shows that the increase in labour productivity growth in the late 1990s for ICT-intensive industries (users rather than producers) was around 1 percentage point higher than in other industries. The correlation between ICT use and stronger productivity growth would suggest a key role for ICT investment in the pick-up in productivity growth.

(iii) Total factor productivity: firm-level evidence of ICT effects

Firm-level evidence has given more unambiguous support for a general ICT effect on productivity growth. Recent work by Brynjolfsson and Hitt (2000) applies standard growth accounting techniques to data from 600 firms, with computer and non-computer capital separately identified. They find that in the short run (of one year), computers have little effect on TFP growth. But over the longer term (3–7 years), the elasticity of output to ICT capital increases by a factor of between 2 and 8, resulting in a substantial contribution from computers to firm-level TFP growth over time. The authors view this, together with other institutional evidence, as evidence that the long-term growth contribution of computers reflects their use alongside complementary organisational investment as part of a more general firm restructuring. That is consistent with a 'general purpose technology' view of computers. And it also suggests that the recent strength of ICT investment growth could lead to continued strong productivity growth during the next few years.

Conclusion

The evidence to date suggests that the strong growth of labour productivity in the United States over the past five years is not just a cyclical phenomenon. It has been driven by large increases in investment in ICT equipment and improved production techniques within the ICT sector, which have been associated with large price falls for such goods. It seems likely that these developments have led to a step shift in the level of productivity, and this has been translated into a number of years of higher productivity growth as the application of the latest technology has diffused through the economy. The question remains as to how long the higher productivity growth rates will last. This will

depend crucially both on the future rate of technological progress and on the extent to which existing technology has already fully diffused through the economy and into firms' production processes. Given the large contribution of ICT capital use and ICT production to productivity growth in recent years, the continuation of the recent productivity trend depends on continued falls in computer prices, which will be determined, in part, by the pace of innovation within the sector. Spillovers and network externalities from recent advances in the ICT sector could also help to sustain stronger productivity growth in the future. But against this, the recent cyclical slowdown has led to a sharp slowdown in investment, initially in non-ICT equipment and more recently in ICT equipment. If this is sustained, it could reduce the amount of capital deepening and its contribution to productivity growth.

The current slowdown in the US economy may well provide an indication of the size of the cyclical component, and over the next few years it should be possible to come to a firmer conclusion on this issue. A sharp slowdown in productivity growth could reflect a cyclical weakening of investment growth and factor utilisation, and so would not necessarily imply that past gains were cyclical in nature. But if productivity growth slows only modestly, this would be supportive of the evidence available so far that structural improvements have played a substantial role in recent productivity gains.

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Sticky prices and volatile output

Working Paper No. 127

Martin Ellison and Andrew Scott

Cycles in economic activity have been evident for most of recorded history, yet economists are still struggling to explain convincingly the patterns revealed in these cycles. Keynesian macroeconomics was an attempt in the 1930s to show how aggregate demand failure could generate recessions, from which there would be no rapid or automatic recovery. However, this relied upon arbitrary assumptions about rigidities in prices and wages that few find plausible today. A more recent agenda within macroeconomics has focused on building explicit dynamic models of the economy that can potentially replicate the observed patterns of business cycles in advanced industrial economies. The current paper offers a contribution to this agenda.

A key component of the modern approach is to build models in which economic agents (households and firms) behave optimally, both currently and over time, subject to the constraints imposed upon them by factors such as accumulated assets, currently available resources and shocks hitting the economy. The behaviour of households as consumers and suppliers of labour should be consistent with the behaviour of firms as producers of goods and employers of labour. Models incorporating these characteristics have grown out of the so-called 'real business cycle' literature but are now generally referred to as dynamic stochastic general equilibrium models (DSGE).

Another key goal of the modern business cycle literature is to build models in which prices adjust to clear markets. Early Keynesians assumed that markets did not work flexibly, otherwise prices would always adjust to equate demand and supply, in which case there could be no unemployment. The Austrian School of the inter-war period tried but failed to build market clearing into their models of the cycle. The real business cycle literature revisited this challenging task with partial success, and DSGE models continue to be developed with this goal in mind.

The current paper presents a specific form of DSGE model. Special assumptions are that firms sell their output in imperfectly competitive markets (so firms have some discretion over the price they set for their product) and consumers are infinitely lived but operate under a cash-in-advance constraint. Two alternative assumptions about price flexibility are used. In one case, all firms can set whatever price they choose in each period, and in the other, only a random selection of firms can change their price in each period. The latter is referred to as the 'sticky price' case.

The method adopted is to derive a set of equations explaining the optimal behaviour of households and firms, and their interaction; then quantitatively to calibrate all the parameters in the various equations; and finally to simulate the dynamic behaviour of the economy in response to various 'shocks'.

One of the main results that emerges from this study is that the incorporation of sticky prices (generally thought necessary in the past to explain real world business cycles) improves the ability of the model to mimic at all frequencies the inflation behaviour observed in real economies. However, the bad news is that, under sticky prices, this model generates short-run output fluctuations well in excess of those observed in data from real economies. The incorporation of sticky prices also worsens the ability of this particular form of DSGE model to explain output fluctuations at business cycle frequencies.

In short, it is shown that the incorporation of sticky prices is not a sufficient condition for improving the realism of common forms of DSGE business cycle models. Future research may determine whether it is necessary, or whether some other form of real rigidity might suffice to reconcile optimisation-based cycle models with reality.

'Oscillate Wildly': asymmetries and persistence in company-level profitability

Working Paper No. 128

Andrew Benito

Competition is central to an understanding of the corporate sector. Such competitive forces are best viewed in the dynamic sense of how quickly high rates of profit are competed away by entry and the threat of entry, and how quickly less profitable companies that survive improve their financial health. If profits persist from one year to the next this indicates that competitive forces do not act especially swiftly in removing such abnormal returns.

In this context, most of the existing literature has focused on those companies with high returns, motivated by concerns about market power. For financial stability it is the low-performing companies that are of special interest. A low rate of profitability is one indicator of financial distress. But the extent to which it is an indication of the company's profitability the following year and its ability to withstand any adverse shock depends on the degree of persistence in profits. Moreover, the emphasis in such financial stability surveillance work concerns the most vulnerable companies in any year. For this reason, the degree of persistence of profitability amongst the weakest companies is especially important. But previous studies of profit persistence have not attempted to distinguish between the experiences of this set of companies from others.

More generally, the motivation for a study of the persistence in profits is based on the notion that examining rates of return of companies, even with disaggregated data, provides only a snapshot of the financial position of a company. Mobility between points in the distribution of returns over time is also of interest. To this end, the paper employs panel data methods using data constructed from the company accounts of 2,129 quoted UK companies over the period 1974 to 1998, making it the most comprehensive study of its kind for the United Kingdom.

A useful precursor to the main empirical analysis is to study the relative position of companies' profit rates and how this varies from one year to the next. This reveals a number of stylised facts. The level of persistence in companies' positions in the distribution is quite high. Moreover, this persistence differs across different parts of the distribution of profitability. Almost three quarters of companies in the top quintile of companies in one year remain there in the following year, on average. This compares with two thirds of companies in the lowest quintile remaining in that part of the distribution the following year.

The more detailed analysis focuses on the extent to which the profit rate of a company deviates from its rate the previous year. The paper finds that persistence in profits is less strong for companies with low rates of profitability in a particular year. The results indicate that surviving companies are able to recover from periods of relatively poor performance more rapidly than previous linear models of profit persistence would suggest. One other possible explanation for this finding is that companies favour a conservative approach to accounting, preferring to report good performance over more years than they would allocate any poor performance. At the same time, the results indicate that previous studies of the persistence of profits are likely to have understated the degree of persistence of high returns.

Only a modest degree of variation among industries has been found on the basis of the standard linear models for persistence, with an increase in the extent of this variation between industries being found on the basis of the non-linear models. The asymmetries in the persistence of profits are estimated to be stronger in 'energy and water supply', a heavily regulated sector in which regulators have had a responsibility for ensuring that companies can finance their functions. The result that high profitability persists more than low profitability is estimated to be present in each industry.

Companies are far from passive to the shocks that they experience. They respond by adopting strategies that involve financial and/or real implications for outcomes such as employment, dividends, wages, productivity and investment. This suggests that future work could explore the strategies available to companies in times of financial distress, the factors that will lead a company to favour one option over another and the implications of each for the wider economy.

Investment-specific technological progress in the United Kingdom

Working Paper No. 129

Hasan Bakhshi and Jens Larsen

This paper addresses how rapid technological progress in the information and communications technology (ICT) goods sector contributes to long-run growth in the United Kingdom and how changes in the processes driving this progress may affect the macroeconomic outlook. Academics and policy-makers alike have argued that the US economy experienced an improvement in trend productivity growth in the second half of the 1990s. And technological progress in the ICT sector, with an associated rapid fall in ICT prices, has been a major contributor to US labour productivity growth over this period.

We start from the striking observation that the relative price of ICT goods has been declining steadily but at a very high rate over the past 23 years in the United Kingdom, accompanied by an increase in the real ICT investment to GDP ratio. We develop a model of the UK economy that can account for this fact. The mechanism is simple and intuitive: technological progress in the sector producing ICT capital goods leads to a decline in the relative price of ICT. Firms respond by substituting ICT capital for other types of capital and labour, raising the ICT capital intensity of production. In other words, technological progress in production of ICT capital contributes to output growth through relative price falls that induce capital deepening. In the model, we describe technological progress that applies only to the production of capital goods as investment-specific technological progress, and distinguish it from sector-neutral technological progress which applies to the production of all goods. The main difference between the two forms of progress is that investment-specific technological progress requires that investment is undertaken before it affects final output; sector-neutral technological progress is a 'free lunch' in that it affects final output directly.

Our model can be shown to be a special case of a more general framework, and has some additional appealing features. In particular, we can characterise the balanced growth path of our model of the UK economy, and can quantify the contributions that ICT investment-specific technological progress makes to long-run growth. This long-run growth path has the property that the expenditure share of ICT investment in GDP is constant: while the relative price of ICT is falling, the quantity of ICT relative to output increases, so the value of ICT investment relative to output stays constant. Our results suggest that despite ICT being only a relatively small component of the overall capital stock, ICT investment-specific technological progress contributes very significantly to labour productivity growth along the balanced growth path of our model of the UK economy, accounting for around 20%–30% of labour productivity growth. But this conclusion depends crucially on how ICT prices are measured and the assumed rate of ICT price decline along the balanced growth path.

The paper goes on to consider various scenarios for structural change: first, if the rate of technological progress in ICT production increases temporarily, resulting in a temporary pick-up in the rate at which ICT prices decline; second, if the rate of technological progress increases permanently, and third, if structural changes lead to temporary increases in the expenditure share of ICT investment in overall output. We show that this last scenario can account for the increase in the rate at which the aggregate capital stock depreciates, as appears to have been observed in the United Kingdom in the 1990s.

The real interest rate gap as an inflation indicator

Working Paper No. 130

Katharine S Neiss and Edward Nelson

In this paper, we investigate the business cycle properties of the real interest rate relative to its natural value. Our investigation into the natural real interest rate is motivated by the possibility of constructing a measure of monetary policy stance based exclusively on interest rates. Recent work by Michael Woodford has revived the ideas of Knut Wicksell by focusing on 'the gap between the current level of the 'natural rate' of interest and the interest rate controlled by the central bank' as the key variable for the analysis of 'inflationary or deflationary pressures'. In line with this terminology, we describe the spread between actual and natural real interest rates as the real interest rate gap.

This paper examines a number of questions involving the real interest rate gap, including:

- Does the real interest rate gap provide a useful tool for monetary policy analysis?
- Is the real interest rate gap more difficult to measure than the output gap?
- How do empirical measures of the real interest rate gap perform in forecasting UK inflation?

We develop a dynamic stochastic general equilibrium model with sticky prices in order to examine the behaviour of the natural real interest rate and the real interest rate gap. In our model, household spending and asset accumulation, and the prices that firms set, are based on optimising behaviour. We build on the existing literature by including capital formation (subject to adjustment costs), habit persistence in consumption, technology and demand shocks, and two alternative models of price stickiness. The baseline model of price stickiness that we use is Calvo price-setting, which can be interpreted as a system of staggered contracts for nominal prices.

We calibrate the model to the UK economy, and examine the response of the natural real interest rate to shocks to both technology and demand. Our focus is mainly on the indicator properties of the real interest rate gap, and so we examine how well the real interest rate gap does in signalling future inflation—both in response to specific shocks (which we examine using impulse response functions) and when all shocks are hitting the economy simultaneously (which we examine using stochastic simulations).

Using our model as a guide, we also construct empirical estimates of the natural real rate and the real interest rate gap from UK data.

Our key results include:

- The response of the natural real interest rate to a technology shock depends on whether or not capital is included in the model and, if so, whether or not there are capital adjustment costs. We find that with capital adjustment costs, the natural real interest rate can fall in response to a technology shock. For a given actual real interest rate, this leads to a rise in the real interest rate gap.
- Conversely, the natural real interest rate rises in response to a demand shock. For a given actual real interest rate, this leads to a decline in the real interest rate gap.
- The less firms and households are willing to adjust their quantities, the more the natural real rate needs to adjust to maintain equilibrium.
- Stochastic simulations indicate that the real interest rate gap and output gap do equally well in forecasting inflation. In addition, the behaviour of the real interest rate is a reasonable approximation for the behaviour of the real interest rate gap. By contrast, output (or detrended output) is not a good indication of the behaviour of the output gap. This suggests the value of constructing measures of both gaps instead of concentrating only on output gap measures.

Finally, we test the predictive power of the real interest rate gap for UK inflation. On quarterly UK data, the real interest rate gap is closely related to future inflation, whether the relationship is judged by correlations or by the marginal predictive content of the gap for inflation in regressions. Our results suggest that constructing a real interest rate gap series, using theory as a guide, can have value for evaluating the stance of monetary policy and the prospects for future inflation, in keeping with the neo-Wicksellian framework of Woodford (2000).

The structure of credit risk: spread volatility and ratings transitions

Working Paper No. 131

Rudiger Kiesel, William Perraudin and Alex Taylor

Regulators designing capital requirements for loan portfolios or senior bankers deciding levels of economic capital for their institutions need to know the magnitudes of the risks involved in holding portfolios of credit exposure of different types. This paper quantifies the risks involved in holding large portfolios of different credit qualities and times to maturity. To accomplish this, we formulate a ratings-based credit risk model and simulate it for large portfolios of credit exposures.

The model we develop generalises a widely employed model, namely the Creditmetrics approach popularised by JP Morgan, to include risks not just of rating transition and random recoveries but also random shocks to spreads in non-default states. Spread risk is important since it is highly correlated across different exposures and hence does not diversify away in large portfolios.

Incorporating spread risk is a difficult task not because of the added complexity of the credit risk model which is relatively slight, but more because of the difficulty of estimating a joint distribution of spread changes over the long horizons typically employed in credit risk modelling. We propose a non-parametric approach to estimating moments of spread changes over one year or more and argue that over such long periods, spread changes appear approximately Gaussian.

Our non-parametric approach may be thought of as filtering out high frequency components of spread volatility, leaving volatility associated with permanent shocks to spreads. Since a relatively large proportion of the volatility of high credit quality spreads is made up of short term shocks that are reversed by subsequent, off-setting spread changes, filtering in this way increases the gap between the volatility of changes in high and low credit quality spreads.

Basing our discussion on Value at Risk (VaR) measures of risk, we show that spread volatility contributes much the largest fraction of total risk for investment quality portfolios. For reasonable confidence levels, portfolios of credit exposures that possess the same rating profile as that of an average large US bank turn out to have VaRs similar in magnitude to the capital charges required by the 1988 Basel Accord. Lastly, we document the fact that credit risk has an important maturity dimension in that we show portfolios with similar ratings profiles but longer maturity possess substantially larger VaRs.

Ratings versus equity-based credit risk modelling: an empirical analysis

Working Paper No. 132

Pamela Nickell, William Perraudin and Simone Varotto

In the last five years, many banks have implemented elaborate credit risk models in order to assess the risk of their corporate credit exposures. Such models provide a framework for calculating the joint distribution of future portfolio returns based on (i) consistent assumptions about the risks inherent in individual exposures and (ii) hypotheses about the degree of correlation between changes in the value of these exposures.

A major problem with credit risk models is that it is extremely difficult to assess the accuracy of the risk measures they supply. The models have not been implemented long enough for either firms or regulators to have much experience of their performance. Parameters are often based on relatively little information given the paucity of historical data on credit risk.

The present paper is the first to attempt a systematic back-testing exercise of credit risk models. Two models are implemented for large portfolios of dollar-denominated Eurobonds over an eleven-year period. Risk measures for a one-year investment horizon are calculated on a rolling basis for each successive month and then compared with the actual outcome for the change in the value of the portfolio in question over the following year. We are careful when we implement models to do so using data that would have been available at the relevant time.

The models we examine are canonical examples of ratings-based and equity-based approaches to credit risk modelling. Ratings-based approaches such as JP Morgan's Creditmetrics framework suppose that the risk of credit exposures is summed up in their credit quality rating and model transitions between ratings categories for individual exposures and correlations between transitions for pairs of exposures. Equity-based models like those implemented by the consulting firm KMV suppose, as in Merton (1974), that the value of credit exposures are derivatives written on the firm's underlying asset value. The volatility and correlation structure of asset values are then deduced from the behaviour of changes in equity values.

