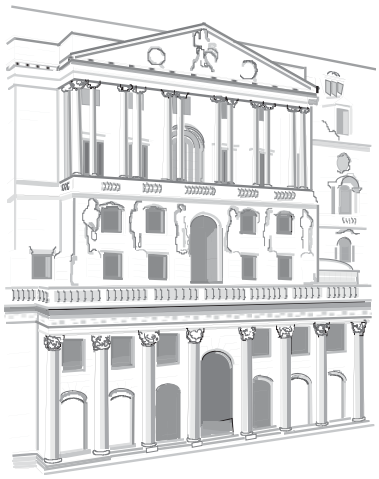
# Bank of England Quarterly Bulletin



November 2000

Volume 40 Number 4

# Bank of England Quarterly Bulletin

## November 2000

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# The Quarterly Bulletin and Inflation Report

### *Inflation Report*
(published separately)

The *Inflation Report* reviews developments in the UK economy and assesses the outlook for UK inflation over the next two years in relation to the inflation target. The *Report* starts with a short overview section. The following four sections analyse developments in money and financial markets, demand and output, the labour market, and costs and prices respectively. The concluding sections present a summary of monetary policy since the August *Report* and an assessment of inflation prospects and risks. The *Bank of England Agents' summary of business conditions* is appended to the *Report*. Minutes of recent Monetary Policy Committee meetings are attached as an annex.

### *Markets and operations*
(pages 321–38)

This article reviews developments in international and domestic financial markets, drawing on discussions with the Bank of England's market contacts, and describes the Bank's market operations in the period 30 June to 6 October 2000. Official interest rates were raised in the euro area by 50 basis points during the review period, and were left unchanged in the United States and United Kingdom. Short-term interest rate expectations for 2000–02 were largely unchanged in the euro area, but were revised down by around 30 to 60 basis points in the United States and the United Kingdom. An increasing number of market participants believed that official rates in the United States and the United Kingdom had peaked. The US and UK government bond yield curves became less inverted. The German government bond yield curve shifted upwards slightly during the period. Volatility in the money and bond markets diminished in Q3 and uncertainty about the short-term outlook for interest rates remained at historically low levels. World equity markets weakened during the period, but the volatility seen in stock prices in Q1 and Q2 diminished in Q3. The dollar appreciated further against all the other major currencies, while the euro continued to depreciate. On 22 September the G7 central banks intervened in the foreign exchange markets, buying euros.

### *The international environment*
(pages 339–50)

This article discusses developments in the international environment since the August 2000 *Quarterly Bulletin*, as well as the outlook for inflation and output over the next two years. World GDP is estimated to have grown by 1.0% in the second quarter, a deceleration from 1.5% in the first quarter. Growth rates remained strong in the major economies, but fell in the emerging Asian economies. World industrial production growth has continued to rise. In the United States, GDP grew strongly in Q2 but slowed in Q3; final domestic demand growth moderated in both quarters. In the euro area, quarterly GDP growth in Q2 remained at 0.9% for the fourth consecutive quarter. The Japanese economy grew by 1.0% in Q2, the second consecutive quarter of positive growth. Oil prices have risen further, amid uncertainties about the future balance of demand and supply. Consumer price inflation rates have reflected this to a varying degree. Headline inflation has risen in the euro area but has fallen in the United States over the period. Non-energy inflation rates have risen in both economies, notably in the euro area. Official interest rates have risen in Japan and the euro area since the previous *Quarterly Bulletin*. The Bank of Japan ended its zero interest rate policy by raising rates to 0.25%, and the ECB increased rates in two steps, by 0.5 percentage points in total, to 4.75%. The FOMC has maintained the Federal funds target rate at 6.5%. The IMF has raised its projection of world GDP growth to 4.7% in 2000, the highest growth rate in more than ten years, and to 4.2% in 2001. These revisions reflect continued robust growth in the major economies, and a strengthening of economic fundamentals in many emerging markets. Since the previous *Quarterly Bulletin*, projections published by Consensus Economics for GDP growth in most regions have been revised upwards for 2000, though are mixed for 2001, perhaps partly reflecting the expected effects of higher oil prices. World trade is forecast by the IMF to grow by 10% in 2000, slowing to around 8% in 2001. The balance of risks around most forecasts remains on the downside, largely from the effects of a possible fall in asset market prices and from the uncertain impact on activity of higher oil prices.

## *The external balance sheet of the United Kingdom: implications for financial stability?*

(pages 351–64)

This article looks at developments in the UK external balance sheet in the wider context of the UK economy and financial system. UK net external liabilities increased sharply in the late 1990s. This largely reflected changing asset values, including exchange rates, rather than financial flows. The currency composition of UK external assets and liabilities means that, other things being equal, a falling exchange rate would reduce UK net external liabilities via valuation changes. In addition, the way foreign direct investment is valued could mean that UK external assets are significantly underestimated. The article also analyses the impact of banking sector business on the UK external balance sheet. UK external short-term debt is large because of the scale of international banking activities. A comparatively small proportion of this is carried out by UK-owned banks.

## *Research and analysis*

(pages 365–402)

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

*Economic models at the Bank of England.* In April 1999, the Bank of England published *Economic models at the Bank of England*, a book that described the economic modelling tools that help the Monetary Policy Committee (MPC) in its work. It was made clear at the time that economic models should not be thought of as fixed in form or content, and that model development is a continual process. An update to the book was published in September 2000 covering model developments over the past 18 months, particularly in relation to the Bank's main macroeconometric modelling tool. The update, while giving details of the core macroeconometric model, also refers to other work within the Bank that has added to the range of models used by the MPC.

*International financial crises and public policy: some welfare analysis* (by Michael Chui, Prasanna Gai and Andy Haldane of the Bank's International Finance Division). This article describes a model of financial crisis and explores its implications for public policy. The framework nests the key features of earlier models but is better able to address international architecture questions in a welfare setting. In particular, this framework is used to assess the welfare costs of creditor coordination failure and several recent public policy proposals on reforming the international financial architecture. The costs of creditor coordination failures are found to be high. But policies that improve sovereign liquidity management or that stall creditor runs—such as payments standstills—can mitigate these costs.

*Central banks and financial stability* (by P J N Sinclair, Director, Centre for Central Banking Studies). Many central banks have seen a recent increase in their autonomy in monetary policy, and also a transfer of supervisory and regulatory responsibilities to other bodies. But the maintenance of financial stability is, and remains, a core function for all central banks. This paper presents details of 37 central banks' functions and powers as they stood in March 2000. It goes on to discuss financial crises and the morbidity of banks, the trade-off between competition and safety in the financial system, the international dimension to financial crises, the many links between financial stability policy and monetary policy, and the nature of the work of those charged with safeguarding financial stability.

*Inferring market interest rate expectations from money market rates* (by Martin Brooke of the Bank's Gilt-edged and Money Markets Division, and Neil Cooper and Cedric Scholtes of the Bank's Monetary Instruments Division). The Bank's Monetary Policy Committee is interested in market expectations of future interest rates. Short-term interest rate expectations can be inferred from a wide range of money market instruments. But the existence of term premia and differences in the credit quality, maturity, liquidity and contract specifications of alternative instruments means that we have to be careful when interpreting derived forward rates as indicators of the Bank's repo rate. This article discusses the differences between some of the available instruments and relates these to the interest rate expectations that are calculated from them. It also describes the Bank's current approach to inferring rate expectations from these instruments.