Our major conclusion is that the two classes of models as commonly implemented significantly under-estimate the risks involved in holding our eurobond portfolios. The problems arise particularly when the models are implemented on portfolios of bonds issued by non-US domiciled obligors. The risk measures obtained for portfolios of bonds issued by US-domiciled obligors appear more consistent with the realised risks subsequently observed.

The implication of our analysis is not that credit risk models have no value. Rather it suggests (i) that models should be employed cautiously with conservative parameterisations, and (ii) that care should be taken when models are implemented for portfolios outside the standard case of US industrials for which reasonable amounts of historical data are available.

Stability of ratings transitions

Working Paper No. 133

Pamela Nickell, William Perraudin and Simone Varotto

Credit ratings published by agencies such as Moody's or Standard and Poor's play an increasingly important role in financial markets. The significance of agency ratings will be even greater if they are used as a basis for calculating bank's regulatory capital as suggested in proposals recently issued by the Basel Committee.

An important question is to what extent ratings correctly summarise the risks involved in holding a particular exposure. In allocating obligors or bond issues to different rating categories, rating agencies endeavour to ensure that similar ratings imply similar credit quality in some broad general sense. Even if they succeed in this, it is not obvious that default probabilities for different horizons will be the same for similarly-rated obligors, however.

To assess the stability of the distribution of rating changes, this paper examines whether probabilities of moving between categories over one-year horizons vary either across different obligor types or across different stages of the business cycle. If these ratings transitions probabilities were stable, then default probabilities at all possible future horizons would be stable so studying the rating transition matrix is a convenient way of examining stability of default probabilities.

Two approaches to estimating rating change probabilities are implemented. The first is a simple non-parametric approach which consists of simply estimating probabilities based on relative frequencies for separate data sets corresponding to obligors of different types or observed at different stages of the business cycle. The second approach employs a parametric ordered probit model. This has the advantage that one may estimate the impact on rating change probabilities of altering a single characteristic of an obligor, holding other characteristics and the stage of the business cycle constant.

Our conclusions are that there is significant variation across different obligor types. Ratings of financials are more volatile than those of industrials although they exhibit a mean reverting tendency in that down (up) grades are relatively likely for highly (lowly) rated financials. In our sample (which pre-dated most of the Asian crisis) Japanese rating transition probabilities were consistent with less volatile ratings than those of United States and United Kingdom. These cross-country differences are especially important for higher credit quality obligors. Business cycle effects are important particularly for low rated borrowers.

Consumption, money and lending: a joint model for the UK household sector

Working Paper No. 134

K Alec Chrystal and Paul Mizen

Consumption and money demand functions have been the object of countless empirical studies over the last half-century or so. These two relationships still provide the core of textbook models of the macroeconomy, at least at the undergraduate level, and are implicit in the foundations of the more sophisticated models used in graduate textbooks. Consumption behaviour continues to be a topic of major interest to policy-makers, not least because it is the largest single component of aggregate demand and so is central to any macroeconomic forecast. Money demand has been of much less concern recently since many monetary authorities have abandoned monetary targets and adopted inflation targets instead, although, for inflation targeting central banks, money is still of interest when it can be used to help forecast inflation. To do this it must contain leading-indicator properties for some component of aggregate demand, hence if 'money' is to provide useful information it must be demonstrated that it has linkages with consumption or investment expenditure. For the household sector that is studied in this paper it is consumption that is relevant. Any other variable that helped to forecast consumption would also be useful, and in this paper we incorporate credit as another variable of potential interest. Credit could be more useful than money as a leading indicator of consumption if households borrow extensively to finance their spending. Credit is taken out simultaneously with the decision to spend because interest charges are levied on amounts outstanding, but money can be held for long periods as idle balances and might also be regarded as an important form of saving.

Most previous work on consumption and money demand has estimated these relationships as separable single equations. There have been very few studies of credit but those that exist have also tended to use a single-equation approach. We know, however, that decisions to spend, change money holdings or borrow must be interrelated. In this paper we treat them as jointly determined by a common set of driving variables. The driving variables chosen are the obvious ones: labour income, tangible net wealth, and various interest rate spreads between alternative assets and liabilities. The dependent variables are consumers' expenditure, household holdings of broad money (M4), and the stock of unsecured (M4) lending to households.

The method adopted involves estimation in two stages. The first stage identifies long-run (cointegrating) relationships for consumption, money and lending. These relationships include direct effects of money and lending on consumption and they also provide evidence of spillovers of deviations from each equation onto the others. A simple transformation of the estimated cointegrating relationships shows that these results are consistent with plausible parameter values, equivalent to long-run consumption and money demand functions. The long-run unsecured lending equation is less familiar but equally plausible and well determined.

In the second stage, deviations of actual dependent variables from their long-run values are embodied in dynamic equations that determine the growth rates of consumption, money holding and unsecured borrowing. Insignificant variables are eliminated from these equations using a general-to-specific search procedure until a parsimonious form is identified. The final form satisfies a battery of specification tests and produces sensible impulse responses to shocks.

The main results are, first, that unsecured household credit can be modelled in the same way as consumption and money demand, and, second, that there are significant spillovers from money and credit to consumption, and *vice versa*. This may be of particular use for policy-makers in the short run, as money and credit data are available monthly while consumption data are quarterly and are often subject to considerable later revision. Monetary targeting may have been superceded by inflation targets but money and credit data can still be of use as leading indicators of household spending, a major component of aggregate demand, and an underlying guide to future inflation.

Hybrid inflation and price level targeting

Working Paper No. 135

Nicoletta Batini and Anthony Yates

The success and spread of inflation targeting (documented by, for example, Julius *et al* (2000)) has stimulated interest in the merits of price level targeting. Under inflation targeting, the expected variance of the price level increases without bound as we look further into the future; under price level targeting, policy acts to reverse shocks to the price level, and the expected variance is constant.

A literature has grown examining the benefits of price level versus inflation targeting, including Lebow *et al* (1992), Fillion and Tetlow (1993), Haldane and Salmon (1995), Black *et al* (1997), Kiley (1998), Svensson (1999a), Smets (2000), Williams (1999), Vestin (1998), and Dittmar *et al* (1999). In the early days of this research effort it was thought that while price level targeting meant lower price level variance, it brought with it the cost of higher variance in inflation (as, for example, below-target misses are inflated back next period) and, in worlds of sticky prices, a greater volatility of output about the natural rate. But more recently, exceptions to this early result have been uncovered.

This paper contributes by first describing and then analysing the consequence of regimes that can be thought to lie 'in between' the extremes of price level and inflation targeting. We describe two ways of characterising the spectrum of regimes. The first is a spectrum of regimes that come from computing optimal rules subject to loss functions that have different relative weights on price and inflation deviations from target. The second spectrum is defined by a set of simple rules where, at one extreme, the real interest rate responds to forecast deviations of prices from target, and at the other from forecast deviations of inflation from target (and a term in the output gap). In between, policy responds to forecast deviations of prices from a moving price level target.

We compute inflation, price and output variability when these rules are followed using a calibrated, rational expectations model of the United Kingdom used in Batini and Haldane (1999).

The paper shows that these 'intermediate' regimes are interesting in that inflation, output and price level variance do not change monotonically as we move from one extreme to another. We also show that the cost benefit analysis of regimes along our spectra depend, not surprisingly, on the degree of forward-lookingness embodied in price-setting, and contrast results obtained using a form of nominal stickiness akin to that in Taylor (1980) on the one hand and Fuhrer and Moore (1995) on the other. We also use our results on how the variance of nominal interest rates changes along the regime spectrum to comment on the probability of hitting a zero band associated with different policies.

Crisis costs and debtor discipline: the efficacy of public policy in sovereign debt crises

Working Paper No. 136

Prasanna Gai, Simon Hayes and Hyun Song Shin

Recent financial crises have generated much debate in policy circles. Although there has been some progress on crisis prevention measures—for example, greater emphasis on managing the national financial balance sheet—a consensus on the role of the official sector in crisis management is yet to be achieved. In particular, views vary on the likely impact of crisis management policies on lending by private creditors and the consequent welfare of sovereign borrowers.

In this paper, it is taken as given that the motivation for public intervention in crisis management stems from a coordination problem among creditors. The lack of coordination can be costly: in the event of a sovereign default, disorder in the workout process can lead to the premature scrapping of longer-term investment projects and a protracted exclusion from international capital markets. Much of the policy debate has therefore focused on reducing the costs of crisis.

But this may not be as benign an objective as it sounds. Dooley (2000) argues that the threat of substantial output costs in the event of non-payment provides the incentive for sovereign debtors to repay—crisis costs encourage debtor discipline. On this view, any move to reduce these costs will worsen the debtor moral hazard problem, and the supply of credit will be curtailed.

More generally, there is a trade-off between ensuring that sovereign borrowers adhere to debt contracts when they have the means to repay (termed '*ex ante* efficiency'), and the avoidance of large output losses following a bad-luck default ('*ex post* efficiency'). This trade-off is characterised in the paper. In particular, three key questions are addressed: (i) what are the main factors influencing the trade-off between *ex ante* and *ex post* efficiency? (ii) what is the role of the official sector in crisis management? and (iii) what impact might official sector involvement have on lending and welfare?

A simple model is presented in which the optimal level of lending and expected output are derived under two scenarios. In the first, creditors rely on high costs of crisis to ensure a debtor's willingness to pay (ie to deter strategic default). In the second, a representative of the international official sector—labelled the 'IMF'—receives a noisy signal on whether a default is strategic or arises from bad luck. If a default is perceived to be the result of bad luck, policies are implemented to alleviate the output disruption that would otherwise ensue. The official sector therefore acts in a dual capacity as 'firefighter' (trying to reduce crisis costs) and 'whistle-blower' (monitoring the debtor's ability to repay). In this second scenario, policy measures that alleviate crisis costs might include IMF lending (known in official circles as 'lending into arrears'), or measures to make the debt workout process more orderly (eg stays on litigation, mediation in the debt workout process, and oversight of best-practice guidelines for sovereign debt workouts).

Although the public policy framework described in the model leads to lower levels of lending, it confers *ex post* benefits and so can be welfare-improving. Whether this happens depends on two factors. The first is the quality of public monitoring. The better able is the 'IMF' to distinguish between bad-luck and strategic defaults, the greater the discipline on the debtor and the higher the level of lending extended by private creditors. The second factor is the efficacy with which the 'IMF' can reduce the costs of crisis. If the 'IMF' is a reasonably effective monitor, welfare is increasing in the degree to which crisis costs are alleviated. But beyond some point, the lower level of discipline that arises from the reduction in crisis costs offsets the extra discipline from 'IMF' monitoring. There is therefore a balancing act between the whistle-blowing and the fire-fighting functions: strategic behaviour is discouraged by better monitoring, but policy measures that lower the costs of crisis increase the incentive to behave strategically. Some analysis of a 'case-by-case' approach to public intervention is also presented, and it is shown to fall between full public intervention and no intervention.

Leading indicator information in UK equity prices: an assessment of economic tracking portfolios

Working Paper No. 137

Simon Hayes

Although movements in asset prices often seem to defy rational analysis, they do seem to respond to macroeconomic news in fairly predictable ways—see, for example, recent event studies such as Clare and Courtenay (2000). Clare and Courtenay relate asset prices only to the announcement of the most recent data point. But because equities are claims on cash flows over an indefinite time period, one might expect equity prices to respond to changes in expectations of macroeconomic events some way into the future. The question addressed in this paper is whether equity price movements can be used to infer changes in investors' expectations about particular macroeconomic variables over a variety of time horizons.

The approach taken is based on Lamont (1999), who constructs what he calls 'economic tracking portfolios' (ETPs). The returns on an ETP track how investors revise their expectations about the relevant macroeconomic variable period by period. To understand this relationship, note first that the level of asset prices is likely to incorporate forecasts of future macroeconomic outcomes. For example, equity prices are likely to reflect expectations of future dividends, interest rates and risk premia, all of which may be related to forecasts of a variety of macroeconomic variables. Changes in equity prices should therefore be related to **revisions** to investors' forecasts. An ETP is constructed so that the unexpected portion of the portfolio return has the maximum correlation with revisions to expectations of the target variable. In this paper I construct a set of ETPs using UK data, and assess their usefulness for macroeconomic forecasting.

When assessing the information content of equity prices, ETPs have a number of attractive features:

- One can, in principle, construct a tracking portfolio for any macroeconomic variable of interest over any forecast horizon.
- Previous studies have looked at the relation between capitalisation-weighted equity indices and macroeconomic variables. But it seems likely that the values of the largest companies are more dependent on macroeconomic factors outside the United Kingdom, and should therefore be given less weight than smaller firms' equity. The weights of an ETP are tailor-made to maximise the relationship with the target macroeconomic variable.
- Once the portfolio weights have been estimated, we can study the portfolio's performance at any frequency of interest. In this way, ETPs may provide a more timely indication of the economic state than the lower-frequency economic data on which they are based.

An important aspect of this study is that I focus on the out-of-sample properties of tracking portfolios. Many previous studies have found that, over a long sample, there is a significant relationship between equity prices and various macroeconomic variables. But if one were to use ETPs in real-time conjunctural assessment, what matters is the out-of-sample performance, which in turn depends on the stability of the relationship.

I construct ETPs for three target variables: inflation, industrial production growth, and growth in the volume of retail sales. I present results for forecast horizons of 0, 6, 12 and 24 months. The tracking portfolios are constructed using sectoral equity indices. In sample, practically all of the tracking portfolios are highly significant. But out of sample, the results are poor. There is a marked deterioration in the relationship between the target variables and the ETPs, such that the latter provide virtually no reliable information. This finding is apparent for all forecast horizons, and holds regardless of the frequency with which the portfolios are rebalanced or of the data window over which the weights are estimated.

This analysis suggests, therefore, that ETPs should be treated with some caution. One should certainly not automatically assume that an ETP will prove useful for out-of-sample analysis: a full statistical analysis needs to be conducted on a case-by-case basis to determine whether a given set of base assets can track a particular target variable over a particular horizon. The potential benefits of tapping into information that is not available from any other source need to be weighed against the danger of uncovering spurious relationships, which is a problem with any data-based approach to forecasting.

Core inflation in the United Kingdom

MPC Unit Discussion Paper No. 3

Joanne Cutler

Measures of core inflation attempt to strip out the effect of temporary disturbances from headline inflation, to uncover the underlying rate of inflation. This article looks at a selection of core inflation measures that have been estimated for the United Kingdom. It also introduces a new measure based on the idea that persistence of disaggregated inflation rates matters when measuring core inflation. These different measures of core inflation are evaluated against a number of desirable criteria, as suggested by the literature, and in particular their correlation with future RPIX inflation.

There are various ways of attempting to strip out the effects of so-called noise or nuisance elements from headline inflation. A common approach is to ignore erratic items, like seasonal foods that are affected by temporary weather-related disturbances, or energy that is affected by oil price fluctuations, to obtain, for example, a measure of RPIX excluding food and energy. RPIY excludes indirect tax changes on the grounds that these have short-lived effects on the annual inflation rate, affecting it when they are implemented and a year later when they drop out of the calculation. A more sophisticated statistical approach is to ignore items with 'extreme' inflation rates, on the grounds that these are not representative of generalised movements in inflation—the so-called trimmed mean approach proposed by Bryan and Cecchetti.

A different approach to measuring core inflation, proposed by Alan Blinder, focuses on the durable or persistent component of the underlying price changes. Blinder argues that persistent price changes capture the ongoing element of price changes and so should contain more information about future inflation. Policy-makers need to form a judgment about future inflation because of the long lags between changes in interest rates and changes in inflation. This paper reports a new persistence-weighted measure of core inflation for the United Kingdom based on this concept. The study uses the same underlying price data as in RPIX, but it weights individual-component inflation rates by their persistence over the past, instead of their expenditure weights. The idea is not to measure changes in the cost of living but instead to develop an indicator of future inflation that has a high signal-to-noise ratio.

The movement of the persistence-weighted measure over the early 1990s suggests that there was more momentum behind the inflationary pressures that built up during the late 1980s than was apparent in RPIX itself. It also suggests that disinflationary pressures were more intense in the second half of the 1990s, the index being consistently lower than RPIX since autumn 1996. This reflects the weakness of non-seasonal food, and clothing and footwear prices, where competitive pressures were intensified by the strength of sterling, the Asian crisis and global over-supply. These items have a high weight in a persistence-based core inflation measure.

In terms of predictive ability, the persistence-weighted measure outperforms most other core inflation measures in forecasting RPIX at short-term horizons. It also outperforms current RPIX as a predictor. RPIY seems to be a good predictor of RPIX as well, although the relationship is less stable over the second half of the 1990s than the first half. By contrast, RPIX excluding food and energy, and an estimate of the trimmed mean for the United Kingdom, are poor predictors over the sample period considered. One explanation is that they take no explicit account of the persistence of individual price changes in their construction and therefore they may exclude important information about underlying inflation.

International efforts to improve the functioning of the global economy

In this speech,[1] *the* ***Governor*** *reviews the progress of collective international efforts to improve the functioning of the global economy, covering both economic management and the international financial system. He concludes that, although the pace may seem slow, and in some areas there remains a long way to go, very real progress has been made towards defining common objectives and agreeing upon tangible steps that will help to achieve them.*

A week ago I returned from the annual Spring Meeting of the IMF in Washington, and I thought that I might discuss with you this evening where we are in our collective international efforts to improve the functioning of the global economy. In particular I will touch upon two broad areas: first, the approach to overall economic management; second, the approach to strengthening the international financial system.

But I should like to begin with a few words about the process of international monetary and financial co-operation. Finance Ministers and Central Bank Governors, as well as their Deputies, spend a good deal of time at meetings in various different international fora. I am often asked after one or other of these meetings 'what exactly did you decide?' And more often than not, the answer is that we did not actually take any specific decisions. We exchanged opinions, and often agreed that we needed to do more work on this or that issue, which we could review and debate at a subsequent meeting. You could be forgiven for thinking that the process of reaching international agreement on anything moves at a snail's pace. To a degree that is true.

But even a snail can make considerable progress provided it keeps going. I am told that the world record for a snail is about 16 cms a minute, or roughly one kilometre in four days. On that basis a snail could leave here this evening and be at the BIS in Basel in under a year. It necessarily takes time to build an international consensus to move forward on any significant issue, and you need a broad consensus if whatever it is you agree is to have any meaningful effect. And if you look back over ten, or even five, years, rather than just at the outcome of any particular meeting, then the amount of progress really has been very considerable.

Overall economic management

Let me illustrate this first in relation to the broad consensus that now exists—within the developing, emerging, and transition economies as well as within the industrial world—on the general approach to overall economic management. That consensus can perhaps be summed up essentially as 'macroeconomic stability and supply-side flexibility', though that characterisation needs elaboration.

On the macroeconomic side we have learned (and it has taken some countries longer than others) that you cannot achieve what we are all trying to achieve—sustained growth, high levels of employment and rising living standards—simply by pumping up demand in our economies through expansionary monetary and fiscal policies, without proper regard to the underlying supply-side capacity of our economies to meet that demand. Short-term demand management through monetary policy too often led instead to accelerating inflation, and increasing external deficits, which had eventually to be brought under control through recession—an absolute recipe for short-termism in both financial and business behaviour. Equally, excessive public expenditure—which had ultimately to be financed through higher taxation—imposed burdens on the private sector, which weakened its capacity to generate employment and income and wealth.

So the emphasis now, more or less everywhere, is on effective price stability as the immediate objective of

(1) Given to the Swiss Institute of International Studies at the University of Zurich on 7 May 2001. This speech can be found on the Bank's web site at www.bankofengland.co.uk/speeches/speech126.htm

macroeconomic policy—not simply as an end in itself but as a measure of the balance between aggregate demand and underlying supply in the economy as a whole. In effect, the aim of monetary policy in particular is to moderate, rather than aggravate, the economic cycle, and so to provide the basis for sustainable growth at around the underlying rate of growth of productive, supply-side, potential. And the emphasis now—again more or less everywhere—in relation to fiscal policy is to limit public sector borrowing, and the outstanding level of public sector debt, to levels that can be sustained into the medium and longer term, without the need for increasing tax burdens or the imposition of rising real interest rates on the private sector.

These objectives of macroeconomic policy—monetary and overall fiscal policy—will certainly be familiar to you in this country; they are at the heart of the policies being pursued right across Europe; and they are the policies endorsed, too, by all the members of the IMF in the Madrid Declaration adopted at the IMF Annual Meeting in 1994 and expanded and updated two years later. Of course on occasion the flesh proves to be weaker than the spirit—and achieving these macroeconomic objectives is not easy in practice even as a technical matter. But the intention—the international commitment to macroeconomic stability—is clear.

Acceptance of the aim of macroeconomic stability served to bring into sharper focus the structural, supply side, of the economy—that is the whole raft of influences that can affect the underlying growth rate of capacity and thus the growth rate of aggregate demand that can be sustained.

And here, too, there has been a strengthening international presumption in favour of open markets and free competition—both domestically and internationally—with a continuing strong presumption against predatory trade or exchange rate manipulation. The justification is that undistorted competition contributes to potential global economic growth through increased efficiency and the more effective allocation of productive resources. Faster growth in turn provides a more favourable context for addressing social concerns, including the issue of poverty.

The international presumption in favour of free markets in itself is somewhat remarkable, given that, at the microeconomic level, increased competition invariably constitutes a threat to established producers—and their employees—who might well be tempted to urge protection in one form or another on their national governments. Consumers, who benefit from such competition, tend to be less vocal or well organised. The threat of protectionism is never, therefore, far away. But in fact the presumption in favour of competition has proved encouragingly robust. And that is not just in relation to international trade. There is a parallel presumption in favour of freedom of capital movements, and much greater openness around the world to foreign investment.

Among other things on the supply side, there is a shared emphasis on the need to direct public spending to developing human resources through education and training, to effective health care, and affordable social safety nets. There has been a global trend to privatisation through which governments have increasingly returned essentially commercial activities, in which they have no necessary comparative advantage, to market disciplines. And there is a common recognition of the need for reforms in labour and product markets designed to reduce distortions that impede the efficient allocation of resources.

Now I don't pretend to you, Mr Chairman, that the international policy consensus in favour of macroeconomic stability and supply-side reform is fully articulated, particularly on the supply side; nor do I claim that it is subscribed to in its detail equally in every IMF member country. But it does represent a substantial evolution in our collective thinking over the past decade or so towards a much more common approach to economic management, which serves as a valuable framework within which countries' performance can be assessed. The snail may have moved slowly but it has in fact travelled a considerable distance!

But broad agreement on the principles does not make them any easier to apply in practice. This is evident from the imbalances that have built up within and between the major industrial countries in recent years. It is uncertainty as to how those imbalances are likely to be corrected that underlies much of the current concern about the prospects for the global economy.

The major uncertainty relates to the situation in the United States, which has experienced a period of exceptionally strong economic growth with relatively low

inflation until quite recently. Briefly—and no doubt oversimply—this very strong performance is widely seen as driven largely by exceptional productivity gains, as the application of new information and communications technologies spread through the economy. This development promised a higher sustainable rate of growth in the US economy and higher corporate earnings growth. That expectation contributed to a rapid rise in equity prices, especially in the 'high-tech' sectors, which in turn helped stimulate both business investment in the United States and consumer demand, causing the private sector to move into financial deficit. It also attracted massive direct and portfolio investment inflows from abroad which over-financed an increasing current account deficit in the United States and caused the dollar to strengthen against other currencies. By the first half of last year the US economy was expanding at a rate of over 5%, which even on the most optimistic view of underlying productivity growth was clearly unsustainable. The pace of demand growth in the United States needed to slow down—as of course it has.

The big questions now are about the extent of the slowdown and how long it will last. And the reality is that no one can be confident that they know the answers.

What we do know is that the US data on the whole have not so far been as weak as many commentators predicted. Consumer spending in particular has held up reasonably well, though there has been a fall-off in investment growth, as well as a sharp downward stocks adjustment and an associated decline in US imports. On an optimistic view, if consumption continues to hold up, and assuming that the recent underlying productivity gains can be maintained, investment spending will recover as the spread of ICT through the economy resumes, and the downward stock adjustment will come to an end. On this view we can look forward to a pick-up in US activity as we move, say, into next year. But the pessimist is inclined to point to the weakness of private sector saving, which could induce more cautious consumer behaviour especially if unemployment continues to rise; he points to a possible overhang of past investment excesses; and he points to the US external deficit, which will at some point need to be corrected. These adjustments might take place gradually over time, in which case the United States might face a more protracted period of relatively slow growth; or, if you are really pessimistic, the adjustments might be more abrupt implying a possible period of negative growth and global financial instability. The recent somewhat erratic recovery of US stock markets from their earlier gloom suggests that they are beginning to side with the optimists; some of the survey evidence of consumer and business confidence on the other hand still supports a rather more pessimistic view. For what it is worth, and given the strong policy response in the United States, I am modestly optimistic, but I recognise the downside risks. The outcome is obviously the major uncertainty surrounding the global economic prospect, and policy-makers elsewhere can only monitor, continuously and very closely, the emerging evidence and react to that in the light of its likely impact on their own situation.

The US slowdown comes at a particularly bad time for Japan, which is already suffering from a combination of weak domestic demand—particularly consumer demand—and supply-side constraints reflecting pressures on the banking system, heavily burdened with non-performing loans, and an acknowledged need for restructuring parts of the non-financial sector. Japan has pretty well exhausted the scope for macroeconomic stimulus. Successive fiscal packages focused on public works and a sustained period of attempted monetary expansion, at near-zero interest rates in the face of deflation, have failed to overcome a high rate of precautionary saving by an ageing population facing an uncertain economic future. The policy emphasis of the new Japanese administration appears to be shifting towards firmer action to bring about supply-side reform in the belief that this will help to engender greater confidence. The danger is that, to the extent that more aggressive restructuring results in bankruptcies and higher unemployment in the short term, that in itself might tend to weaken consumer demand for a time before the benefits of the restructuring come through.

Closer to home, the euro-area economy is a good deal better placed to withstand the US slowdown, although we are all bound to be affected to some degree. For most of last year the euro-area economy performed relatively strongly, with overall output growth well above trend, and unemployment in the area as a whole continuing to fall from its earlier chronically high level.

A problem, of course, was the persistent weakness of the euro in foreign exchange markets, despite strong 'fundamentals' in terms of conventional analysis. This was largely the result of an outflow of capital, much of it

drawn into the United States by the magnetic attraction of prospective corporate earnings growth—and apparently continuing despite the US slowdown.

The euro's weakness gave rise to widespread—but in my view unjustified—criticism of the European Central Bank. The task of a central bank operating an independent monetary policy is necessarily a limited task, not least because it effectively has only one instrument—its control over short-term interest rates. Its role—as I said earlier—is essentially to use that instrument to influence aggregate demand in the economy, with the aim of keeping demand broadly in line with the supply-side capacity of the economy. The measure of its success is consistently low inflation. Against that criterion the ECB has been relatively successful. The euro-area economy has grown, above trend, with core inflation nevertheless remaining within the tolerance range of 0%–2%, even though on the headline measure, influenced by rising oil prices and the weaker exchange rate, inflation has for the time being moved above the top of that range. The ECB would have put that internal stability of the euro area as a whole at risk if it had attempted at the same time to use monetary policy to target the euro's exchange rate.

The more recent criticism has been that the ECB has been slow to respond to the weakening of the US economy. Implicit in that criticism is no doubt a judgment about the extent and duration of the US slowdown and its likely impact on the euro area. As I have said there is in fact a great deal of uncertainty about that. But the ECB has to take account, too, of domestic demand pressures in the euro area, and of the fact that even on the core measure, euro-area inflation has been moving up gradually towards the top of the ECB's 0%–2% range. Frankly I don't see how anyone can be confident whether the ECB has it precisely right or wrong—it is perfectly normal for even the best-informed people to disagree on these judgments, as anyone who reads our own Monetary Policy Committee meeting minutes will tell you. But I am wholly confident that the ECB is sensitive to the issues surrounding those judgments, including the downside risks in the United States.

So, too, are we in the United Kingdom. In our case, we again enjoyed relatively steady overall economic growth last year combined with a further fall in unemployment to its lowest rate for 25 years. Inflation meanwhile continued to run somewhat below the Government's $2^1/_2$% target, partly at least as a result of the dampening effect of sterling's surprisingly persistent strength against the euro. The problem that has been with us for some time now is the sectoral (and associated regional) imbalance within our overall economy. The domestically oriented sectors have, for the most part, been doing relatively well, whereas those sectors that are exposed to competition within or from the euro area have been under considerable pressure.

Domestic demand growth has remained relatively robust into this year, but we too are affected by the US slowdown and by the associated weakening of equity prices. And we have had a new problem of our own in the form of foot-and-mouth disease, the effects of which have gone a good deal wider than just the agricultural sector. These new developments were likely to have a dampening effect on demand pressure within the overall economy, both through their direct impact and through possible damaging effects on confidence. Given the fact that we started from a position in which inflation was below target (and expected to remain so for some period ahead); and given only modest upward pressure—at least so far—on wages and earnings growth, despite the continuing tightness in the labour market; we judged that we needed to reduce interest rates—by $^1/_2$%—earlier this year in order to meet the inflation target further ahead. And we have made it clear that we will continue to monitor the downside risks very closely, in the context of course of all the other developments affecting our economy.

Mr Chairman, I have discussed the current international conjuncture at some length to illustrate that even though we all have broadly common economic objectives, that does not make them easy to achieve. We all face our own domestic uncertainties and are exposed to the international repercussions of developments elsewhere.

Financial stability

One of the greatest difficulties we face is the problem of how to cope with movements in financial asset prices, including exchange rates. That problem has become an increasing preoccupation with increasing financial wealth in our economies and with global financial integration.

In the context of macroeconomic stabilisation we can, and of course do, take account of asset prices as best we can in both our projections and our policy decisions.

The strength and subsequent weakening of stock markets in all our economies, for example, will have been one of the factors influencing both investment and consumer demand to varying degrees for all of us; and the behaviour of exchange rates is clearly a factor influencing inflationary pressures in our respective economies, both through its direct effect on prices and indirectly through its impact on net external demand. But while we can try to make allowance for these effects we cannot predict future asset price movements and we certainly cannot seek to control them. They remain a major source of uncertainty.

They also, of course, represent a major potential threat to financial stability, which is a necessary concomitant to monetary stability. In the rest of my remarks I should like to comment briefly on the evolving international consensus on the approach to maintaining financial stability.

The 1994 Madrid Declaration, to which I referred earlier, had already welcomed 'the growing trend towards currency convertibility and encouraged IMF member countries to remove impediments to the free flow of capital'. One might have supposed that the subsequent eruption of the Asian financial crisis—which was certainly aggravated, if not provoked, by volatile international capital flows—might have resulted in something of a reaction to further evolution in that direction. In fact, in the midst of the turmoil, in September 1997, the IMF's Interim Committee confirmed the consensus view that: 'Private capital flows have become much more important to the international monetary system, and an increasingly open and liberal system has proved to be highly beneficial to the world economy. By facilitating the flow of savings to their most productive uses, capital movements increase investment, growth, and prosperity'. In other words, while markets may not be perfect, they are in general the best means we have of allocating financial resources efficiently. The impact of the crisis was instead to give fresh impetus to defining and establishing the conditions that are necessary for financial markets to function more efficiently, and that would help to reduce the risks of and limit the damage from, volatile shifts in market sentiment, with their potentially disruptive effects on both economic and financial stability.

It goes without saying that macroeconomic stability is our first line of defence. But, beyond that, a huge amount of work has been undertaken in a variety of international fora to develop codes and standards of best practice in a whole range of more specific areas relevant to improving the functioning of the international financial system. The IMF has produced codes of good practice on data dissemination and on transparency of monetary, financial and fiscal policies, and guidelines for public debt and reserves management. The main Basel Committee has put forward proposals for revising its capital accord designed to align regulatory capital requirements more closely with economic capital, and has drawn up core principles for effective banking supervision. The Basel Committee on Payments and Settlement Systems has developed core principles for systemically important payments systems. The International Organisation of Securities Commissions has developed objectives and principles for securities regulation; the International Association of Insurance Supervisors has developed insurance core principles; and the OECD has developed a set of principles on corporate governance. The International Accounting Standards Committee has developed international accounting standards; and the International Federation of Accountants has developed international standards on auditing and audit practice; and so the list goes on.

The emphasis now has to be on implementation by national authorities with the help where necessary of the international community. And there needs to be increasing emphasis, too, on transparency and validation of progress towards implementation in individual countries in the context of IMF surveillance.

The Financial Stability Forum has recommended that in seeking to strengthen their financial systems countries give priority to implementing standards and codes in twelve particular areas, and the IMF and World Bank have developed a framework for assessing the progress countries are making in implementing these key standards and codes. Standards that are particularly relevant to the development of sound financial systems are evaluated under the Financial Sector Assessment Programme (FSAP), while Reports on the Observance of Standards and Codes (ROSC) provide summary assessments of a country's progress in observing standards across a range of areas. Taken together all these initiatives should contribute to greater stability at the national level. But they should also help lenders and investors better to assess the risks of lending to or investing in one country as against another, dampening potential volatility and, at the same time, giving the

countries themselves stronger incentives to move toward best practice. As far as crisis prevention goes our snail has come a long way in the past few years, though of course it needs to keep moving forwards.

But while we can hope to reduce the risk of crises we cannot realistically hope that they will not continue to occur. So a great deal of attention has also been paid to improving our capacity for crisis management.

A major step forward was the agreement—at the G7 Summit some two years ago—on a set of principles and tools that could be applied in managing a crisis.

Broadly, having emphasised the importance of not undermining contractual obligations, the principles stress that all private creditors should accept responsibility for their lending and investment decisions—without expecting to be underwritten or bailed out by the official sector. They encourage co-operative solutions between the debtor country and its creditors, building on effective dialogues established in advance. The tools link official support to efforts by the debtor country to obtain private financing—or maintain existing exposures—on a voluntary basis, and provide for comparability of treatment within the Paris Club, of all categories of creditors other than international financial institutions. They include mechanisms that can be used to limit the use of official financing to fund external deficits or domestic capital outflows or to repay private sector debt. And they provide ultimately for capital controls, as part of payments standstills, in conjunction with IMF programmes.