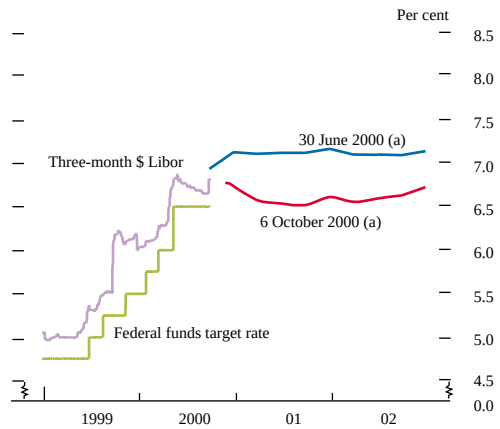
The contents page, with links to the articles in PDF format, is available at www.bankofengland.co.uk/qb/n00qbcon.htm
The speeches contained in the *Bulletin* can be found at www.bankofengland.co.uk/speeches

# Markets and operations

*This article reviews developments in international and domestic financial markets, drawing on discussions with the Bank of England's market contacts, and describes the Bank's market operations in the period 30 June to 6 October 2000.*

- *Official interest rates were raised in the euro area by 50 basis points during the review period, and were left unchanged in the United States and United Kingdom.*
- *Short-term interest rate expectations for 2000–02 were largely unchanged in the euro area, but were revised down by around 30 to 60 basis points in the United States and the United Kingdom. An increasing number of market participants believed that official rates in the United States and the United Kingdom had peaked.*
- *The US and UK government bond yield curves became less inverted. The German government bond yield curve shifted upwards slightly during the period.*
- *Volatility in the money and bond markets diminished in Q3 and uncertainty about the short-term outlook for interest rates remained at historically low levels.*
- *World equity markets weakened during the period, but the volatility seen in stock prices in Q1 and Q2 diminished in Q3.*
- *The dollar appreciated further against all the other major currencies, while the euro continued to depreciate. On 22 September the G7 central banks intervened in the foreign exchange markets, buying euros.*

**Chart 1**
**US interest rates**




Source: Bloomberg.

(a) Interest rates implied by eurodollar futures contracts at the dates specified. From October 2000 onwards, the x-axis relates to contract expiry dates.

## International markets

### *Short-term interest rates*

In the United States, the Federal Open Market Committee (FOMC) left the Federal funds target rate unchanged at 6½% during the review period. There was also a significant fall in the market's short-term interest rate expectations (see Chart 1). Expectations were hardly changed after the 22 August FOMC meeting, reflecting the consensus view that rates would be left at 6½% (a Reuters poll taken before the meeting suggested that 28 of 29 economists anticipated such an outcome). In contrast, interest rates implied by short-term eurodollar futures contracts rose moderately after the 3 October meeting. Though the decision not to change the Federal funds target rate had been foreseen by most market participants, the FOMC's accompanying statement warning about the risks of heightened inflation pressures had been less fully discounted.

Table A shows that economic forecasters generally revised up their expectations for US economic growth during the review period. Average GDP forecasts for 2000 and 2001 reported by Consensus Economics increased by 0.4 and 0.5 percentage points, to 5.2% and 3.6% respectively. Nonetheless, short-term dollar interest rates fell

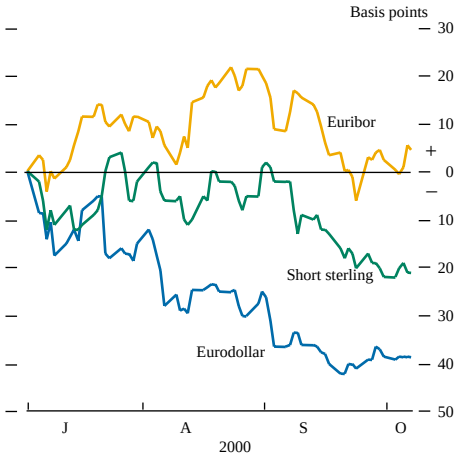
## Table A
## Forecasts for GDP growth

Per cent; *percentage points in italics*

| | 2000 | | | 2001 | | |
|---|---|---|---|---|---|---|
| | July | October | Change | July | October | Change |
| United States | 4.8 | 5.2 | *0.4* | 3.1 | 3.6 | *0.5* |
| Euro area | 3.4 | 3.4 | *0.0* | 3.2 | 3.1 | *-0.1* |
| United Kingdom | 3.0 | 3.0 | *0.0* | 2.6 | 2.7 | *0.1* |
| Japan | 1.5 | 2.0 | *0.5* | 1.6 | 2.0 | *0.4* |

Source: Consensus Economics.

## Chart 2
## Cumulative changes in expectations for three-month interest rates(a)




Source: Bloomberg.

(a) As indicated by changes in rates implied by futures contracts maturing in December 2000.

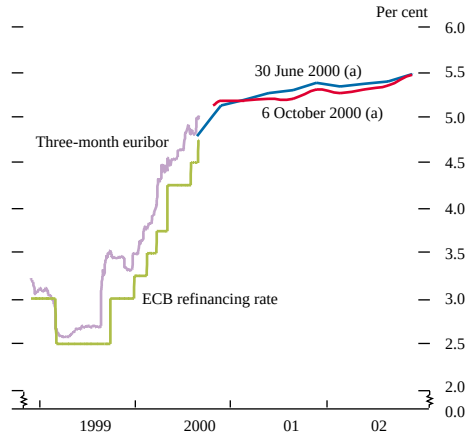
## Table B
## Forecasts for inflation

Per cent; *percentage points in italics*

| | 2000 | | | 2001 | | |
|---|---|---|---|---|---|---|
| | July | October | Change | July | October | Change |
| United States | 3.2 | 3.3 | *0.1* | 2.6 | 2.7 | *0.1* |
| Euro area | 1.9 | 2.2 | *0.3* | 1.7 | 2.0 | *0.3* |
| United Kingdom | 2.0 | 2.1 | *0.1* | 2.4 | 2.3 | *-0.1* |
| Japan | -0.4 | -0.6 | *-0.2* | 0.0 | -0.1 | *-0.1* |

Source: Consensus Economics.

## Chart 3
## Euro-area interest rates




Source: Bloomberg.

(a) Three-month interest rates implied by euribor futures contracts at the dates specified. From October 2000 onwards, the x-axis relates to contract expiry dates.

gradually throughout the period (see Chart 2). Rates implied by Federal funds futures fell by around 35–60 basis points for contracts expiring in 2000–02. Despite the significant fall over the period as a whole, daily changes in short-term interest rates tended to be moderate. For example, the standard deviation of daily price movements for the front futures contract was only 3 basis points in Q3, down from 5 basis points in Q2.

The main influences on short-term interest rate expectations over the period were weaker-than-expected price and labour market data. Inflation indicators were generally interpreted as benign, especially the prices component of the August Chicago Purchasing Managers' Index survey. The July and August provisional labour market reports recorded declines in non-farm payrolls, and the average hourly earnings component was also seen as benign. In addition, comments from Federal Reserve Chairman Greenspan to the Senate Banking Committee on 20 July also contributed to the fall in rate expectations.

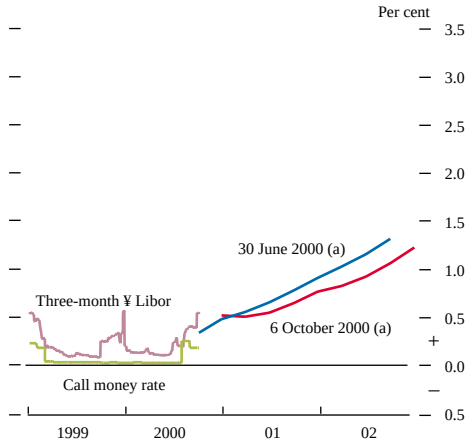
Reflecting the stronger-than-expected GDP growth and weaker-than-expected employment growth, US non-farm productivity increased at an annual rate of 5.3% in Q2, much higher than the median market expectation of 4.5%. Furthermore, this estimate was subsequently revised upwards on 6 September to 5.7%. This supported the belief of many market participants that growth could continue at a higher rate than previously thought without increasing inflation pressures. Consequently, market expectations of inflation were revised up only marginally during the period, despite the quite large upward revisions to growth (see Tables A and B).

The market also revised down its expectation for the peak in the FOMC's official rate. On 30 June, futures contracts settling on the Federal funds target rate suggested a peak of 6.96% in March 2001. By 6 October, the market's central expectation was that there would be no further increases in the target rate, and that there was some chance of a decline in the official rate in the first quarter of 2001.