So we have the principles and we have the tools. What we still need to develop is a better framework of understanding as to how they might normally be applied. I agree of course that we should not adopt hard and fast rules, because to a degree each case is different. But we do need to develop some kind of presumption about the limits within which IMF support might be made available to member countries in different situations, and the conditions, relating both to adjustment action and to private sector financing that would normally be applied. We need to develop a clearer presumptive framework of this kind—no doubt with provision for exceptions where they could be properly justified—before the next crisis hits us, because what debtor countries and their private sector creditors believe they can expect will influence their behaviour in the meantime.

What we all have to recognise is that the exceptional amounts of official funding committed during the Asian crisis are far less likely to be forthcoming in future. And to the extent that official funding is forthcoming, conditions may well be attached to ensure that it is not used simply to re-finance payments of short-term debt to private sector creditors or to fund a resident capital outflow. Several of the tools that the G7 communiqué identified are designed to have precisely this effect.

The last thing that the official international community wants is to get dragged into the micro-management of relations between debtor countries and their creditors. We would all agree on the desirability of voluntary solutions, which might be easier to achieve if borrowing countries and their major creditors—above all the short-term lenders—were to establish, during the good times but on an ongoing basis, arrangements for regular dialogue. Nor would anyone want to insist upon the imposition of constraints on capital outflows.

But where, in more extreme situations, an agreed solution in relation to external debt is not immediately achievable there may be a logical case for the orderly suspension of payments until a better alternative can be put in place. This could have advantages for committed private sector creditors as well as for the debtor country and the official international community if it prevented free riders running for the exit, or seeking to attach assets, and provided time for orderly negotiations on the provision of new finance or for equitable debt rescheduling. Similarly, in some situations, there may be an equivalent case for restraining domestic capital outflows.

I am under no illusion that this area is an extremely sensitive and complex one. There are no simple solutions. But we do need to continue to explore the available options or we will remain in the position of making things up as we go along. The snail in this area certainly still has a long way to go!

Conclusion

Mr Chairman, I hope that I may have been able to persuade you this evening that the continuous round of meetings on international monetary and financial question do indeed serve a useful purpose, even though the outcome from one meeting to another may not be immediately apparent. It may just reflect the increasing patience that comes with advancing years, but I believe we have in fact made very real progress towards defining

common objectives, and agreeing upon tangible steps that will help us towards achieving those objectives, in relation both to monetary, and broader macroeconomic, stability and to creating a more effective and more robust financial system. It is of course an endless journey, and no doubt we will from time to time run into rough waters. But I'm convinced that our snail will keep moving forwards—and that it will even learn to swim!

Monetary stability as a foundation for sustained growth

In this speech,(1) *Ian Plenderleith, Executive Director and member of the Monetary Policy Committee, reviews the prospects for the UK economy, identifying three main areas of uncertainty. The first is the economic slowdown in the United States. The second is the extent of supply-side improvements in the UK economy, where he argues that the changes are delivering benefits, but through a gradual and progressive process rather than any sudden leap forward. The third is the underlying strength of demand. In facing these uncertainties, Mr Plenderleith takes confidence from the underlying soundness of the economy, on the basis of which the uncertainties could be addressed from a position of strength.*

The UK economy has embarked on the new millennium with much the same healthy stride as marked its progress through the final years of the old.

Over the past year, we have seen the economy continue to achieve steady and sustainable growth. We are, indeed, now in the ninth year of continuous positive growth in output. This remarkable track record has brought with it a steady rise in employment, with the benefits being felt in high levels of job creation throughout the regions of the country; and unemployment has fallen to the lowest levels we have seen in decades. All of this has been achieved with inflation remaining low: RPIX is currently running a little below our target of $2^1/_2$% and has averaged 2.4% a year over the nearly-four years since the MPC was given responsibility for managing interest rates. In the process, with inflationary expectations now anchored at low levels, 10-year bond yields have fallen to around $4^3/_4$%, as low as can be found in any industrialised country except Japan.

What is particularly encouraging about the past year is not just that we have been able to continue on the track of steady growth. More than that, developments during the year have helped in several ways to strengthen the prospect of our being able to sustain this improved economic performance going forward. A year ago, output was growing at more than 3%, which is arguably faster than we can hope to sustain for any length of time without running risks of generating inflationary pressures. We needed therefore to see some degree of moderation in the pace of overall demand, to ensure that the economy could continue to grow without generating strains. For preference, the moderation needed to come principally in the area of consumption spending, which had been the major factor driving growth through last year, as households enjoyed the benefits of high employment and rising incomes. Sustainable growth in household spending is, of course, highly desirable and very much the mark of a healthy and growing economy; but it needed to be balanced against the equally desirable planned increases in government spending on public services, and the higher levels planned for public investment on improved infrastructure, both made possible by the government's strong fiscal position. The need was to ensure that all these sources of demand did not over-stretch the economy's overall productive capacity. The evidence that consumption spending may indeed have moderated somewhat towards the end of the year, and in parallel that there has been a resumption of growth in business investment, represents an improvement in the balance of demand in the economy, which in turn improves the prospect of our being able to sustain growth going forward.

An improvement in the balance of the economy was also achieved last year from another source—a welcome easing in the strength of sterling, which itself had been a reflection of the persistent weakness of the euro. As the euro has recovered somewhat over the past year, and sterling has moved back from its peak levels, this has, at least in degree, eased some of the pressures faced by exporters and by businesses most exposed to import competition. The result is a better balance between the

(1) Given at the National Association of Pension Funds Investment Conference on 14 March 2001. This speech may be found on the Bank's web site at www.bankofengland.co.uk/speeches/speech118.htm

externally exposed sectors of the economy and domestically orientated businesses, between manufacturing and services, and between different regions of the country.

Two other clouds that had threatened the sustainability of our growth performance also receded somewhat last year. One was the impact throughout the economy emanating from the steep rise in oil prices, which abated as oil prices fell back from their peak levels. The other concern was that share prices had risen to levels which many felt were not sustainable in terms of reasonable expectations of future corporate profits. The fall in share prices during last year was not a comfortable experience—falling asset prices rarely are—but it removed some of the sense of unreality. Of course, it is never easy to judge what levels of financial asset prices are realistic, and the risk of volatile adjustments remains, as we have seen in recent days, but the important point is that the downwards adjustment experienced last year, which could have been abrupt and might have generated wider economic effects, was in fact achieved without significant repercussions on the real economy. In both cases, the result is a better foundation for the prospects for sustaining growth in the economy.

Let me now turn from the year past to the year ahead. I have stressed the encouraging performance of the economy over the past year, and the confidence we can hopefully take in its underlying soundness, because we undoubtedly face serious challenges and a material increase in uncertainty in the year ahead. Most notably, we have to manage the UK economy against the background of an international environment in which the US economy has begun to experience a sharp slowdown.

Decision-making under conditions of uncertainty lies at the core of any business activity, so I was once taught, and that is just as much true of our job on the MPC as for yours. We all of us get used in our professional lives to looking through a glass darkly. But in relation to prospects for the economy, that is even more than usually the case now, given the uncertainties we face. Looking ahead, we can in a sense see two rather different pictures, one superimposed on the other. One is the domestic economy, where demand remains reasonably well sustained and now, as I have indicated, better balanced than it was; employment remains high; and consumer and business confidence both seem reasonably up-beat. The other picture is the international environment, where the US slowdown is likely to have a dampening effect, but how quickly, and on what scale, and for how long, remains uncertain. Since the United Kingdom is not, except literally, an island, these two pictures do not mesh. But it is not easy to see how they will coalesce into a single image. The operation of monetary policy is often said to be more of an art than a precise science. But none of us can claim to be a Michelangelo. So let me take you briefly through three particular areas of uncertainty we face, in the hope that, when we get to the discussion session, you will be able to add definition and colour to my half-formed sketches.

First, the slowdown in the United States is an important area of uncertainty because, if the downside risk of a deeper or more prolonged slowdown materialises, we would face slower growth and lower inflation in the United Kingdom than we are projecting on our central projection. That would, of course, be grounds for us to contemplate further easing in our monetary stance. That follows because our inflation target is, importantly, a symmetrical one: we need to be just as ready to contemplate easing if we see evidence on the downside of the economy underperforming, and hence the likelihood of inflation running over time materially below our 2½% target, as we would be to exercise restraint on the upside. We take this symmetrical nature of our responsibility very seriously and there is undoubtedly a significant risk that the US slowdown could have a material dampening effect on UK activity.

Analysts have used a large part of the alphabet to try to describe various views of how the US economy may develop. I am not sure that I find any of these pictograms particularly helpful, not least because people are sometimes pretty vague about vital details like the dimensions of the letter they favour or the angle of its arms: a big V, after all, can feel awfully like a U when you are down at the bottom and trying to find your way up again.

The short answer is that none of us can pretend to know precisely how the story will develop. It will be important to keep an open mind and be prepared to adapt our assessment in the light of actual events. But in doing so, there are four considerations that I would suggest are particularly germane to this first area of uncertainty.

First, we need to recognise that we are talking about slowdown in the United States from what have been

extremely buoyant rates of growth, maintained for several years past, as the US economy has reaped the benefits of the application of information technology and the rise in productivity growth that had engendered—the 'new economy'. There is plenty of evidence that growth in the United States needed to slow somewhat, to alleviate imbalances in the economy. So part of what is happening should be helpful in providing a sounder base for sustainable recovery.

Second, the new economy is, in the United States, a reality: there plainly has been a continuing process of improvements in efficiency, achieved by harnessing the benefits of IT, which have raised the growth capacity of the economy. It seems unlikely that those gains will vanish into the night and, if they remain in place, they should provide a basis for a recovery in US growth when the present adjustment has run its course.

That, of course, says nothing about how long the adjustment may take. But a third important feature is that the Federal Reserve has demonstrated a willingness to act rapidly and vigorously in easing monetary conditions in response to the downturn. Monetary policy cannot remove economic cycles. But active and intelligent management of interest rates can help substantially to alleviate the severity of the adjustment. And a fourth factor suggests that the markets share this view. In the situation where some forecasts have been extremely pessimistic, one might expect markets to adjust correspondingly in an abrupt fashion. In the event, in the foreign exchange markets the dollar overall has remained rather steady; and the short-term interest rate futures curve implies that rates are expected to bottom out later this year and then begin to rise. Moreover, while the stock market has fallen back over the past year from what many felt were unrealistic levels, and has been volatile again in recent days, the downturn in the mainstream market has so far been relatively limited, with the greatest fall concentrated in more speculative stocks. Equity valuations are always uncertain at times of adjustment, and we could see some continued volatility in that area, but the overall picture is that the markets as a whole are 'looking through' the present slowdown, on the basis that they see a reasonable prospect for a recovery in US growth after the present adjustment.

A second area of uncertainty lies much closer to home, and happily its ramifications are almost wholly beneficent. This is the question of whether changes in the supply side of the UK economy mean that we can hope to achieve higher rates of sustainable growth, consistently with our inflation target, than has been possible in the past.

One essentially empirical argument that is sometimes made to suggest that we can achieve faster sustainable growth is that inflation has in fact run a little below our target for most of the past two years. This is not in itself a particularly powerful argument, because the undershoot has been marginal and probably owes a great deal to the unexpected strength of sterling. Indeed, before we began to track a little below the target, we had for around two years been tracking above it.

Nonetheless, the strength of demand in the economy does seem to have exercised less upwards pressure on prices over the past two years or so than we would have expected from earlier experience; and this applies both to prices of goods sold in the product market and to pay and earnings in the labour market. Why is this? In the product market, one factor may be greater competition, which has caused producers and retailers to accept lower margins. Another factor may be new forms of marketing and retailing, for example the spread of e-commerce. This may have cut the cost of distribution, and it may also have intensified consumers' awareness of prices and their resistance to price increases, by enabling them to compare prices more easily. Another possibility is that we may be seeing an increase in productivity growth, perhaps stimulated by the pressures many businesses faced from the strength of sterling, and perhaps also arising from the application of IT—possibly the beginnings of the arrival of the new economy from across the Atlantic. In the labour markets, reforms which have made possible greater labour flexibility, and competitive pressures which have stimulated firms to adapt more quickly to changes in their business environment, may underlie the more benign performance of real earnings growth. More widely, the greater stability the economy has enjoyed in recent years from the medium-term framework that governs both fiscal and monetary decisions may, by stabilising inflationary expectations at a low level, have made it less attractive, and more risky, to try to raise prices even when demand is strong, and may also have enabled industry and commerce to plan their business activities on a sounder and more forward-looking basis.

There is plenty of evidence that all these factors are, in varying degrees, at work in the United Kingdom; and they offer the prospect of genuine improvements in the

functioning of the economy. But the question is—on what scale, and are the improvements temporary or here to stay? We take considerable care to try to factor these developments into our decisions on interest rates, but the difficult judgment is to assess how much faster the economy can grow as a result without jeopardising our inflation target. My own view is that supply-side improvements are delivering benefits, but the process is a gradual and progressive one, rather than any sudden leap forward. Miracles in the real world are pedestrian affairs, arriving step by step. The appropriate response for us in setting interest rates, therefore, is to try to stay in step and keep pace—not running ahead, but equally not lagging behind.

The third and final area of uncertainty I want to focus on is the underlying strength of demand in the UK economy. The US slowdown may, as I have said, have some dampening effect on other countries, including the United Kingdom. The supply-side improvements I have described may enhance our growth capacity. Both these factors could provide grounds for the monetary stance to provide more stimulus to the economy, depending on how events develop. But a third area of uncertainty—the underlying strength of demand in the United Kingdom—could point to less need for stimulus. Consumer spending may be slowing somewhat, but it remains relatively buoyant. Retail sales continue to grow and housing market activity may be picking up. Consumer and business confidence remains steady, with new orders holding up well. The easing in sterling has improved our competitiveness in key export markets. Business investment is picking up. The planned increases in government spending are beginning to come through. Employment remains high and earnings are showing signs of some upward creep as businesses experience skill shortages. All of this is welcome evidence of a healthy and thriving economy, and, with inflation remaining low, it is a performance that can be sustained without immediate risk of overheating. But it is also a situation in which cost and price pressures can begin to build up. The task of the MPC is to ensure that this does not happen, by keeping inflation in line with our target so that the economy can continue to grow at a sustainable rate.

The uncertainties I have described thus lie in both directions: the economy could grow more strongly or less strongly than we currently project, though the risks lie predominantly on the downside. The uncertainties are probably rather greater than normal just at present, but we can take some confidence from the underlying soundness of the economy. So we address the uncertainties from a position of strength. That does not mean that the ride may not be bumpy at times, but it does mean that we have grounds for reasonable optimism that we will come through the present uncertainties in good shape.

The 'new economy': myths and realities

In this speech,[1] *Sushil B Wadhwani,*[2] *argues that the 'new economy' has changed some of the underlying relationships that we rely on for purposes of monetary policy, and also has important implications for the appropriate measurement of the capital stock and GDP. However, some of the other claims that have been made for the 'new economy' are shown to be too extravagant.*

Introduction

Mr Chairman, it is a great pleasure to be here today, on the occasion of the annual Travers Lecture.

Developments in information and communications technology have generated much excitement in recent years. Even allowing for the enthusiasm that might be expected from one of the pioneers, I recall being struck by the boldness of Mr Gates'[3] claim in Davos earlier this year:

'*The PC is the best thing that Man ever created.*'

Being awestruck by the technological advances we have seen also appears to go hand-in-hand with a belief that the economic benefits are likely to be correspondingly large. Hence, notwithstanding the significant decline in the share prices of technology companies over the past year, Mr Chambers,[4] also speaking in Davos, asserted that:

'*The productivity gain that will be delivered by IT will be at least as great as the electricity, transportation and telephone revolutions put together.*'

There has, in recent years, been much discussion of the 'new economy' (NE). There is no generally accepted definition of what is meant by the NE.[5] Recall that the term NE in the early 1980s implied an economy that was driven by services rather than manufacturing.[6] Then, the worry was that a service-driven economy was going to create poor, low-wage jobs. More recently, the use of the term NE has been transformed radically. Unsurprisingly, there are those who see the NE as being synonymous with an acceleration in the diffusion of information and communications technology (ICT) (see, for example, Gordon (2000)). However, I regard that as a rather narrow definition. Indeed, much that might be different about the economy today relates not just to ICT advances, but also to the effects of globalisation, intensifying product market competition, labour market reform, financial market liberalisation, and several other factors.

A more appropriate characterisation of how a central banker might define the NE is, perhaps, that provided by Chairman Greenspan.

'*…it is certainly true that we have a new economy. It is different. It is behaving differently and it requires a different type of monetary policy to maintain its growth than we had in the past*'.[7]

I shall therefore discuss today some of the important ways in which our economies seem to be operating differently compared with, say, the 1970s and 1980s. Although I do not always believe some of the more extravagant claims that are made for the NE, my best guess is that enough has changed for it to be material to the setting of monetary policy.

(1) Given as the Travers Lecture at London Guildhall University on 20 March 2001. This speech can be found on the Bank's web site at www.bankofengland.co.uk/speeches/speech119.pdf

(2) Member of the Bank of England's Monetary Policy Committee, and Visiting Professor at the City University Business School and the London School of Economics. I am extremely grateful to Jo Cutler, Nick Davey, Jennifer Greenslade, John Henderson, Nick Oulton and Kenny Turnbull for their help and advice. Bill Allen, Chris Kelly (HMT), Mervyn King and Prabhat Vaze (ONS) provided me with helpful comments on an earlier draft. The views expressed in this lecture are entirely personal and do not necessarily reflect the views of the MPC or the Bank of England.

(3) The Chairman of Microsoft, as quoted in *The Independent*, 29 January 2001.

(4) The President of Cisco, also quoted in *The Independent*, 29 January 2001.

(5) See Browne (2000) for an extensive discussion of this issue.

(6) See, for example, Mandel (2001).

(7) Testimony before Senate Banking Committee, 23 February 2000.

Is the business cycle dead?

In recent years, it had become increasingly fashionable to assert that recessions were a thing of the past. For example, consider the following quote from the *Wall Street Journal* (15 November 1996).

'*From boardrooms to living rooms and from government offices to trading floors, a consensus is emerging. The big, bad business cycle has been tamed.*'

Or, more recently, a columnist(1) in the same journal:

'*The business cycle—a creation of the Industrial Age—may well become an anachronism.*'

Of course, since late last year, sentiment has deteriorated significantly, with increased concern about a recession in the United States. While the notion that the business cycle might be dead might seem even more questionable now, the less extreme view that economies might have become more stable is clearly worth taking seriously.

Research at the Federal Reserve Bank of New York(2) has shown that a significant decline in the volatility of US GDP growth has occurred since the mid-1980s. Specifically, the variance of output fluctuations over the 1953–83 period is more than four times as large as the variance for the period since 1984. The research shows that the reduction in volatility largely emanates from a reduction in the volatility of durable goods production and that, further, this appears to correlate with a decline in the share of durable goods accounted for by inventories. One hypothesis that might explain these results is that changes in inventory management, such as the use of 'just-in-time' techniques, have helped bring about a reduction in the share of durables inventory. Of course, ICT advances have facilitated some of the improvements in inventory management techniques, as information now flows more speedily than before.

Chart 1 shows that a similar reduction in the volatility of output growth has also occurred in the United Kingdom. Table A shows, though, that unlike the United States, little of the decline in the volatility of output is accounted for by stocks—instead, the largest arithmetical source of the decline in the volatility of GDP growth is what has happened to the volatility of consumption growth.

A variety of possible factors could potentially explain the decline in the volatility of consumption growth, though one possibility is that financial liberalisation might have reduced the effect of credit constraint induced lurches in consumption growth. Given that the stock-output ratio has fallen in the United Kingdom as well, and the wealth of anecdotal evidence on 'just-in-time' stocks, it does, at first sight, seem surprising that stockbuilding has not become less volatile. This merits further research.

Chart 1
Rolling five-year standard deviations of quarterly GDP growth

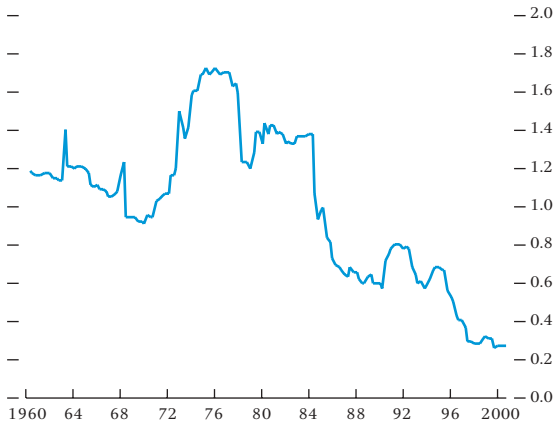


Table A
Volatility of the components of GDP growth(a)

	1955–84	1985–2000
GDP (a)	1.24	0.58
Stocks (b)	0.73	0.69
Consumption (b)	0.78	0.47
Investment (b)	0.47	0.46

(a) Standard deviations of quarterly growth.
(b) Standard deviations of the contributions to quarterly GDP growth.

Although the decline in observed output volatility is encouraging, it is appropriate to be cautious. First, one should recall that previous, long-lived economic expansions have led to the misplaced belief that lower volatility was here to stay; eg Browne (2000) reminds us that in 1968, the US Commerce Department dropped the title 'Business cycle developments' from one of its publications, concluding that the business cycle was dead.

Second, there are many other causes of recessions that are unaffected by the NE. For example, the sharpness of the fall of business and consumer confidence in the United States in the past few months has been a

(1) 'So long, supply and demand', Thomas Petzinger, Jr, 31 December 1999, R3.
(2) See McConnell and Quiros (2000).

surprise. However, Chairman Greenspan[1] reminds us that:

'*The unpredictable rending of confidence is one reason that recessions are so difficult to forecast. … Our economic models have never been particularly successful in capturing a process driven in large part by non-rational behaviour.*'

Third, and perhaps most importantly, some of those who believe that we have a NE also think that the business cycle has not been repealed, but '*… been reincarnated in a different garb …*'.[2] Michael Mandel, the economics editor of *Business Week*, a magazine that was early to forecast an upturn in productivity growth in the United States, has recently published a book entitled *The coming Internet depression*. He argues that in a downturn, a vicious cycle might develop.

Specifically, if investment sags, productivity growth will slow, which might cause the stock market to fall. Of course, the fall in the stock market will further reduce investment and adversely affect the flow of venture capital, which, in turn, will reduce productivity growth further. Mandel draws specific attention to the fact that, historically, venture capital funding cycles have a significant amplitude—for example, between 1987 and 1991, first-round financing for new companies fell by 75%.

We shall return to a discussion of Mandel's hypothesis when I consider the cyclicality of productivity growth below, but suffice it to say that there is nothing in the NE view, properly understood, to suggest that recessions will not occur. Historically, periods of rapid technological change have not been recession-free.

That is why I have never fully understood authors who have argued that the NE can contribute to much higher share prices because it can rationalise a very low, or even zero, equity risk premium. A representative example is that of a Wall Street equity strategist, arguing, in May 1998, that the 'risk premium is dead',[3] because:

'*There is no threat of world conflict … . There is no recession in sight … . American prosperity is structural, not transitory.*'

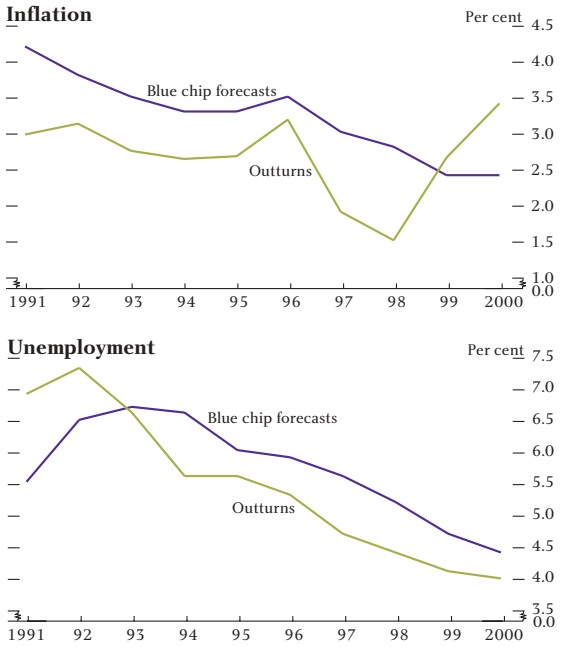
Of course, recent events have reawakened perceptions of risk associated with holding equities.

Notwithstanding the re-emergence of recession risk and a higher equity risk premium, it is, nevertheless, true that the US and UK economies appear to have behaved differently in recent years, and it is to a consideration of this evidence that I turn next.

The recent forecasting record

Chart 2 compares the forecasts by blue chip panellists for US unemployment and inflation with the actual outturns over the 1991–2000 period.[4]

Chart 2
Blue chip forecasts vs actual outturns



Note that forecasters have, for most of the period, overpredicted the level of the unemployment rate. Nonetheless, they have simultaneously overpredicted inflation until recently.

Similarly, economic forecasters have been persistently too gloomy about the UK economy since the departure from the ERM.

Table B displays the average forecast errors that have been made over this period.[5] Focusing on the average of all forecasts (ie 'the consensus'), notice that, on

(1) Monetary Policy Report to Congress, 28 February 2001.
(2) See, for example, Mandel (2001), page 52.
(3) Byron Wien of Morgan Stanley in 'Risk premium—RIP'; though I should emphasise that these sentiments were by no means unusual.
(4) Kohn (1999) presents a similar picture of the 1991–97 period.
(5) These numbers are based on preliminary work by Nick Davey and Jennifer Greenslade of the MPC Unit at the Bank of England, the group of economists who work with the 'external' members of the MPC.

average, GDP growth has been underestimated by about 0.5% a year, which is a large error in relation to the actual average annual growth rate of around 2.9%.

Table B
Average forecast errors[a] in the United Kingdom, 1993–99

	Average error (per cent) (b)	Significant at 10% level (c)
GDP growth forecast	+0.48	Yes
Inflation (RPIX) forecast	-0.53	Yes

(a) Four quarter ahead forecast errors.
(b) Sample period: 1993 Q1–1999 Q4.
(c) Using a t-test over this sample period, with Newey-West standard errors.

A conventional view holds that if GDP growth were faster than expected over a sustained period of time, then,[1] on average, actual inflation must also be higher than expected. However, the actual inflation outturn over this period was, on average, 0.5% lower than the 'consensus' inflation forecast. Hence economic forecasters appear to have been simultaneously too gloomy about both GDP growth and inflation. I should say, in passing, that virtually all forecasters (including the Bank of England) failed to spot this benign sequence of events during the 1990s. There are a variety of possible explanations for this phenomenon. One class of hypotheses would envisage a significant change in the structural relationships that underlie the forecasting processes. I discuss some of these hypotheses in the next section, as policy-makers must always be alive to the possibility that historical relationships might be breaking down.

Before doing so, I note that some argue that the low inflation outturns are attributable entirely to a strong exchange rate. I find that implausible as sterling was weak during the 1992–96 period, and only strengthened significantly thereafter. Hence the exchange rate can only potentially explain the surprisingly low inflation outturns for part of the sample period. Further, we are trying to explain the simultaneous occurrence of higher-than-expected GDP growth and lower-than-expected inflation. While an unexpectedly high exchange rate can readily explain surprisingly low inflation outturns, in most standard macro-models a stronger-than-expected exchange rate would cause lower-than-expected (not higher-than-expected) GDP growth. Further, I have argued previously (see Wadhwani (1999)) that part of the explanation of the strength of sterling versus the continental European currencies is the possibility that the United Kingdom has embraced the NE more readily than Europe. If true, then part of the disinflationary impact of strong sterling can be attributed to the NE.

I now turn to consider some direct evidence for the structural changes that underlie the NE hypothesis.

Has the NAIRU fallen?

An example of a structural change that might explain the pattern of observed forecast errors would be a fall in the so-called non-accelerating inflation rate of unemployment (NAIRU).

An impressive feature of recent US experience is that, over the period 1992–2000, although unemployment fell from 7.5% in 1992 to 4.1% in 1999, the rate of price inflation was essentially constant. Moreover, when the unemployment rate first fell below 6% (the then prevailing 'consensus' estimate of the NAIRU), many economists predicted an acceleration in inflation that failed to materialise. UK experience has been quite similar. In 1995, the consensus estimate of the NAIRU was that it was around 6½%–7% (using the claimant count definition). Yet unemployment has fallen steadily to the current 3.4% without, as yet, triggering any discernible rise in inflation.

Of course, various alternative hypotheses have been advanced in an attempt to explain these facts. In the United States, they include:

(a) **Temporary factors.** It is argued that lower import prices (a higher dollar, the Asian crisis, etc) and decelerating health insurance costs have played an important role in temporarily depressing inflation, and that the NAIRU is actually higher than the current unemployment rate.[2]

A variant of this view argues that the acceleration of productivity growth in the 1990s has not, as yet, been fully reflected into wages because wage aspirations respond slowly to increases in productivity growth.[3] As aspirations catch up, inflation will rise so the fall in unemployment may be only partially sustainable.

(b) **Permanent factors.** One might expect the fall in unemployment to be sustainable if the NAIRU has actually fallen for NE-type reasons.

(1) Conditional on potential output growth having remained constant.
(2) See, for example, Blinder and Yellen (2001).
(3) See, for example, Ball and Moffitt (2001).

The NAIRU might fall either because of improvements in the workings of the labour market, or because of the intensification of product market competition. In terms of the labour market, various hypotheses that have been advanced include changes in how people look for work (eg temporary help agencies), or differences in the demographic composition of the workforce.(1) The increased openness of the US economy, product market deregulation and, more recently, the Internet are all possible explanations for the widely repeated perception of an intensification of product market competition, which might also have helped lower the NAIRU.

As one would imagine, various authors have attempted to trace the evolution of the NAIRU in the United States,(2) but given the well-known difficulties with this kind of work, obtaining a precise split between the rate of the temporary and permanent factors is difficult. However, I find it difficult to believe that temporary factors could entirely explain why inflation has been so benign even as unemployment has fallen. For instance, one needs a whole sequence of temporary factors for an eight-year period to explain what has happened. In any case, several studies point to some role for an enduring decline in the NAIRU.

Turning to the United Kingdom, I have previously discussed the far-reaching changes that have occurred in the labour market over the past two decades (see Wadhwani (2000a)), so I will not have much to say on that topic today. However, Table C reminds us that, along a variety of dimensions, a great deal is different today (*cf* 1998 vs 1980). Union membership and strike activity are much lower. Imbalances in the pattern of labour demand and supply have diminished significantly. Turning to the unemployment benefits regime, the conventional replacement ratio (ie the ratio of out-of-work benefit to estimated in-work income) has fallen. Further, the New Deal and other measures that have tightened the availability of benefits have also probably been influential. Also, Barwell (2000) suggests that some of the decline in unemployment can be attributed to changes in the age structure of the labour force.

It is notable that if one takes the wage equation that is to be found in the Bank of England's core macroeconometric model (see Bank of England (2000)), then there is evidence that it has overpredicted wage growth in recent years (ie since around 1992).

Table C
Some key features of the labour market

	1998	1992	1980
Union density	0.30	0.36	0.49
Number of working days lost ('000s)	30	48	957
Mismatch:			
Industrial (a)	0.24	1.26	1.18
Skills (b)	4.90	8.00	8.00
Replacement ratio	0.18	0.18	0.24

(a) Annual (absolute) change in the ratio of employee jobs in the production and construction industries to total employee jobs.
(b) Ratio of manufacturing firms reporting skilled labour shortages to those reporting shortages of other labour (source: CBI Industrial Trends Survey).

It is sometimes pointed out that while many of the labour market variables that are supposed to underlie the NAIRU changed during the 1980–92 period, much of the evidence for a lower NAIRU appears to post-date 1992. Hence, some argue that the changes in the labour market cannot be the explanation for the change in the NAIRU.

On the other hand, industrial relations experts like Professor William Brown of Cambridge argue that the structural improvements in the labour market during the 1980–92 period did not translate into improved wage performance until other catalytic events induced firms to undertake radical industrial relations change in the early 1990s. Possible candidates as catalysts are the 1990–92 recession, and the re-election of the government in 1992, which implied that many of the structural changes in the labour market were not going to be reversed. Other possible catalytic events include the reduction in inflation expectations, which began during the recession in the early 1990s, but was possibly aided by the adoption of an explicit inflation target after 1992. Personally, I have no problem with the notion that structural changes can take time before they manifest themselves in improved macroeconomic performance. Any changes to the way labour is used (eg reforming pay systems, improving selection, etc) requires managerial effort, and takes time to put in place and be effective.

Of course it is plausible that some of the improvement in the wage-unemployment trade-off during the late 1990s

(1) See, for example, Katz and Krueger (1999), for a discussion of some of these hypotheses.
(2) See, for example, Staiger, Stock and Watson (2001), and the many references therein.

in the United Kingdom is also attributable to temporary factors like lower import prices—caused by a combination of an appreciation of sterling, weak commodity prices during the 1997–98 Asian crisis and possible supply-side improvement in other countries. Note though that the trade-off appeared to improve after the United Kingdom left the ERM in 1992 even though a fall in sterling boosted import prices, so I am relatively confident that structural changes have also played a role.

Of course, many of those who have been excited by the potential economic impact of ICT typically think first of the impact on productivity—it is to a discussion of that issue that I turn next.

The 'new economy' and productivity growth

As long ago as 1995, various people were arguing (eg *Business Week*) that the NE had led to an acceleration of productivity growth in the United States.