The European Central Bank (ECB) raised its refinancing rate by 25 basis points on 31 August and by a further 25 basis points on 5 October, to 4.75%. Ahead of the August meeting, a minority of market participants had expected the ECB to raise its refinancing rate by 50 basis points, due to evidence of rising inflationary pressures and perceived price risks from higher oil prices and the depreciation of the euro. Consequently, rates implied by euribor futures contracts fell by 3–5 basis points after the ECB's announcement. Prior to the October decision there had been an expectation that the ECB would leave the refinancing rate unchanged—a Reuters poll, for example, reported that economists, on average, attached a 64% probability to such an outcome. Euribor rates therefore rose after the announcement.

Euro-area growth expectations were little changed during the period, while inflation expectations were revised upwards (see Tables A and B). Consistent with this, economists revised up their forecast for the peak in the ECB's refinancing rate—a Reuters poll on 5 October suggested an average forecast for the peak of 5.08%, compared with 4.94% in the survey conducted at the beginning of July.

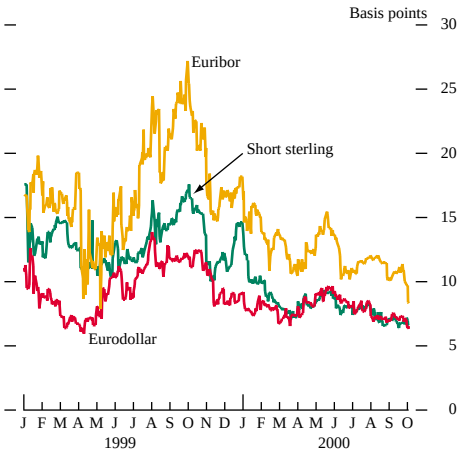
## Chart 4
## Japanese interest rates




Source: Bloomberg.

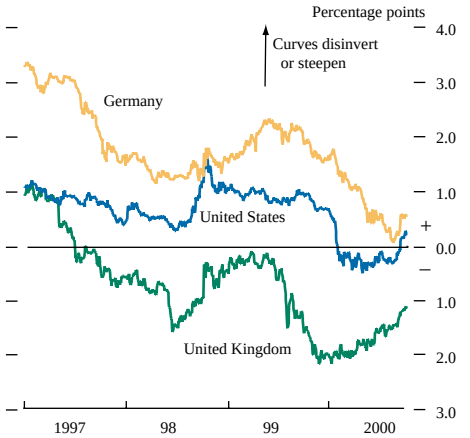
(a) Three-month interest rates implied by euroyen futures contracts at the dates specified. From October 2000 onwards, the x-axis relates to contract expiry dates.

## Chart 5
## Interest rate uncertainty(a)




(a) Implied volatility of three-month constant-horizon interest rate futures contracts.

## Chart 6
## Twenty-year minus two-year government bond yield spreads(a)




(a) Zero-coupon spot yields derived from the Bank's VRP curve-fitting technique. For further details on this technique, see Anderson and Sleath, *Bank of England Quarterly Bulletin*, November 1999.

In contrast, market interest rate expectations derived from euribor futures contracts were little changed over the period (see Chart 3). As in the United States, daily changes in short-term market interest rates were generally small; the standard deviation of daily price movements for the front euribor futures contract was only 3 basis points, compared with 5 basis points in Q2. Although international considerations influenced euribor rates on occasion, domestic factors appeared to be more important for much of the review period. The main influences that led to higher euribor rates included movements in the oil price and stronger-than-expected French and German CPI data (for June and September respectively), while the main influences that lowered euribor rates were German retail sales (for July), and the ECB rate announcement on 31 August. In addition, the depreciation of the euro also influenced rate expectations during the period; falls in the euro exchange rate index tended to coincide with increases in interest rate expectations relative to the United Kingdom and United States.

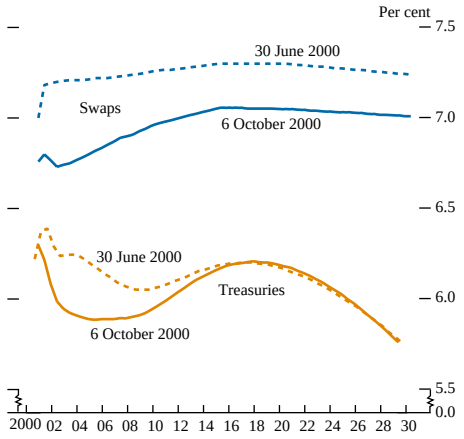
Short-term interest rate expectations implied by euroyen futures were virtually unchanged for the December 2000 contract, but fell by up to 25 basis points for contracts maturing in 2001–02 (see Chart 4). Interest rate expectations fell during July, partly reflecting weakness in the Japanese equity market (the TOPIX index, for example, fell by 9% in July). Rate expectations then rose in August both ahead of, and after, the Bank of Japan's decision on 11 August to raise the overnight call rate to 0.25%. The market had broadly expected this announcement, following comments from Bank of Japan officials and evidence of strengthening domestic activity. Rate expectations fell again in September, mainly for euroyen contracts with longer maturities, reflecting further weakness in the Japanese equity market, some weaker-than-expected activity data and downward revisions to inflation forecasts (see Table B).

There was little change in market uncertainty about the future path of interest rates in the United States and euro area (as measured by the prices of options contracts settling on euribor and eurodollar futures). Interest rate uncertainty remained at low levels, compared with the first quarter of this year and most of last year (see Chart 5).

### *Long-term interest rates*

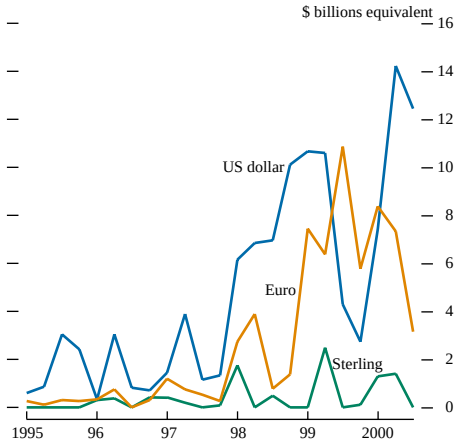
Yields on US Treasury securities with a maturity of five years or less fell by as much as 30 basis points during the period, while long yields were little changed. Consequently, the Treasury curve disinverted (see Charts 6 and 7). Movements in yields of all maturities were highly correlated during the first six weeks of the period, with the Treasury yield curve shifting down by 15–25 basis points. Thereafter, while short-maturity yields continued to fall, longer-maturity yields rose. The disinversion of the yield curve reflected a number of factors. First, higher oil prices led to an increase in inflation expectations and a rise in uncertainty about future inflation. As can be seen from Table B, the increase in inflation expectations for 2000 and 2001 was not particularly large, however. Second, comments by the United States presidential candidates led market participants to attach a higher probability to an easing of fiscal policy. These developments put upward pressure on yields at all maturities. Third, declines in equity prices at the end of the period led to increased flows into short-maturity government bonds. Consequently, short-dated yields fell relative

**Chart 7**
**US Treasury and swap curves**




Sources: Bank of England and Bloomberg.

**Chart 8**
**Bond issuance by telecoms firms**




Source: Capitaldata.

to longer-dated yields. The sharpness of the increase in longer-maturity bond yields in mid-September also caused some market participants to close out some of their long positions, thereby accentuating the yield movements.

Interest rate expectations can also be derived from the swap market. The swap curve shows the rates at which market participants are willing to exchange fixed-rate liabilities for floating-rate (Libor-based) liabilities. Over the review period, US swap rates fell at all maturities (see Chart 7), causing the spreads between swap rates and Treasury yields to narrow. The decline in short-dated swap rates was largely due to the same factors that affected short-term interest rate expectations. In addition, private sector dollar bond issuance was lower than expected and contributed to a fall in swap rates at all maturities—total non-government dollar-denominated fixed-rate issuance was $54 billion in Q3 compared with $63 billion in Q2. Market participants report that swap rates also fell because of higher-than-expected demand for fixed-rate income in the swap market from telecoms companies. Fixed-rate bond issuance by telecoms companies was about $12 billion in Q3, much the same as in Q2 (see Chart 8). Many of these telecoms firms issued fixed-rate dollar bonds to pay for licences for the Universal Mobile Telecommunications Systems (UMTS) in Europe. The market had anticipated such activity, but a greater-than-expected amount was then swapped into floating-rate liabilities in the dollar swap market (by receiving fixed-rate income and paying floating rate), then swapped into euros and sterling via currency swaps. This higher-than-expected demand to receive fixed-rate income from telecoms companies therefore contributed to the fall in dollar swap rates.