This view was initially resisted by academic economists.(1) The view then gradually evolved, as a mixture of data revisions and the passage of time appeared to lead to a discernible change in the trend rate of measured productivity growth. Even then, there was some further resistance to accepting the possibility of a change in the rate of structural productivity growth. The rise in actual productivity growth was initially characterised as cyclical, then said to be confined only to the ICT-producing area, and then only to the durables manufacturing sector and so on.(2) This is an active research area, and the debate continues to move ahead.(3)

We know that non-farm labour productivity growth has increased from 1.5% over 1973–95, to around 2.9% in the 1995–2000 period. Although different studies disagree on the precise magnitudes, we also know that:

(a) Boost to capital per head

About a third to a half of the acceleration in labour productivity growth has come through the boom in corporate investment. Much of the capital deepening that occurred is largely accounted for by more ICT capital per head. At least some of this extra investment has occurred because the price of ICT capital was falling fast, partly because of Moore's law, according to which the processing power of a silicon chip would double every 18 months.

(b) Other factors

In terms of the remainder of the increase in productivity, different studies disagree about the relative importance of:

(i) More efficient production of ICT equipment itself.

(ii) The benefits conferred by the use of ICT in non-ICT sectors.

(iii) The stage of the business cycle, with productivity growth tending to be higher in booms.

However, some of the more recent studies argue that the productivity rebound was not merely confined to a few NE sectors, but that various other sectors also did well.(4) Also, Basu *et al* (2000) attempt to allow for the influence of temporary factors like factor utilisation on productivity growth, but conclude that '*… the recent increase in productivity growth does appear to arise from an increase in technological change*'. Notwithstanding this work, it remains extremely difficult to know how much of the increase is productivity growth has been related to the fact that GDP growth has been high.

Nevertheless, so far, the academic evidence in the United States is growingly supportive of the notion that ICT investment has played an important role in increasing labour productivity growth in a variety of sectors of the economy, which is broadly consistent with predictions made by various NE advocates from around 1995 onwards.

Of course, one must recall that the post-1973 period was one of relatively slow productivity growth, which spawned a large number of studies that attempted to explain the productivity 'slowdown' that occurred from around that date. Hence the post-1995 acceleration of growth has occurred in the context of productivity growth having been weak in the preceding period. The recent spurt in productivity growth in the 1995–2000 period is by no means historically unprecedented, eg non-farm business productivity grew faster in 1960–65 than in 1995–2000.

(1) A representative view was that of Blinder (1997), who characterised it as 'mostly poppycock'.
(2) See Gordon (2000) for discussion of some of these issues.
(3) See Bosworth and Triplett (2000) for a recent survey.
(4) See, for example, Nordhaus (2001) or Basu *et al* (2000).

On the other hand, the contribution of ICT to productivity growth is, by historical standards, impressive. It is significant that Crafts (2000) argues that '*… the growth contribution of ICT in the past 25 years outstrips that of electricity and even more so that of railroads over comparable periods …*'. This is documented in Table D, which shows that even before the post-1995 period, the contribution of ICT to growth compared favourably relative to these other innovations.

Table D
Relative contribution of different technologies to US growth

Percentage points per year

	1974–90	1991–95	1996–99
ICT	0.65	0.76	1.54
	1839–70	1839–90	
Railroads	0.21	0.35	
	1894–1929	1919–29	
Electricity	0.56	0.98	

Source: Crafts (2000).

Turning now to the United Kingdom, anecdotal evidence suggests that ICT investment has grown at a healthy rate in recent years—indeed, Table E suggests that investment in software and telecoms equipment in the United Kingdom has matched or exceeded growth rates in the United States in the last decade.(1) While the United Kingdom has not matched the stunning 35% growth rate in computer investment in the United States, investment in that area has nevertheless grown at a healthy clip (28% a year).

Table E
Growth rates of ICT inputs in the United Kingdom and United States

	United States		United Kingdom	
	1990–95	1995–99	1989–94	1994–98
Software	12.8	13.1	17.8	12.6
Computers	17.5	35.9	18.6	28.4
Telecommunications equipment	3.6	7.2	8.7	13.5

Source: Oulton, Bank of England.

Table F displays the relative contribution of ICT to productivity growth in recent years. As one might expect, it shows the contribution of ICT capital to productivity growth rising in both countries (from around 0.4% in 1974–90 to around 1% in the post-1995 period in the United States, and from 0.35% in 1979–89 to 0.6% in 1994–98 in the United Kingdom).

Table F
Productivity and the contribution of ICT: a US-UK comparison

	United States			United Kingdom		
	1974–90	1990–95	1995–99	1979–89	1989–94	1994–98
Growth of output per hour (a)	1.43	1.61	2.67	2.20	2.57	1.58
Contributions from: (b)						
ICT capital	0.44	0.50	0.96	0.35	0.39	0.62
Other capital	0.37	0.11	0.14	0.52	0.96	0.11
TFP plus labour quality	0.62	1.00	1.57	1.32	1.23	0.85

Sources: United States: Oliner and Sichel (2000). United Kingdom: Oulton, Bank of England.

(a) Per cent per year.
(b) Percentage points per year.

The level of the ICT contribution is lower in the United Kingdom, partly because the income share of ICT inputs started at a lower level.(2) However, notwithstanding the rising contribution from ICT, productivity growth in the United Kingdom decelerated in 1994–98 compared with the early 1990s, while it accelerated in the United States. This is puzzling.

Kneller and Young (2000) argue that part of the decline in productivity growth may be attributed to the strong pound, which depressed investment in 'other capital', whose contribution fell markedly over this period (see Table F). They also argue that the unemployed who were absorbed into employment over the 1994–98 period were, on average, less productive on account of having lost skills during their spell of unemployment. On the basis of these hypotheses, one would argue that the benefits of ICT might have been obscured during the 1994–98 period, and that as the adverse effects of a high pound wear off and/or the rate at which the long-term unemployed enter employment diminishes, productivity growth can be expected to pick up. Certainly, productivity growth has picked up more recently—the four-quarter growth rate is currently(3) around 2.5%.

Another possibility is that measured productivity growth understates actual improvements in productivity. There are reasons to believe that this has been an important factor in the United States (see, for example, Corrado and Slifman (1999)), where it is likely that productivity growth has been increasingly understated in recent years. Work on possible biases in the measurement of ICT in the United Kingdom suggests that GDP and labour productivity growth may have been understated

(1) Table E is based on the measures of ICT investment discussed below.
(2) Note that these estimates of the ICT contribution to growth in the United Kingdom are rather higher than those in Kneller and Young (2000), partly because those authors excluded the contribution of software and telecommunications. The calculations reported in Goldman Sachs (2000) also potentially understate the contribution of ICT, because they do not correct for the potential understatement of software investment.
(3) 2000 Q3.

by perhaps around 0.4 percentage points per year during 1994–98[1] (already allowed for in the estimates in Table F).

Of course, there may be other reasons for believing that productivity growth has been understated during the late 1990s. I have previously discussed this issue at some length (see Wadhwani (2000b)), so I shall be brief here, but I would point to the following.

(i) Official data suggest that manufacturing productivity growth was zero during 1995–97, while survey responses from the CBI Pay Databank sample suggested productivity growth averaged around 4% per year over this period.

(ii) No one has satisfactorily explained why the measured deceleration in manufacturing productivity growth appeared to coincide with a rise in profitability (over the 1995–97 period).

(iii) The 'hard-to-measure' service sectors have become more important over time.

Of course, more research is needed, but it is possible that measurement issues have obscured some of the benefits from the NE on UK productivity.

The prospects for productivity growth

Notwithstanding evidence that ICT technology has made a significant contribution to productivity growth, there has, of course, been a significant change in sentiment recently. For example, the *Financial Times* recently proclaimed that:

'*Another pillar of the new economy story is under threat. First, the Internet stock bubble burst. Then the hopes of an end to business cycles were dashed by recent economic data from the US. And yesterday, the predictions of permanent increase in productivity growth began to look suspect.*' (8 February 2001)

Of course, some of the rise in productivity growth that occurred in the United States in recent years can be attributed to the fact that output growth was high. An above-average increase in output growth boosts productivity growth through higher utilisation and through returns-to-scale effects. Although it is virtually impossible to estimate accurately the precise impact of the cycle on productivity growth, some attempts to do so[2] suggest that a significant proportion of the rise in productivity growth that we have seen cannot be directly attributed to the cycle.

Nevertheless, with the US economy having decelerated significantly in recent months, it would be surprising if productivity growth did not decelerate for purely cyclical reasons, without that having any necessary implications for the NE view that the medium-term trend of productivity growth has risen.

We noted earlier that a significant fraction (perhaps a third to a half) of the upsurge in labour productivity growth in the United States can be attributed to an increase in capital accumulation. We have already seen signs of investment spending growth in the United States moderating significantly, which, given its high growth rate in the previous year, and with the stock market down significantly over the past year, is scarcely surprising. If it were true that the stock market had been 'irrationally exuberant', it would be surprising if some of the corporate investment decisions that were made over the past 2–3 years were not similarly based on irrational exuberance. Hence, a significant reduction in investment growth caused, in part, by a perception that some over-investment had occurred could also significantly reduce labour productivity growth. I have previously discussed Mandel's (2001) view that the fall in the stock market can be expected to be associated with a significant reduction in venture capital finance. The associated slowing in innovation then reduces productivity growth.

What happens next depends, in part, on how the stock market reacts to the slide in measured productivity growth.

Significant share price (and investment) volatility around periods of significant technological change is not unusual. In their discussion of the 1882 'electrical mania', Kennedy and Delargy (1997) calculate that the average share price of their sample of quoted electrical companies fell by around 93% between the peak in 1882 Q3 and the trough in 1884 Q4! Similarly, in discussing the electrical mania, in 1882 the *Economist* newspaper[3] recalled an earlier mania:

(1) I discuss this work further below.
(2) For example, Basu, Fernald and Shapiro (2000).
(3) 20 May 1882, pages 604–05.

'*The greatest invention of the century resulted in the railway mania of 1845–46 … . In August 1846, London and North-Western stock was selling at 235, North British at 155 … . And never since, prosperous as our railways have been, have such high prices been touched.*'

The fluctuations in the stock market affected the ability of the electrical industry to raise money, and thereby develop. Kennedy and Delargy (1997) point out that while the prospective electrical supply undertakings raised more than £2 million at the height of the mania in 1882 alone, they were only able to raise around £235,000 in the subsequent five-year period, and they contend that:

'*The pace of electrical development paralleled the flow of funds into the industry closely. By the time electrical investment began its feeble recovery after 1887, British firms were already technologically backward.*' (page 76)

It is, though, easy to become excessively gloomy. Although share price volatility probably affected the time path of investment in, say, electrical undertakings, it did not stop us from reaping the benefits of electricity eventually.

Similarly, notwithstanding the possibility that the downturn in share prices depresses ICT-related investment for some time, one would still expect the benefits associated with ICT-related developments to be realised over the medium term. In that regard, one might draw some comfort from a recent e-business survey conducted by the CBI,(1) which found that 41% of companies reported that e-business was already having a real impact on all aspects of the organisation, with 99% of respondents expecting some impact in the next 2–3 years. The proportion of turnover expected to be derived from e-business was expected to rise significantly over the next 2–3 years (see Table G).

Table G
E-business turnover—current and expected

Per cent

Percentage of turnover	Current	Anticipated
0	38	7
1–5	38	14
6–10	11	21
11–20	8	20
20+	5	38

Source: CBI (2001).

It is also plausible that Mandel (2001) is too gloomy about the prospects for productivity growth in the United States. Many firms feel that they have not, as yet, taken advantage of the new technologies at their disposal. Also, scientists claim that Moore's law is likely to continue to operate, so the falling price of ICT investment is likely to continue to stimulate spending.

If it did turn out that a deceleration in GDP growth and/or the decline in share prices did lead to a pronounced decline in productivity growth, then there will be many who will proclaim that no sustainable increase in the growth rate of productivity had occurred in the United States. Indeed, I have already noticed some commentators declare that the NE hypothesis will be seen to have failed if US productivity growth falls to levels associated with past cyclical downturns. This is mistaken.

It is perfectly possible to envisage circumstances under which the NE has increased the average growth rate of productivity, but also simultaneously increased its cyclical variability. This could be true if, say, corporate investment had become more sensitive to movements in the stock market than in the past. This merits further investigation.

In addition, if we have had a period of over-investment, one would expect the subsequent adjustment period to be characterised by unusually low investment, which might temporarily depress productivity growth, thereby masking an underlying improvement in the trend rate.

I fear, therefore, that some of the conventional methods of cyclical adjustment for productivity growth may not be appropriate. For example, Gordon's (1999) method of cyclically adjusting labour productivity growth relies on a stable relationship between detrended (cyclical) changes in hours and corresponding cyclical changes in output. Yet if the behaviour of, say, investment growth were different over this cycle relative to previous cycles, then it is not obvious that the hours-output relationship would remain stable. Also, recall that pre-war US business cycles were quite different from the post-1945 business cycle. For example, recessions during pre-war cycles were longer-lived, as they often arose from the bursting of speculative bubbles in the financial markets, and were associated with the elimination of overhangs.

(1) 'The quiet revolution: a report on the state of e-business in the UK', CBI and KPMG Consulting, February 2001.

By contrast, many of the post-war cycles have been associated with inflation-fighting by the Fed. There are those who argue that the current cycle more closely resembles the pre-war cycles.(1)

In any case, extrapolating longer-term growth trends on the basis of a period that includes a significant cyclical downturn can be a rather unreliable way of estimating long-term growth. Oulton (1995) discusses the hypothetical situation of attempting to forecast US economic growth over the long term from the vantage point of being in 1937. Table H sets out the average peak-to peak growth rates over selected periods. By focusing on the very recent period (including the Depression), the forecaster would have no idea that the US economy was poised to grow at the exceptionally healthy rate of 4.6% over the subsequent 16 years. Indeed, the forecaster would have got closer to the final outturn by excluding the Depression altogether, though that would have been virtually impossible to do in 1937.

Table H
Average annual growth rates of US GNP

Period	Per cent per year
1913–29	3.26
1919–29	3.48
1929–37	-0.25
1929–41	2.09
1917–37	1.80
1937–53	4.63

Notes: 1913, 1929, 1937 and 1953 were cyclical peaks. 1919 was the first 'normal' year after World War 1. 1941 was the last year before US entry into World War 2.

Source: Oulton (1995).

The new economy, measurement error and monetary policy

I have discussed how the structural changes associated with the NE make it difficult to assess the underlying rate of productivity growth, or the equilibrium rate of unemployment (NAIRU). However, our problems are compounded by the potential existence of measurement error. Indeed, I wish to offer some examples of measurement error that have become more important as the amount of ICT investment has risen, making the setting of monetary policy even more challenging.

I shall argue that the types of potential measurement error that I discuss below may have led us to significantly overestimate the degree of inflationary pressure in recent years. There are those (see, for example, Krugman (1997)) who argue that the possibility that we may be understating productivity growth through mis-measurement should have no implications for our assessment of inflationary pressure as both actual and trend GDP growth are understated, leaving our assessment of the output gap unchanged.

However, I shall offer examples today where instances of potential measurement error are seen to have a material impact on our assessment of 'capacity utilisation' and the NAIRU.

My first example relates to alternative conceptual measures of the capital stock.

Alternative conceptual measures of the capital stock

At the Bank, one of our methods of computing the supply potential of the economy relies on summing the weighted growth rates of employment, the capital stock and technical progress. Among other things, it is obviously rather important to use a measure of the capital stock that reflects its productive potential when performing this calculation. Different methods of obtaining a measure of the capital stock can yield rather different results.

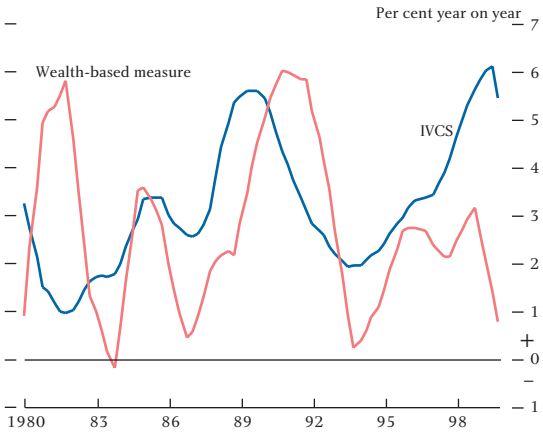
For example, current ONS estimates of the capital stock are a so-called 'wealth type measure', where each item is weighted by its current asset price. While this is a valid measure for balance sheet purposes, it will be less appropriate for an assessment of productive potential, where one might want to compute an index of the volume of capital services (IVCS) instead. Note that in the IVCS, each item of capital is, in principle, weighted by its contribution to output (ie its marginal revenue product) rather than its asset price. A consequence of using the IVCS is that it increases the weight accorded to shorter-lived assets such as machinery, equipment and software, relative to buildings. If the stocks of shorter-lived assets (eg computers) are growing more rapidly than other types, then the IVCS will, in turn, grow more rapidly than the wealth-based measure.

Nicholas Oulton of the Bank of England has computed a preliminary measure of the IVCS, which may, for purely illustrative purposes, be compared with the wealth-based aggregate (see Chart 3). Joint research with the ONS is

(1) While methods that cyclically adjust TFP growth rather than labour productivity growth (eg Basu *et al* (2000)) appear to control the cyclicality of investment growth, recall that investment sometimes has 'spillover' effects on TFP, and also that an important part of the rise in TFP growth in the United States is the growth of the ICT-producing industries. Hence a cyclical slowing in investment growth that was disproportionate relative to the slowing of hours could appear to be misleadingly associated with a slowing of the cyclically adjusted TFP residual.

ongoing on this issue. Note that the IVCS estimate has shown a rather higher growth rate in recent years, a period when we know that ICT investment accelerated. However, notice also that there are periods (eg the early 1980s), when the wealth measure of the capital stock grew more quickly than the IVCS measure.