It is noteworthy that the US swap curve has remained positively sloped this year, even though the US Treasury curve has been inverted or, more recently, flat. In the United Kingdom, the gilt yield curve and the swap curve have been inverted for most of the period since the second half of 1997. The inversion of both government bond yield curves has been related to reductions in the outstanding stocks of government debt. In addition, in the United Kingdom, there has also been very strong demand for long-maturity sterling fixed-interest payments from institutions such as pension funds and life assurance companies. Such demand has also caused sterling swap rates to fall at longer maturities, by encouraging high-credit quality institutions (for example supranational institutions) to issue fixed-rate bonds to UK end-investors, and then receive fixed-rate income in the swap market.(1) This demand for fixed-rate income was not offset by a corresponding rise in the supply of fixed-rate income in the swap market, and caused a significant fall in longer-maturity sterling swap rates relative to short-maturity swap rates.

As noted previously, there has also been a rise in the demand to receive fixed-rate income in the dollar swap market. However, this has been a more recent phenomenon, with demand spread across a wider range of maturities than in the sterling swap market. Also

(1) These institutions are able to receive a higher rate in the swap market than the coupon rate payable on their bonds because of their higher credit rating. Hence they can lower their cost of financing by participating in both the sterling bond and swap markets (for further details see the box on page 130 of the May 2000 *Quarterly Bulletin*).

there is some evidence that liquidity is lower in the sterling swap market. Lack of liquidity may have exaggerated sterling swap rate movements resulting from the demand and supply imbalances noted above. A recent survey(1) suggested that turnover in the sterling swap market is more concentrated in the hands of a few market participants. The survey found that the highest market share of a firm in the sterling swap market was 73% for swaps with a maturity of ten years or more, compared with 16% in the dollar swap market (for maturities of less than ten years, concentration was only slightly higher in the United Kingdom). So there is some evidence that the inversion of the sterling swap curve not only reflects very strong demand for long-maturity fixed-rate income, but also perhaps a relative lack of liquidity, factors which have been less influential in the dollar swap market.

The German government bond yield curve shifted upwards slightly over the review period. Yields fell at longer maturities in the first six weeks of the quarter, partly reflecting upward revisions to the expected proceeds from the sale of UMTS licences and equivalent downward revisions to expected government bond issuance. The German UMTS auction finished on 17 August, raising €50.5 billion, five times the German government's initial forecast. It was confirmed that the proceeds would be used to reduce government debt. However, long-maturity yields rose over the rest of the period, reflecting concerns about rising oil prices and speculation that fiscal policies would be loosened following the petrol price protests in Europe. As in the United States, many market participants quickly reversed their trading positions as long-maturity yields rose, and this accentuated yield movements. German swap rates were little changed over the period.

Movements in Japanese government bond yields were similar to those of euroyen futures rates for much of the review period. Speculation that the Japanese government would announce a supplementary budget put some upward pressure on bond yields at medium and long maturities, causing the yield curve to steepen.

### *International equity market developments*

Most of the major equity market indices fell over the review period, but price movements were generally much less volatile than earlier in the year. The S&P 500, Wilshire 5000, TOPIX, German DAX, and the French CAC were all weaker (see Table C), but the FTSE 100 finished 1.2% higher at 6391.

With the exception of Japan, global equity prices rose in July and August, partly reflecting the downward revisions to short-term interest rate expectations and the upward revisions to growth forecasts in the United States (see Table A). However, equity prices then declined sharply in September, due largely to three related considerations. First, market commentary increasingly focused on the dampening effect that higher oil prices might have on global activity, and the possibility that firms might be unable to pass on higher costs to their customers and so experience narrower margins. Second, more general concerns arose regarding the profitability of blue-chip companies, particularly in the United States where there were a number of announcements either of weaker-than-expected profits, or forecasting weaker future profits.

**Table C**
**International equity market performance**

Percentage changes from previous period, in local currencies

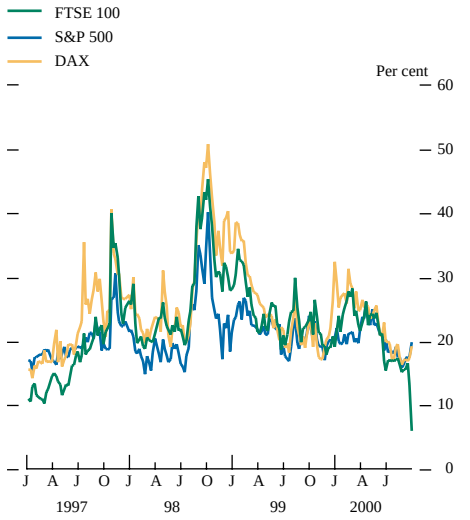
| | 1999 | 2000 | | |
|---|---|---|---|---|
| | Year | Q1 | Q2 | Q3 (a) |
| **United States** | | | | |
| S&P 500 | 19.5 | 2.0 | -2.9 | -3.1 |
| Wilshire 5000 | 22.1 | 3.5 | -4.7 | -3.5 |
| **Europe** | | | | |
| CAC 40 | 51.1 | 5.5 | 2.6 | -2.9 |
| DAX 30 | 39.1 | 9.2 | -9.2 | -1.8 |
| FTSE All-Share | 21.3 | -4.1 | -2.6 | 1.2 |
| FTSE 100 | 17.8 | -5.6 | -3.5 | 1.2 |
| **Japan** | | | | |
| TOPIX | 58.4 | -0.9 | -6.7 | -5.6 |
| **IT indices** | | | | |
| Nasdaq Composite | 85.6 | 12.4 | -13.3 | -15.3 |
| FTSE techMARK 100 | 56.1 (b) | 14.6 | -21.7 | 10.0 |
| Neuer Markt | 66.2 | 95.0 | -19.0 | -16.5 |
| Nouveau Marché | 135.3 | 80.9 | -30.5 | 11.6 |

Source: Bloomberg.

(a) 30 June–6 Oct. 2000.
(b) 4 Nov.–30 Dec. 1999.

(1) 'Swap volumes see euro wane', *Risk* magazine, September 2000.

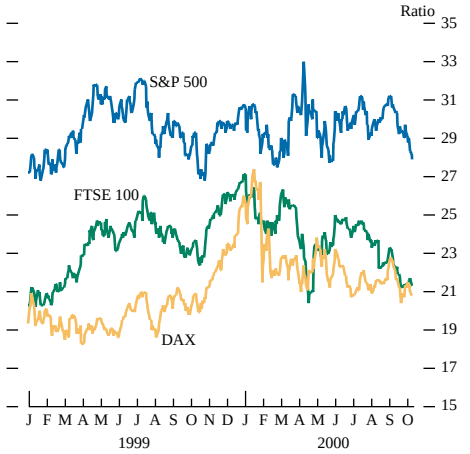
**Chart 9**
**Implied volatility of major equity indices**(a)




Source: Bloomberg.

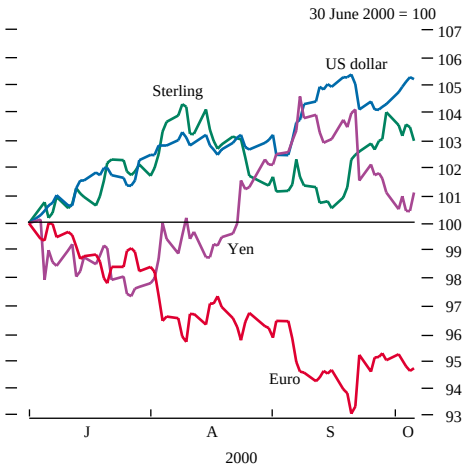
(a) Implied volatility of three-month constant-horizon equity options contracts (weekly average).

**Chart 10**
**Price/earnings ratios for equity market indices**




Source: Primark Datastream.

**Chart 11**
**Effective exchange rate indices**




Third, telecommunications and technology stocks fell sharply in September. These declines reflected weaker-than-expected profit announcements and concerns about the costs to telecom companies of European UMTS phone licences. In the United States, the 13% fall in the Nasdaq in September coincided with a 5% fall in the S&P 500 index. And in Germany, the worst-performing sectors of the DAX included telecoms, software and other technology stocks.

For the period as a whole, technology indices gave a mixed performance, unlike in the first half of this year, when the movements in these indices were more closely correlated. The Nasdaq and German Neuer Markt fell, while the FTSE techMARK and French Nouveau Marché both rose (see Table C). Equity prices for UK technology firms were lifted by better-than-anticipated results.

In Japan, the TOPIX fell through most of the period. First, the liquidation in July of Sogo (a large department store group) contributed to speculation that there might be further bankruptcies. Second, there were reports of Japanese companies reducing their holdings of Japanese equities ahead of the financial half-year-end in September. For example, a Merrill Lynch survey of Japanese fund managers showed a decline in the number with overweight positions in Japanese equities (from around 65% to 60%) and an accompanying decline in the number with underweight positions in US equities (from around 40% to 15%).

Volatility in all the major markets (except Japan) was on average lower during the review period than in Q2, though it rose at the end of the period. Furthermore, uncertainty about future price movements remained quite low. The implied volatility of the FTSE 100 index fell to levels last seen in 1997, before the financial market turbulence of that year (see Chart 9).

Despite announcements of weaker-than-expected profits, the falls in major equity market price indices led to lower price/earnings (P/E) ratios(1) (see Chart 10). The P/E ratio for the S&P 500 fell to 28 at the end of the period, down from a peak of 33 in the middle of 1999. The P/E ratio for the FTSE 100 was around 21 on 6 October, also close to its level at the start of 1999. Nevertheless, P/E ratios remain high by historical standards.

## Foreign exchange markets

The main exchange rate developments over the period were the appreciation of the dollar, the renewed depreciation of the euro, and the concerted intervention by the central banks of the Group of Seven (G7) countries on 22 September. Between 30 June and 6 October, the dollar's trade-weighted exchange rate index (ERI) increased by 5.2% while the euro ERI fell by 5.3%. Both the sterling and yen exchange rate indices appreciated, rising by 3.0% and 1.1% respectively (see Chart 11).

Changes in short-term interest rates appeared not to influence exchange rates during the period. The appreciation of the dollar's effective exchange rate and bilateral rates against sterling, the euro and the yen occurred despite short-term interest rates falling by

(1) The price/earnings ratio relates a company's share price to its annual earnings.

more in the United States than in the United Kingdom, the euro area and Japan (see Chart 2). Similarly, the euro depreciated against the dollar, sterling and the yen, even though euro-area interest rates rose by more or fell by less than in the United States, United Kingdom and Japan. The Bank of Japan's decision to end its zero interest rate policy on 11 August had been widely anticipated by financial market participants and had little impact on the foreign exchange market.

Exchange rates were, therefore, primarily influenced by factors other than short-term interest rates over the period. Market commentary focused on changes in countries' relative growth prospects. Higher potential growth is often associated with increased equity market returns which, in turn, help to attract more foreign investment, thereby generating greater demand for the local currency in the foreign exchange markets. As the supply of government bonds has declined, equity flows have received increasing attention as a potential influence on exchange rates.

The dollar's appreciation in Q3 coincided with the release of stronger-than-expected data for Q2 GDP and labour productivity, together with continued indications of relatively benign inflation pressures. These data encouraged market participants to believe that the US economy would avoid a 'hard landing', involving higher inflation, higher interest rates and sharp declines in equity valuations and GDP.

Some market participants use recent GDP growth outturns and short-term forecasts to estimate changes in potential growth. In the United States, consensus forecasts for GDP growth in 2000 and 2001 were revised up over the period (see Table A). By contrast, most forecasts for GDP growth in the United Kingdom and euro area were little changed. Changes in short-term relative growth prospects were therefore consistent with the dollar's appreciation against sterling and the euro in Q3. Japanese Q2 GDP data, released in mid-September, exceeded market expectations and led most forecasters to revise up their projections for Japanese GDP growth in 2000 and 2001. This is consistent with the yen's appreciation against sterling and the euro.

Market sentiment more generally was also an influence on exchange rates. Sentiment towards the euro was negative in Q3, with market participants seemingly reacting more to negative than to positive news. For instance, there was little effect on the currency from potentially positive developments on structural reform, including the legislative passage of the German tax reform package, and larger-than-expected revenues from the German UMTS auction. Instead, market participants focused on evidence of slower euro-area growth. Another recurring theme was the outflows of foreign direct investment, equity and bond capital from the euro area, in particular to the United States.

On 22 September, the G7 countries intervened in the foreign exchange markets, buying euros. The G7 summarised its activities in the following statement: 'At the initiative of the European Central Bank, the monetary authorities of the United States, Japan, the United Kingdom, and Canada, joined with the European Central Bank on Friday 22nd September in co-ordinated intervention in exchange markets, because of the shared concern of Finance

**Chart 12**
**Sterling exchange rates**

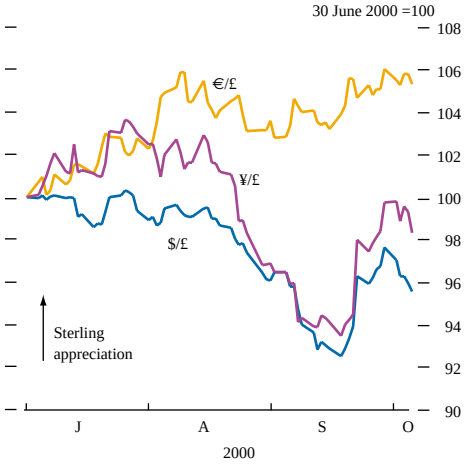



**Chart 13**
**Sterling-dollar exchange rate**

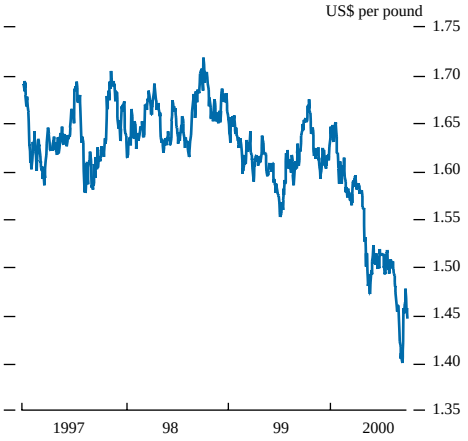
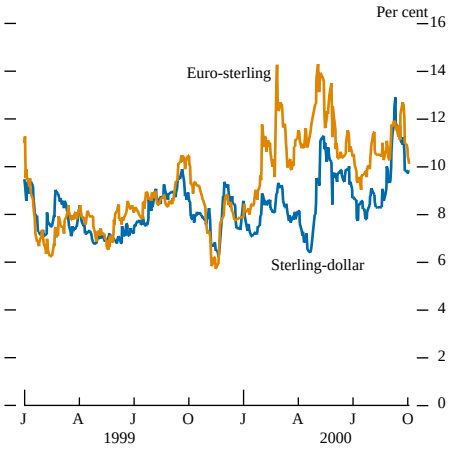



**Chart 14**
**Implied volatility of sterling exchange rates**(a)




Source: Chase Manhattan Bank.

(a) Implied volatility is derived from the one-month foreign exchange options prices.

Ministers and Governors about the potential implications of the recent movements in the euro for the world economy. In light of recent developments, we will continue to monitor developments closely and to co-operate in exchange markets as appropriate'.

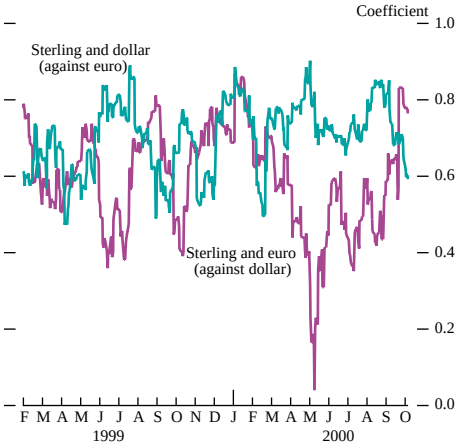
By the close of trading in London on the day of the intervention, the euro had appreciated by 3.4% against the dollar compared with its rate the previous evening. Following the intervention, euro call options (against the dollar) rose sharply in price relative to euro put options for maturities up to three months ahead, suggesting that market participants were willing to pay more to protect themselves against the risk of euro appreciation. By 6 October, the euro-dollar exchange rate had depreciated to below $0.87, from its high of $0.90 immediately after the intervention, but risk reversals at that point still indicated a preference for euro calls.