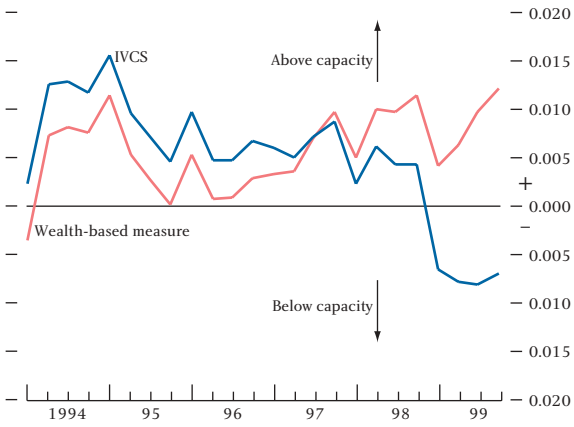
Chart 3
Non-housing capital stock



Of course, there is no straightforward link between the rate of growth of the capital stock and estimates of potential output because changing one's view of the appropriate capital stock will also affect one's estimate of what economists call total factor productivity (TFP). Nick Davey and Jennifer Greenslade of the MPC Unit at the Bank of England have examined these issues in the context of the Bank of England's medium-term macroeconometric model (MTMM).(1) Because they use alternative capital stock data, various relationships have to be re-estimated. Their work is ongoing, but some interesting results from their pilot study include the possibility that the alternative capital stock data would have yielded a different picture for 'capacity utilisation' in recent years—see Chart 4, which displays alternative proxy capacity utilisation series based on the wealth and the IVCS measures respectively.(2)

Although the two measures moved broadly in line until the end of 1997, they have diverged since then. Hence, in 1999, the series based on the wealth measure suggested 'overheating', while that based on the IVCS suggested that there was still some slack in the economy. Obviously, these two different views about the absence (or otherwise) of spare capacity can have an important effect on an assessment of the degree of inflationary pressure. Davey-Greenslade's preliminary results suggest that the use of the IVCS series for the capital stock instead of the wealth measure might lead one to reduce one's estimate of the extent of inflationary pressure implied by the macroeconometric model in recent years. This may be partly because the disinflationary impact of a higher measured growth rate of the capital stock more than outweighs the inflationary consequences of somewhat lower measured TFP growth in recent years. Of course, more work is needed in this area, which is true of most issues relating to the NE. We await the results of the Bank-ONS project on the IVCS with great interest.

Chart 4
Capacity utilisation



I turn now to another example where the NE and potential measurement error related issues interact in a way that makes monetary policy formulation quite difficult.

Alternative measures of ICT investment

There are various subtle issues relating to the appropriate measurement of ICT investment, some of which I discussed in an earlier speech (see Wadhwani (2000c)). Nicholas Oulton has applied US methods for measuring ICT investment. He has used US price indices for computers and software, because they incorporate a substantial amount of research into adjustment for quality change. Because ICT products are extensively traded internationally, it is plausible that the rate at which quality-adjusted prices are falling should be much the same in all countries (after adjustment for exchange rate changes). However, it should be noted also that the measurement of price

(1) They base their analysis on the November 2000 version.
(2) Note that, in the Bank of England model, 'capacity utilisation' is an estimated quantity provided by residuals of a production function where the direct inputs are employment (measured in hours), the non-residential capital stock and labour-augmenting technical progress. Further details may be found in Bank of England (2000). Davey-Greenslade re-estimate the relevant parts of the model to obtain the alternative series displayed in Chart 4.

indices for computers is conceptually very challenging due to the rate of technological change, and no single approach of quality adjustment is without its drawbacks.

Obviously, if inflation in computers and software is overstated in the United Kingdom, then real growth has been understated, since it is money values that are measured directly. Using US-style price indices should lead to higher estimates of ICT investment, GDP growth and productivity growth for the United Kingdom (as we discuss below). In the recently released *National Statistics Quality Review* report, there are some calculations which suggest that using US price indices for the computer industry (but not changing the assumptions regarding software), the level of industrial production in 2000 Q1 would have been about 6% higher, with much of the gap being established in the post-1997 period. There are those who believe that the hedonic price indices used in the United States actually somewhat understate inflation, and this is clearly a controversial area. However, on the basis that it is important to be aware of the quantitative importance of alternative assumptions about price indices in the ICT sectors, I shall discuss some preliminary illustrative estimates of the potential biases in estimated GDP growth below.

Note that there are other important differences between ICT measurement practices in the United States and the United Kingdom that might also have the effect of understating the amount of ICT investment in the United Kingdom relative to the United States.

For example, although the growth rate of nominal software investment (measured in current prices) is very similar in the United States and the United Kingdom, there is a large discrepancy in the levels. Specifically, in the United States, software investment has averaged 140% of computer investment, while, by contrast, the corresponding ratio was only 39% in the United Kingdom. Since people buy computers to run software, it seems very unlikely that there should be such a large discrepancy between the United Kingdom and the United States. This striking difference in the estimated levels of software investment might arise because of differences in the interpretation of what is investment, and what is intermediate consumption in computer services—in the United States, about three fifths of the total products of the computer services industry is classified as investment—in the United Kingdom, the corresponding proportion is less than one fifth.

In some interesting recent work, the head of the National Accounts Department at INSEE in France, Lequiller (2001), documents the fact that the proportion of software spending that is counted as being investment is substantially lower in the United Kingdom than in several European countries (eg France, Germany, Italy and the Netherlands), though he also points out that the corresponding proportion is higher in the United States than in all European countries that he considers. Work on this issue is ongoing at the OECD.(1)

Oulton suggests, for illustrative purposes, that it might be appropriate to inflate the UK figure for software investment by a factor of 3, which is at the lower end of the possible range of grossing-up factors he considers. Of course, this is an extremely difficult area, and because of the paucity of reliable information, that might seem a conservative assumption to some, might appear to be too high to others. However, as a policy-maker, it is important to be aware of the full range of possibilities, and it is in that spirit that I look at alternative illustrative computations of ICT investment. I also look forward to ongoing research into this issue at the ONS.

Note that these adjustments imply that GDP growth may have been underestimated by as much as 0.4 percentage points per year over 1994–98. Importantly, for the assessment of underlying inflationary pressure in the economy, the size of the GDP growth bias has grown over time. Had the bias been constant over time, it would be unlikely to affect the results from a conventional econometric model. However, the GDP growth bias has risen from around 0.1 percentage points per year for 1979–89 to about four times that in 1994–98.

Further, and perhaps even more importantly, the software adjustment implies that nominal GDP growth has been understated as well as real GDP growth, and consequently, the labour share might be lower than is conventionally measured. Of course, in conventional macro-models (eg the Bank's MTMM or Batini, Nickell and Jackson (2000)), a lower labour share implies lower inflation. Hence, Davey-Greenslade find that allowing

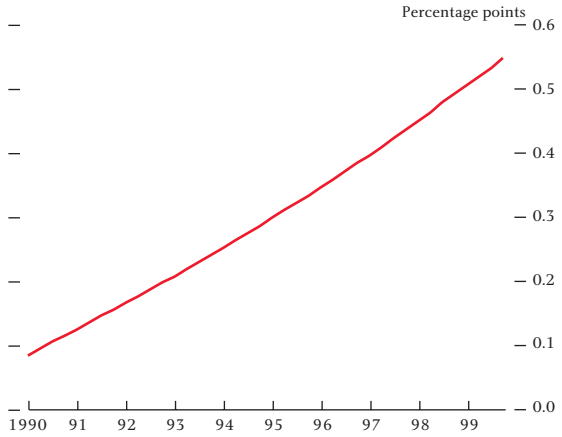
(1) Interestingly, in a French context, Lequiller finds this software adjustment to be much more quantitatively important than the adjustment for the much-discussed hedonic pricing.

for the ICT adjustments in a macroeconometric model can have important implications for the assessment of inflationary pressure.(1) In particular, they find that, other things being equal, using the alternative data instead of the official data would have led to a lowering of the estimate of the NAIRU by around 0.5 percentage points in 1999 (see Chart 5), which could, if interpreted mechanically, have altered a two year ahead RPIX forecast made in 1999 by as much as 0.6 percentage points. Their estimates of the impact of using the alternative numbers on ICT investment on the NAIRU has grown over time in recent years (see Chart 5)—eg the effect was close to zero in the early 1990s—so it is possible that we have overestimated inflationary pressure to a growing extent in recent years.

Of course, they have only undertaken a pilot study, so more research is necessary, but standard economic theory suggests that the direction of the bias to the inflation forecast should be in the same direction as what they find, though the actual estimate might change.

Also, the preliminary estimates of the alternative data series are predicated on particular assumptions and are designed to be purely illustrative. It is possible that further work (with the active and essential co-operation of the ONS) might lead to different point estimates of the size of the biases in GDP growth. However, the direction of the bias in GDP estimates and the direction in which the bias is moving seem relatively uncontroversial and, as policy-makers, it is important for us to be aware of them.

Chart 5
Difference between estimates of the NAIRU



One reason that I have spent so much time today on what might seem like a relatively arcane discussion of the intricacies of how we measure things, is that I suspect that this might, in part, explain why economic forecasters have overestimated the degree of inflationary pressure while having simultaneously underestimated growth in the 1990s.

Conclusions

Today, we have discussed how the NE has changed some of the underlying relationships that we rely on for the purposes of monetary policy, and have also considered possible implications for how we measure things. However, we also saw that some of the claims that have been made for the NE are far too extravagant. There is much about the NE that remains uncertain, and I, therefore, look forward to learning more over the next few years.

(1) It is important to emphasise that their result of an impact on the NAIRU depends critically on the existence of a software adjustment, which affects the measured labour share. Of course, the much-discussed hedonic price adjustments have no implications for the measurement of the labour share, since they leave nominal GDP unchanged.

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The impact of the US slowdown on the UK economy

In this speech,[1] Sushil B Wadhwani,[2] argues that conventional macroeconometric models are likely to significantly understate the impact of a US slowdown on the UK economy. Linkages that might not be captured well by models include the effects of significant foreign direct investment, the fact that the United Kingdom's sectoral specialisation resembles that of the United States, possible contagion effects on confidence, and the likelihood that domestic prices will be depressed by global excess capacity.

It is a great privilege for me to have the opportunity to meet with you and learn about your own evaluation of the prospects for your various businesses.

In the context of the international economy, this is a time of great uncertainty. The recent abrupt slowing of the US economy has obviously led some commentators to worry that this might have a large and significant impact on the UK economy as well.

However, indicators of business or consumer confidence in the United Kingdom have not changed in a consistent direction in recent months, with some having even improved since the news of a sharper-than-expected slowing in the United States first emerged (see Table A).

Table A
Recent selected surveys of the UK economy

Indicator	Most recent value	Value in November 2000
Optimism		
CBI quarterly Industrial Trends Survey	-3 (a)	-9 (b)
GfK consumer confidence	5.4	-1.5
CIPS services	74.3	76.4
Export orders		
CIPS manufacturing	53.7	50.4

(a) 2001 Q1.
(b) 2000 Q4.

Moreover, many observers have argued that since the United Kingdom's exports to the United States are worth only around 5% of GDP, the direct impact of a slowing over there might be relatively modest over here. Hence it is not surprising that simulations using macroeconometric models,[3] which typically also allow for third-country effects, tend to suggest that the impact of a shock to US demand that reduces US growth by 1 percentage point for a single year might only reduce UK GDP growth by between 0.15 and 0.25 percentage points. Of course, there are additional effects associated with a fall in global equity prices to consider, but these have, so far, been relatively small. Since our November 2000 *Inflation Report*, UK equity prices are down by only around 5%,[4] which, given past historical relationships, is unlikely by itself to have a large effect on GDP growth.

In the light of the above considerations, in preparing our February 2001 *Inflation Report*, the assumed temporary reduction in US growth in 2001 was expected to reduce UK inflation (with some time lag) by only around 0.25 percentage points,[5] an effect that was broadly offset by the 3½% decline in sterling since November 2000.

Given that the US economy has slowed significantly from an annual four-quarter rate of around 6% at the end of 2000 Q2 to a current quarterly rate that is 'close to zero', the effects on growth and inflation discussed above might seem surprisingly low. Certainly, folk wisdom has it that when the United States sneezes, the United Kingdom catches a cold. Also, historically, the UK and US economies appear to have been highly synchronised. A recent IMF study[6] reminds us that the UK GDP growth cycle is more highly correlated with the

(1) Delivered to the Bank of England's North East Agency contacts in Newcastle on 22 February 2001. This speech can be found on the Bank's web site at www.bankofengland.co.uk/speeches/speech115.htm
(2) Member of the Bank of England's Monetary Policy Committee, and Visiting Professor at the City University Business School and the London School of Economics.
(3) For example, the National Institute's NIGEM, the IMF's Multimod, or the Bank of England's model of the UK economy.
(4) As at 16 February 2001.
(5) Excluding the indirect effect of the lower oil prices that appear to have been associated with the US slowdown. Including this effect would increase the estimated impact on UK inflation by about 0.1 percentage points.
(6) 'The UK business cycle, monetary policy and EMU entry', Kontolemis, Z G and Samiei, H, IMF WP/00/21.

US growth cycle than with the corresponding continental European cycle since 1960 (see Table B). This is at first sight surprising, as the proportion of the United Kingdom's exports to North America have been less than one third of our share of exports that go to Europe, with the gap widening further in recent years. Note also that despite the growth in trade links between the United Kingdom and continental Europe, the UK business cycle has been even more correlated with the United States than with Europe in the recent 1990–97 period. Of course, correlations do not imply causation, and so we must not assume that the correlation will remain high. Nevertheless, it is also possible that the higher correlation between the UK and US business cycles is indicative of links between the two economies that go beyond trade.

Table B
Growth cycle correlation coefficients between the United Kingdom and other countries

	1960(a)–97	1990(b)–97
North America	0.58	0.78
Europe	0.38	0.12

(a) Source: Kontolemis and Samiei (2000), *op cit.*
(b) Source: Own calculations, based on the data used in the IMF study.

Additional links between the United Kingdom and the United States

There are, of course, other very close links between the United Kingdom and the United States, not all of which are captured well by our models. The United Kingdom accounts for about a fifth of the total stock of foreign direct investment (FDI) in the United States, while around two fifths of the stock of FDI in the United Kingdom is from the United States. Relatedly, US-based foreign affiliate sales of UK multinationals are estimated(1) to be nearly $200 billion, which is five times as large as UK exports to the United States. It is possible that companies with significant exposure to the US economy find that a deteriorating cash flow position leads them to scale back on their investment plans in the rest of the world (ie including the United Kingdom) as well. On the other hand, one must also note the possibility that a slowing US economy makes the rest of the world (including the United Kingdom) a more attractive investment destination. Turning to other links, as my colleague, David Clementi, has previously pointed out, the total exposure of UK banks to the United States amounts to $110 billion, or 8% of UK GDP, and is considerably higher than the equivalent exposure to the rest of Europe. The value of UK residents' overseas investment in equity capital and securities is approximately equal to nominal GDP, with around 25% of overseas' equity holdings being held in US assets.

Further, it is worth reminding ourselves that some of the industrial sectors that are slowing most in the United States have also been disproportionately important in the United Kingdom as well. Specifically, it has been estimated(2) that, as a share of GDP, the market capitalisation of the so-called TMT (technology, media and telecommunications) sectors in the United Kingdom is comparable to that of the United States, and is much higher than in continental Europe or Asia. During the 1990s, the financial and business services category punched well above its weight in that it accounted for more than 25% of the growth of the UK economy, although it represented less than 15% of the level of GDP in 1995. Yet, historically, the fortunes of this sector have been linked to fluctuations in US GDP growth.

There is also growing anecdotal evidence that the US slowdown is beginning to be associated with excess capacity and margin pressure in a number of global sectors. The associated intensification of competitive pressure for UK business, domestically and internationally, can be expected to exert additional downward pressure on UK prices, a factor that is not always adequately allowed for in some models of the UK economy.(3)

Likely impact on the UK economy

The degree to which the UK economy will respond to recent US economic weakness must depend, in part, on whether the US economy is expected to recover quickly. This, of course, turns on the seemingly esoteric debate among economists about which letter of the alphabet best characterises the outlook for the US economy. Those in the 'V' camp believe that the recent downturn is not much more than the result of an excessive build-up of inventories that occurred when growth slowed from its previously unsustainable level of around 6%. The economy should recover as these excess

(1) By Morgan Stanley.
(2) In work carried out by economists at HSBC.
(3) For those who are interested in the intricacies of this debate, it is plausible that the fact that the current version of the Bank's medium-term macroeconometric model does not allow the GDP deflator to be directly affected by world export prices implies that it underestimates the disinflationary impact of the recent global slowing.

inventories are worked off, with lower interest rates and energy prices likely to make the recovery quite sharp.