Sterling appreciated by 5.3% against the euro and depreciated by 4.7% against the dollar during the period. The appreciation against the euro occurred mainly in July and the second half of September, whereas the depreciation against the dollar took place during the second half of August and the first half of September (see Chart 12), suggesting that factors not specific to sterling were an important influence. On 12 September, sterling fell to a 14-year low against the dollar, slightly above $1.39. This coincided with a large mergers and acquisition related sale of sterling for dollars. The movement led to further market commentary about a possible 'decoupling' of the close relationship between sterling and the dollar. As Chart 13 shows, the sterling-dollar exchange rate had generally traded within the $1.60–$1.70 range over the period since the start of 1997. The sharp depreciation of sterling below this range since April has led to a rise in the implied volatilities of sterling-dollar options. Chart 14 shows that the implied volatility derived from sterling-dollar options contracts has generally been lower than for euro-sterling contracts. However, this situation was reversed briefly in mid-September, for the first time in nine months.

Another way to consider whether there has been a change in the relationship between sterling and the dollar is to examine the correlations of their co-movements against other currencies. Chart 15 shows exponentially weighted 20-day moving-average correlations between sterling and the dollar (against the euro), and between sterling and the euro (against the dollar). The correlation between movements of sterling and the dollar has been strongly positive, although it fell towards the end of the period. In contrast, movements in sterling and the euro have become more closely correlated since the end of April; furthermore, in mid-September the correlation became greater than that between sterling and the dollar.

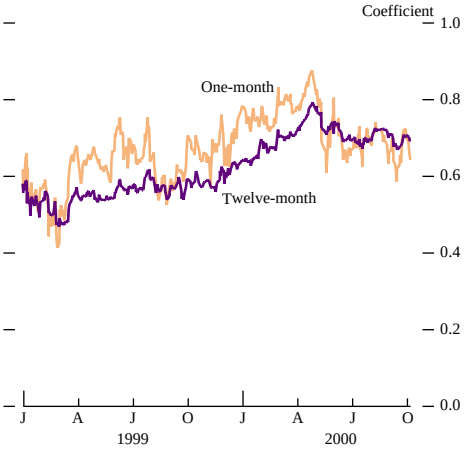
Charts 16 and 17 show the implied correlations between sterling and the dollar (against the euro) and between sterling and the euro (against the dollar). Unlike the moving-average correlations shown in Chart 15, which measure the past co-movement of spot exchange rates, these correlations are derived from options prices and measure the extent to which market participants expect currencies to move together one month and twelve months ahead. The relationship shown in Chart 16 has generally been strong and positive, implying that sterling and the dollar were expected to

**Chart 15**
**Correlations between spot exchange rate pairs**[a]



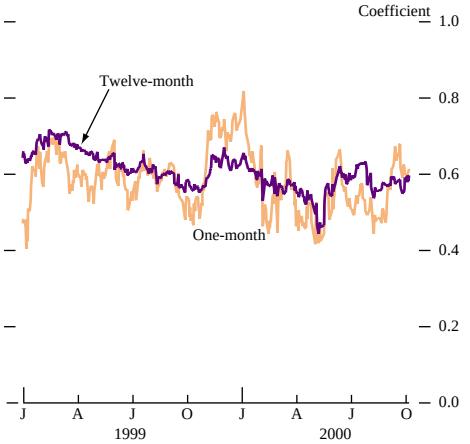

(a) 20-day exponentially weighted moving-average correlations, where daily movements are assigned geometrically declining weights.

**Chart 16**
**Implied correlations between sterling and the dollar (against the euro)**




Sources: Bank of England and Chase Manhattan.

**Chart 17**
**Implied correlations between sterling and the euro (against the dollar)**




move together against the euro. However, the one-month and twelve-month correlations have fallen since the end of April. Chart 17 shows that the degree to which markets expect sterling and the euro to move together has risen since the end of April. In mid-September, the one-month implied correlation between sterling and the euro exceeded that between sterling and the dollar for the first time since the start of the year. However, by the end of the period, the one-month implied correlation between sterling and the dollar was again higher than that between sterling and the euro. Furthermore, the twelve-month correlation between sterling and the dollar remained above that between sterling and the euro throughout Q3.

There is therefore some evidence that the closeness of sterling's relationship with the dollar has diminished. However, the correlation and implied correlation series are very erratic and it is not yet clear that there has been a structural break in the relationship. Moreover, implied correlations based on options prices suggest that future movements of sterling are still expected to be more closely aligned with the dollar than with the euro.

## Sterling markets

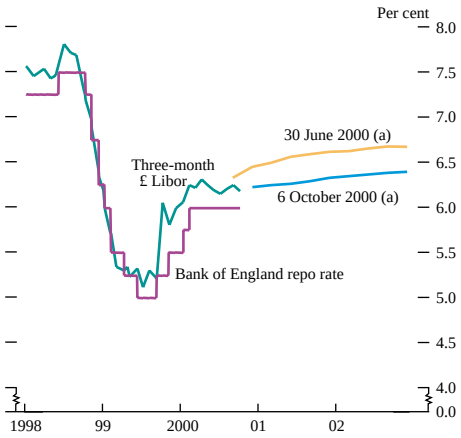
### *Short-term interest rates*

Short-term interest rates were broadly stable during much of the review period, underpinned by the Bank of England's two-week repo rate, which remained constant at 6%. Forward rates implied by short sterling futures ended the period around 20 to 30 basis points below their start-point (see Chart 18), while forward rates derived from the gilt yield curve fell by up to 20 basis points. At the end of the period, neither measure reflected a strong expectation that the Monetary Policy Committee (MPC) would change the Bank's repo rate before the end of the year (see Table D). Expectations of interest rates in December 2000 derived from overnight interest rate swap markets remained at 6% throughout the period, and a Reuters poll of 30 City economists showed that the mean expectation for the level of the Bank's repo rate at the end of 2000 fell by 10 basis points to 6.14%.

During the period, the view that the official rate may have peaked became more widespread in the market. However, various measures of short-term interest rate expectations continued to imply slightly different profiles for the timing and level of the peak. By 6 October, the peak in short sterling futures contracts, which settle on three-month Libor, had fallen by around 30 basis points to 6.40%. Since Libor typically trades 20 to 25 basis points above the Bank's repo rate, this would be consistent with an expected peak in the official rate of around 6.15% to 6.20%. Expectations of the peak are likely to lie at the lower end of this range, however, because term premia tend to increase with the maturity of the futures contract, and the expected peak suggested by the futures market is not until late 2002. The peak derived from the gilt market for two-week forward rates fell by 13 basis points to 5.92%, which implies a Bank repo rate of a little over 6% after appropriate adjustments.[1] The mean forecast for the peak in the Bank's repo

(1) For further details, see the article on pages 392–402, which analyses the different ways of deriving short-term interest rate expectations from sterling money market instruments.

## Chart 18
## UK interest rates




Sources: Bank of England and Bloomberg.

(a) Three-month interest rates implied by the short sterling futures contracts on the dates specified. From October 2000, the x-axis relates to contract expiry dates.

## Table D
## Summary of interest rate expectations

Per cent

| | 5 Jan. | 30 June | 6 Oct. |
|---|---|---|---|
| **Dec. 2000** | | | |
| Short sterling (a) | 7.13 | 6.19 | 5.98 |
| Forward gilt yields (b) | 6.82 | 6.16 | 5.93 |
| Poll of economists (c) | 6.32 | 6.24 (d) | 6.14 (e) |
| Overnight interest rate swaps (f) | 6.94 | 6.00 | 6.00 |
| **Peak** | | | |
| Short sterling (a) | 7.22 Dec. 2001 | 6.45 Dec. 2003 | 6.15 Dec. 2002 |
| Forward gilt yields (b) | 6.85 2001 Q1 | 6.20 2001 Q2 | 6.07 2001 Q2 |
| Poll of economists (c) | 6.52 2000 H2 | 6.34 2000 Q4 | 6.33 2000 Q3 |

Sources: Bloomberg, Reuters and Bank of England.

(a) Implied three-month Libor rate, adjusted for average difference between three-month Libor rate and Bank's repo rate.
(b) Implied two-week forward rates, adjusted for average difference between gilt repo rates and the Bank's repo rate.
(c) Mean expectation for Bank of England repo rate.
(d) Refers to survey on 29 June.
(e) Refers to survey on 28 September.
(f) Implied overnight interest rate.

rate indicated by the Reuters poll of City economists fell by just 1 basis point during the period, to 6.33%. At the end of the period, a minority of market participants thought that the next move in the official rate would be downwards.

Interest rates derived from short sterling futures contracts moved within a relatively narrow range in July and August, and then fell by around 20 basis points in September. Furthermore, the standard deviation of daily price changes in the front short sterling contract fell from 4 basis points in Q1 and Q2, to 3 basis points in Q3. The largest daily change in the front short sterling contract was 6 basis points, compared with 15 basis points in Q1 and 10 basis points in Q2. Uncertainty about the path of future interest rates implied by three-month options prices also continued to decline (see Chart 5). Before each of the four MPC policy decisions made during the period, most of the City economists polled by Reuters correctly predicted that the Bank's repo rate would remain unchanged.

In such quiet conditions, monetary and fiscal policy announcements altered short-term interest rate expectations as much as UK data announcements or international factors. The MPC's decisions to maintain the Bank's repo rate at 6% in August, September and October were each followed by small falls in market interest rate expectations, while each set of MPC minutes—particularly following the 5–4 votes in August and September—led to increased market expectations of a future rise in the Bank's repo rate. The most significant rise in market rate expectations occurred around the time that the Government's 2000 Spending Review was released, on 18 July. Short-term interest rate expectations rose by up to 15 basis points between 14 and 21 July, as market participants initially interpreted the Review's contents as implying an intention to loosen fiscal policy. This rise in short-term interest rate expectations was later reversed, however, after the MPC announced its no-change decision at the start of August, and following the publication of the August *Inflation Report*.

Two international factors had a significant effect on the sterling money markets during the period: the exchange rate and oil prices. Though the rise and subsequent fall in sterling's trade-weighted exchange rate index during July and August failed to change market interest rate expectations, sterling's appreciation in September was thought to reduce the probability that the MPC would raise the Bank's repo rate in the near future. This period of declining rate expectations was combined with a growing market consensus that higher oil prices were likely to dampen activity without putting significant upward pressure on inflation. The market therefore felt that the Bank's repo rate could be maintained at 6% without increasing the risk of inflation rising above the $2^1/_2$% target.

Domestic data releases during the review period were, on balance, weaker than market expectations. Three CBI surveys (two in July and one in September) had a significant downward impact on short sterling futures rates. Furthermore, the combination of several weaker-than-expected average earnings data releases and the slowdown in house price inflation contributed to a growing belief among market participants that the Bank's repo rate had peaked.

## Table E
## Sterling money markets[a]

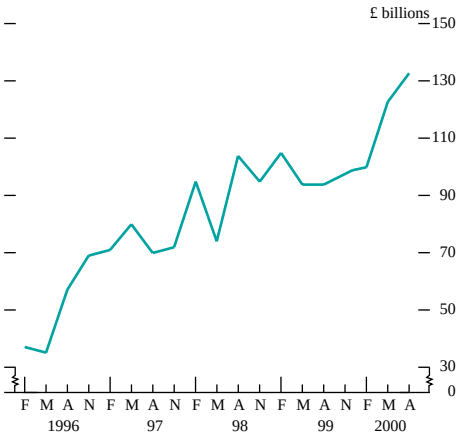
Amounts outstanding: £ billions

| | Interbank | CDs | Gilt repo | Stock lending | Eligible bills | Commercial paper | Treasury bills | Sell/ buy-backs | LA bills (c) | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 89 | 53 | n.a. | n.a. | 23 | 5 | 9 | n.a. | 2 | **181** |
| 1995 | 93 | 66 | n.a. | n.a. | 20 | 6 | 8 | n.a. | 2 | **195** |
| 1998 | 150 | 122 | 95 (b) | 35 (b) | 19 | 10 | 1 | 2 (b) | 1 | **435** |
| 1999 | 146 | 142 | 99 (b) | 49 (b) | 14 | 14 | 4 | 3 (b) | 0 | **471** |
| 2000 Feb. | 155 | 127 | 100 | 51 | 14 | 13 | 2 | 2 | 0 | **464** |
| May | 165 | 138 | 123 | 54 | 13 | 17 | 2 | 3 | 0 | **515** |
| Aug. | 160 | 133 | 133 | 53 | 12 | 15 | 3 | 5 | 0 | **514** |

n.a. = not available.

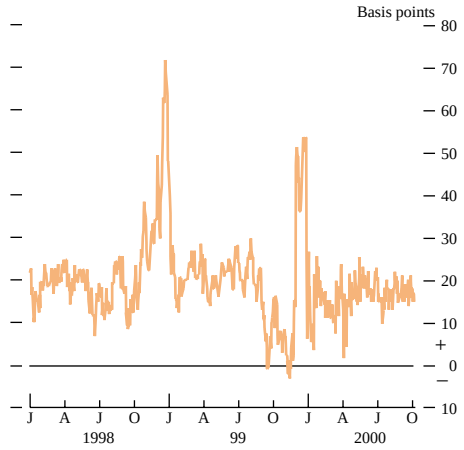
(a) 1990 and 1995 data are end-March; other data are end-period.
(b) End-November data.
(c) Local authority bills.

## Chart 19
## Gilt repo outstanding




Sources: Bank of England and Stock Lending Quarterly Survey.

## Chart 20
## Spread between one-month interbank and repo rates[a]




(a) Interbank offer rate minus GC repo (bid) rate.

### *The sterling money market*

At the end of August, the size of the sterling money market was £514 billion, broadly unchanged from end-May.(1) Looking at the individual instruments, an increase in the outstanding stock of gilt repo was largely offset by falls in interbank deposits and certificates of deposit (see Table E).

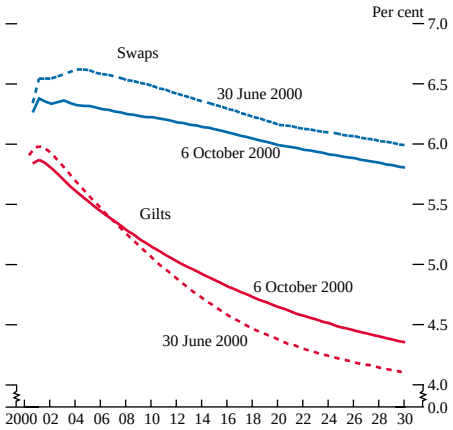
According to the Bank's latest quarterly survey, the amount of gilt repo outstanding rose by £10 billion in the three months to end-August, to £133 billion. This continued the strong growth recorded in the previous quarter (see Chart 19). Although the 'on call and next day' category retained the largest share of gilt repo outstanding, it was the '9 days to 1 month' and the '1 month to 3 month' maturity categories that increased the most. These changes are likely to have been partly influenced by the DMO's cash management operations, particularly its handling of the receipts from the Spectrum mobile telephone licence auctions (payments to the government were made in May and September). In addition, the gilt repo data may have been influenced by the slight increase in the Bank's average daily money market shortages over the quarter (implying a greater need for eligible collateral).

The gilt repo market has grown rapidly since its introduction in 1996. Although this has inevitably led to a decline in the relative shares of the other money market instruments, there has also been a sustained decline in the absolute level of eligible bank bills outstanding. Prior to 1997, eligible bank bills were the principal instrument used in the Bank's open market operations. By Q3 of this year, however, they accounted for only 6% of the collateral held by the Bank, whereas gilt repo transactions accounted for 72%. Although stock lending and repo have a complementary relationship,(2) the amount of stock lending has been little changed this year at just above £50 billion.