Some other economists are a little more cautious and expect something that more closely resembles a 'U', in that they believe that the US economy might see a period of virtually no growth followed by a relatively anaemic recovery. These economists argue that the recent downturn is not just a standard inventory correction, but also reflects the effect of the US corporate sector having over-invested, partly because expectations about returns did, for a while, soar to unrealistic levels. Adjusting to a more appropriate level of the capital stock can take rather longer than merely working off excess inventories.

There are also those who regard the 'U' camp as too complacent, and believe that an 'L' is more likely. They usually point to 'imbalances' in the US economy in the shape of a large current account deficit, a low savings rate and an 'overvalued' stock market. At this stage, the possibilities begin to multiply; I have also met those who believe in a 'V' followed by an 'L', and so on. It is important to recall that no one predicted the suddenness of the US slowdown late last year, and it therefore behoves us to be humble about our ability to forecast the precise course of the recovery. In discussing the role of confidence in precipitating recessions, Chairman Greenspan recently reminded us that:(1)

'*The unpredictable rending of confidence is one reason that recessions are so difficult to forecast … . Our economic models have never been particularly successful in capturing a process driven in large part by non-rational behavior.*'

In preparing our inflation projection, the MPC has assumed a 'V'-shaped recovery in the United States in its central projection, but the risks must therefore clearly reside on the downside. We shall have to continue to monitor international developments closely.

We shall need to be equally vigilant about signs that the international slowdown might be beginning to impact on the UK economy. Our econometric models tend to let us down when there are large changes in confidence. Historical experience suggests that the effect of international developments on business and consumer confidence in the United Kingdom is also, in terms of its timing and magnitude, quite difficult to predict. Recall that during the international crises of 1997–98, which began with the devaluation of the Thai baht in July 1997 but spread relatively quickly to several other Asian economies, business optimism actually initially rose between 1997 Q3 and Q4 (see Table C). It then started to erode gradually (from 1998 Q1 onwards), but fell precipitously during the autumn of 1998 (around the time of the troubles in Russia and parts of the hedge fund industry). Hence it is possible that business and consumer surveys in the United Kingdom might become less optimistic in the next few months as firms find their export orders begin to fall off. However, it is also possible that buoyant public sector demand, combined with current consumer perceptions that their own financial situation is strong, keeps the UK economy relatively well insulated.

Table C
The behaviour of 'confidence' during the 1997–98 international crises

	CBI industrial trends business optimism	CIPS services optimism (a)
1997 Q3	-6	77.8
Q4	2	79.7
1998 Q1	-11	75.3
Q2	-22	72.3
Q3	-44	63.7
Q4	-58	67.0

(a) End-quarter value.

Although consumer confidence in the United States has fallen sharply in recent months, the fact that consumer confidence in the United Kingdom rose by less than in the United States during the 1990s probably means that it is likely to fall less.

Recall also that in the autumn of 1998, the collapse of confidence to recession levels proved to be unwarranted in the light of the subsequent resilience of the UK economy. Some anecdotal evidence suggests that, this time, businesses and consumers have stayed optimistic either because they expect the US slowing to be a relatively temporary affair (as in 1998), or because they expect policy to respond to signs of weakness in the United Kingdom in a sufficiently rapid manner. Of course, from a policy-maker's perspective, the latter interpretation somewhat complicates the interpretation of the survey indicators.

Conclusion

I have argued today that there are many uncertainties about both the outlook for the US economy and the size of the spillover effects onto the UK economy. So

(1) Monetary policy report to Congress, 13 February 2001.

quantifying these effects is pretty difficult.(1) Our central projection assumes a relatively modest downward impact on UK inflation, so the risks from the international economy seem pretty firmly weighted on the downside. This might seem particularly relevant as we have, in any case, undershot the inflation target for 22 months, and, on our best collective projection, are likely to continue to undershoot for some time to come. Of course, not all the risks to the inflation projection go in one direction. The labour market is tight, with skill shortages at a relatively high level. There are some tentative signs that the extent of deflation in the retail sector is coming to an end, and also of a modest uptick of upward price pressure in manufacturing, which has plausibly been associated with the welcome fall in sterling versus the euro. We shall, of course, continue to monitor these risks alongside those emanating from the international economy. Hence it is especially important that those entering into medium-term commitments (eg wage settlements) in the United Kingdom do so being fully aware of the potential downside risks from the international economy. Although I have focused today on the risks associated with the US economy, one should also recognise that many emerging market economies are vulnerable to a US slowdown, and also that there are some signs of a weakening of the Japanese economy.

In forming our policy judgments, it is going to be more important than ever to have our ear close to the ground. Therefore, I am looking forward to hearing your evaluation of how your businesses might be affected by developments in the international economy.

(1) It is therefore not surprising that, as a committee, we found it difficult to sign up to the same quantification of the likely effect—I was one of those who would have been more gloomy than what is embodied in the best collective projection, in part because I believe that standard econometric models do not adequately capture the links between the UK and the US economies.

Contents of recent Quarterly Bulletins

The articles and speeches which have been published recently in the *Quarterly Bulletin* are listed below. Articles from November 1998 onwards are available on the Bank's web site at www.bankofengland.co.uk/qb/qbcontents.htm

Articles and speeches (indicated S)

February 1998
The Inflation Report projections: understanding the fan chart
Investment in this recovery: an assessment
Macroeconomic policy and economic performance in developing countries
Gilt-edged and sterling money markets: developments in 1997
Upgrading the Central Gilts Office
UK monetary framework and preparations for EMU (S)
Recent problems in Asia (S)

May 1998
The Bank of England Act
Recent developments in financial markets
Growth in UK manufacturing between 1970–92
Competition and co-operation: developments in cross-border securities settlement and derivatives clearing
The financing and information needs of smaller exporters
The New Lady of Threadneedle Street (S)
Exchange rates: an intractable aspect of monetary policy (S)

August 1998
The UK personal and corporate sectors during the 1980s and 1990s: a comparison of key financial indicators
Are prices and wages sticky downwards?
Why has the female unemployment rate in Britain fallen?
Testing value-at-risk approaches to capital adequacy
The cyclicality of mark-ups and profit margins: some evidence for manufacturing and services
Three views of macroeconomics (S)
Trade and investment in the light of the Asian crisis (S)
The UK economy and monetary policy—looking ahead (S)
Recent economic developments and the MPC approach to monetary policy (S)
Financial services into the year 2000 (S)

November 1998
Public sector debt: end March 1998
Inflation and growth in a service economy

November 1998 (continued)
The foreign exchange and over-the-counter derivatives markets in the United Kingdom
Recent changes to the national accounts, balance of payments and monetary statistics
Inflation targeting in practice: the UK experience (S)
The objectives and current state of monetary policy (S)
Economic policy, with and without forecasts (S)

February 1999
Sterling wholesale markets: developments in 1998
The external balance sheet of the United Kingdom: recent developments
The impact of inflation news on financial markets
Monetary policy rules and inflation forecasts
The yen/dollar exchange rate in 1998: views from options markets
Risk, cost and liquidity in alternative payment systems
Monetary policy and the international economic environment (S)
Monetary policy and the labour market (S)
EMU: a view from next door (S)
Central bankers and uncertainty (S)

May 1999
The transmission mechanism of monetary policy
Monetary policy and the yield curve
The Bank's use of survey data
Monetary policy and uncertainty
An effective exchange rate index for the euro area
The financing of small firms in the United Kingdom
Structural changes in exchange-traded markets
Developments in small business finance (S)
Economic models and monetary policy (S)
Inflation and growth in the services industries (S)

August 1999
What makes prices sticky? Some survey evidence for the United Kingdom
The use of explicit targets for monetary policy: practical experiences of 91 economies in the 1990s
Financial sector preparations for the Year 2000
The Asian crisis: lessons for crisis management and prevention (S)

August 1999 (continued)
The MPC two years on (S)
Price stability in the United Kingdom (S)
The impact of the international environment on recent monetary policy (S)

November 1999
Sterling market liquidity over the Y2K period
Public sector debt: end March 1999
The external balance sheet of the United Kingdom: recent developments
News and the sterling markets
New estimates of the UK real and nominal yield curves
Government debt structure and monetary conditions
Challenges for monetary policy: new and old (S)
Sterling's puzzling behaviour (S)
Monetary policy and asset prices (S)
Interest rates and the UK economy—a policy for all seasons (S)

February 2000
Sterling wholesale markets: developments in 1999
Recent developments in extracting information from options markets
Stock prices, stock indexes and index funds
Private equity: implications for financial efficiency and stability
Back to the future of low global inflation (S)
British unemployment and monetary policy (S)
Before the Millennium: from the City of London (S)

May 2000
A comparison of long bond yields in the United Kingdom, the United States, and Germany
Money, lending and spending: a study of the UK non-financial corporate sector and households
Monetary policy and the euro (S)
The new economy and the old monetary economics (S)
The impact of the Internet on UK inflation (S)
Monetary policy and the supply side (S)

August 2000
Public sector debt: end-March 2000
Age structure and the UK unemployment rate
Financial market reactions to interest rate announcements and macroeconomic data releases
Common message standards for electronic commerce in wholesale financial markets
The environment for monetary policy (S)
Monetary union and economic growth (S)
The exchange rate and the MPC: what can we do? (S)
The work of the Monetary Policy Committee (S)

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Central bank independence (S)
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Monetary challenges in a 'New Economy' (S)

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Measuring interest accruals on tradable debt securities in economic and financial statistics
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The London Foreign Exchange Joint Standing Committee: a review of 2000
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Explaining the difference between the growth of M4 deposits and M4 lending: implications of recent developments in public finances
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Bank of England publications

Working papers

Working papers are free of charge; a complete list is available from the address below. An up-to-date list of working papers is also maintained on the Bank of England's web site at www.bankofengland.co.uk/workingpapers/index.htm, where abstracts of all papers may be found. Papers published since January 1997 are available in full, in PDF format.

No.	Title	Author
90	Bank capital and risk-taking *(January 1999)*	Alistair Milne A Elizabeth Whalley
91	Forward-looking rules for monetary policy *(January 1999)*	Nicoletta Batini Andrew G Haldane
92	Coalition formation in international monetary policy games *(February 1999)*	Marion Kohler
93	Business cycles and the labour market can theory fit the facts? *(March 1999)*	Stephen Millard Andrew Scott Marianne Sensier
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137	Leading indicator information in UK equity prices: an assessment of economic tracking portfolios *(May 2001)*	Simon Hayes

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 web site at www.bankofengland.co.uk/mpc/extmpcpaper0000n.pdf (where n refers to the paper number).

No.	Title	Author
1	Monetary conditions indices for the United Kingdom: a survey *(September 2000)*	Nicoletta Batini Kenny Turnbull
2	Inflation dynamics and the labour share in the United Kingdom *(November 2000)*	Nicoletta Batini Brian Jackson Stephen Nickell
3	Core inflation in the United Kingdom *(March 2001)*	Joanne Cutler
4	A disaggregated approach to modelling UK labour force participation *(May 2001)*	Joanne Cutler Kenny Turnbull

Monetary and Financial Statistics

Monetary and Financial Statistics (Bankstats) contains detailed information on money and lending, monetary and financial institutions' balance sheets, analyses of bank deposits and lending, international business of banks, public sector debt, money markets, issues of securities and short-term paper, interest and exchange rates, explanatory notes to tables, and occasional related articles. Bankstats is published quarterly in paper form, priced at £60 per annum in the United Kingdom (4 issues). It is also available monthly free of charge from the Bank's web site at: www.bankofengland.co.uk/mfsd/latest.htm

Further details are available from: Daxa Khilosia, Monetary and Financial Statistics Division, Bank of England, Threadneedle Street, London, EC2R 8AH: telephone 020–7601 5353; fax 020–7601 3208; e-mail daxa.khilosia@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 web site at www.bankofengland.co.uk/mfsd/article

Title	Author	Month of issue	Page numbers
A work programme in financial statistics	Chris Wright and David Shawyer	April 2001	7–10
UK banks' income and expenditure	Will Kerry and Daniel Wallace	March 2001	4–6
Banks' average interest rates	Jonathan Bailey and Jim Thame	February 2001	1–3

Targeting Inflation book

In March 1995, the Bank hosted a conference of central banks currently adhering to inflation targets. This book, edited by Andrew Haldane, draws together contributions from each of the eight countries represented at the conference. It details cross-country experiences of this monetary framework and the key operational and theoretical issues it raises. The book is suitable for both academics and practitioners. The price of the book is £20.00 plus postage and packaging.

Index-linked debt book

In September 1995, the Bank held a conference to discuss a broad range of theoretical and practical questions raised by index-linked debt in general, and the UK experience in particular. This book contains revised versions of the papers presented at the conference, as well as the papers that were circulated by the Bank ahead of the conference, setting out background information and key policy issues. The price of the book is £10.00 plus postage and packaging.

Openness and Growth book

The *Openness and Growth* book, published in October 1998, contains the proceedings of an academic conference held at the Bank of England in September 1997. The research described in the book investigates the link between productivity growth and the international openness of the UK economy. The price of the book is £10.00 plus postage and packaging.

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 £10.00 plus postage and packaging. An update was published in September 2000 and is available free of charge.

Government debt structure and monetary conditions

In June 1998 the Bank of England organised a conference to discuss the interactions between the size and structure of government debt and monetary conditions. This book, published in December 1999, contains all but one of the papers presented at the conference, plus a background paper prepared within the Bank. The price of the book is £10.00 plus postage and packaging.

Quarterly Bulletin

The *Quarterly Bulletin* provides regular commentary on market developments and UK monetary policy operations. It also contains research and analysis reports on a wide range of topical economic and financial issues, both domestic and international.

There is a new format for the *Quarterly Bulletin* (introduced at the start of 2001). The *Bulletin* now carries a somewhat broader range of material than before, particularly in relation to the formulation and conduct of monetary policy.

The *Quarterly Bulletin* and *Inflation Report* are no longer published on the same day. Publication dates for 2001 are as follows:

Quarterly Bulletin		*Inflation Report*	
Spring	12 March	February	14 February
Summer	11 June	May	16 May
Autumn	29 August	August	8 August
Winter	26 November	November	14 November

The Bank's quarterly *Inflation Report* was first published in 1993. Since then the *Bulletin* and *Inflation Report* can be bought as a combined package. The *Inflation Report* can also be bought separately. Current prices are set out overleaf.

Back issues of the *Quarterly Bulletin* from 1981 are available for sale. Summary pages of the *Bulletin* from February 1994, giving a brief description of each of the articles, are available on the Bank's web site at www.bankofengland.co.uk/qb/index/htm

The *Bulletin* is also available from Bell & Howell Information and Learning: enquiries from customers in Japan and North and South America should be addressed to Bell & Howell Information and Learning, 300 North Zeeb Road, Ann Arbor, Michigan 48106, United States of America; customers from all other countries should apply to White Swan House, Godstone, Surrey, RH9 8LW, telephone 01444 445000.

An index of the *Quarterly Bulletin* is also available to customers 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* for the period 1960–85 (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 DM 200 per volume or DM 4,825 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 *Report* starts with an overview of economic developments; this is followed by six sections:

- analysis of money, credit and financial market data, including the exchange rate;
- analysis of demand and output;
- analysis of the labour market;
- analysis of costs and prices;
- summary of monetary policy during the quarter; and
- assessment of the medium-term inflation prospects and risks.

The minutes of the meetings of the Bank's Monetary Policy Committee (previously published as part of the *Inflation Report*) now appear as a separate publication on the same day as the *Report*.

Quarterly Bulletin and Inflation Report subscription details

Copies of the *Quarterly Bulletin* and *Inflation Report* are available from the Bank as a **combined** package; the *Inflation Report* is also available separately. The prices are set out below:

Destination		2001				2000			
		Quarterly Bulletin and *Inflation Report* package		*Inflation Report* only (1)		*Quarterly Bulletin* and *Inflation Report* package		*Inflation Report* only (1)	
		Annual	Single	Annual	Single	Annual	Single	Annual	Single
United Kingdom, by first-class mail (2)		£40.00	£10.00	£12.00	£3.00	£40.00	£10.00	£12.00	£3.00
Academics, ***UK only***		*£27.00*	*£6.75*	*£8.00*	*£2.00*	*£27.00*	*£6.75*	*£8.00*	*£2.00*
Students, ***UK only***		*£14.00*	*£3.50*	*£4.50*	*£1.50*	*£14.00*	*£3.50*	*£4.50*	*£1.50*
European countries including the Republic of Ireland, by letter service		£48.00	£12.00	£14.00	£3.50	£48.00	£12.00	£14.00	£3.50
Countries outside Europe: Surface mail		£48.00	£12.00	£14.00	£3.50	£48.00	£12.00	£14.00	£3.50
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	Zone 2 (4)	£66.00	£16.50	£22.00	£5.50	£66.00	£16.50	£22.00	£5.50

(1) There is a 25% discount if five copies or more of the same issue are purchased.
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(3) All countries other than those in Zone 2.
(4) Australasia, Japan, Peoples' Republic of China, the Philippines and Korea.

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The **concessionary rates** for the combined *Quarterly Bulletin/Inflation Report* package and the separate *Inflation Report* are noted above in *italics*. **Academics at UK institutions** of further and higher education are 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; e-mail mapublications@bankofengland.co.uk

General enquiries about the Bank of England should be made to 020–7601 4444.
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