Spreads between secured (GC repo) and unsecured (interbank) interest rates for maturities out to one year remained broadly unchanged in Q3. Chart 20 illustrates recent movements in the one-month spread.

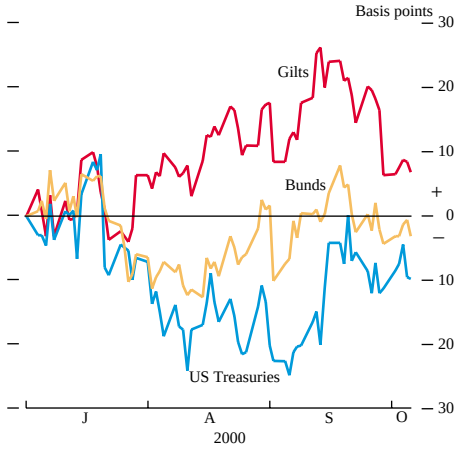
(1) The sterling money market for this purpose includes the interbank, certificate of deposit, gilt repo, stock lending, sell/buy-backs, Treasury bill, eligible bank bill, local authority bill and commercial paper markets.
(2) Many intermediaries borrow gilts from end-investors in a stock lending transaction and then lend them on to banks and securities houses through the repo market. End-investors often prefer not to repo out stock, since this would involve reinvesting the associated cash and requires close monitoring of the trade.

**Chart 21**
**UK gilt and swap curves**




Sources: Bank of England and Bloomberg.

**Chart 22**
**Cumulative changes in ten-year government bond yields**(a)




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

Towards the end of September, member-to-member gilt repo transactions involving the 5¾% Treasury 2009 stock occasionally traded below 2% in the overnight market. This was unusually low relative to overnight GC gilt repo rates, which traded close to 6% at the time. This development largely reflected increased demand for the 2009 gilt as several short positions in the stock matured around that time. Although the stock was the cheapest to deliver into the maturing September long gilt futures contract, there were no reports of delivery problems into the LIFFE contract.

### *Long-term interest rates*

Over the review period, the UK government bond yield curve became less inverted. Longer-maturity gilt yields rose and short-term yields fell (see Chart 21). In line with the money market developments noted above, daily changes in gilt yields at all maturities were generally small. The ten-year gilt yield, for example, traded within a 30 basis point range, down from 70 basis points in Q1 and 40 basis points in Q2. The swap yield curve also became slightly less inverted, although swap rates fell at all maturities. The spread of swap yields over gilt yields therefore fell.

As noted above, this movement in the gilt yield curve occurred alongside a disinversion of the US Treasury yield curve and a slight steepening of the upward sloping German government bond curve, suggesting that common international factors might have influenced all three markets. Chart 22 shows that during August, gilt yields tended to move independently of both US Treasuries and bunds, while in July and September yield changes were more closely correlated. Chart 6 above compares the slopes of the UK, US and German government bond yield curves through the period. In all three markets, long yields rose relative to short-dated yields in September.

There were also several domestic influences on the gilt market. Changes to short-dated gilt yields were mainly driven by the same factors that affected money market interest rates (described above). Long-term gilt yields, however, were more affected by prospective changes to the demand for and the supply of gilts.

On the demand side, long-maturity yields rose through July and August in the run-up to the publication of the review of the Minimum Funding Requirement (MFR), undertaken by the Faculty and Institute of Actuaries for the Department of Social Security. The review had widely been expected to recommend changes to the MFR that would reduce pension funds' demand for gilts. Consequently, long-dated gilt yields rose by around 10 basis points in the few days leading up to the publication of the review on 14 September. However, yields then fell back by up to 7 basis points following publication. Although most participants had anticipated the review's main recommendations (see the box on page 334), the market was generally surprised that the government did not firmly endorse any of the review's recommendations, and that a further period of consultation would mean that implementation of any reforms is not likely until the end of 2001 at the earliest. The largest reaction following the release was in the market for non-government debt. AA-rated non-government bond yields at long maturities fell by 15 to 20 basis points in the week following publication, despite a strong increase in issuance.

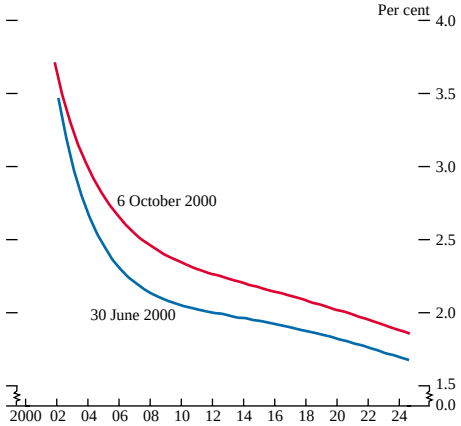
In terms of the supply of gilts, the release of the 2000 Spending Review (SR) on 18 July and the September fuel price protests led to market expectations of looser future fiscal policy. Though the SR left the overall envelope for public spending unchanged, it attracted both press and market interest as details of future spending commitments were released. There was also a strong increase in the issuance of sterling-denominated non-government bonds in Q3, which tended to add to the upward pressure on longer-maturity gilt yields as investors switched out of gilts and into non-government bonds. Announcements by the DMO concerning gilt auctions and buy-backs had only a limited impact on the gilt market.

On 20 July, the House of Lords ruled that The Equitable Life (a life assurance company) was not entitled to differentiate, when setting final bonuses, between policyholders depending on whether or not their policies contained Guaranteed Annuity Rates (GARs). Many of these GARs had been determined in the 1980s when long-dated gilt yields were significantly higher. The ruling led to an expectation that The Equitable Life, and potentially other life assurance companies, would have to purchase more gilts to offset their increased liabilities. Long gilt prices consequently rose and yields fell. However, the market price reaction was smaller than many market participants had expected, as it became apparent that other life assurance companies had already hedged their guaranteed liabilities.

### *Index-linked gilts*

The index-linked gilt yield curve rose by up to 31 basis points during the review period (see Chart 23). Movements at the short end of the curve were dominated by technical factors. The most significant move followed the release on 15 August of the weaker-than-assumed figure for July RPI inflation; the five-year index-linked gilt yield fell by 13 basis points following this release. The rise in yields of medium and long-maturity index-linked gilts was more closely related to the factors that affected conventional bonds: notably the MFR and the SR. In addition, the DMO's index-linked auction of £425 million of 2½% Index-linked Treasury Stock 2013 on 26 July contributed to the rise in real yields, especially at medium maturities.

**Chart 23**
**Index-linked gilt yield curve**(a)




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

### *Gilt auctions*

On 30 June, the DMO announced its Q3 gilt auction schedule, which comprised one index-linked gilt auction, one switch auction from medium to ultra-long maturity stock, and two reverse auctions (see Table F for details). The two reverse auctions were the first debt buy-backs by the British Government for 11 years, and accelerated the decline in the outstanding stock of gilts. The total market value of gilts outstanding has fallen from a peak of £347.4 billion in 1999 to £329.8 billion at the end of 2000 Q3.

### *Other sterling bond issues*

Gross sterling bond issuance (other than gilts) was a record £26.1 billion in Q3, far exceeding the issuance in Q2 and in the third quarter of 1999 (see Chart 24). Issuance of both fixed-rate bonds, at £16.8 billion, and floating-rate notes, at £9.3 billion, were significantly higher than recorded in any previous quarter. Strong UK institutional demand for longer-dated sterling bonds continued,

## The Minimum Funding Requirement review

On 14 September, the Government published the Faculty and Institute of Actuaries' (FIA) review of the Minimum Funding Requirement (MFR), together with a consultation document entitled 'Security for Occupational Pensions'.(1) The MFR was introduced as part of the 1995 Pensions Act, and is applied to the assets of 'defined benefit' occupational pension schemes. Defined benefit funds are those in which members' rights are defined in terms of benefits accruing, rather than contributions made (usually based on formulae related to final salary and length of service) and cover around 13 million members in the United Kingdom. Pension funds build up a stock of assets to cover these long-term liabilities, but there is no guarantee that the assets will be sufficient to fund a scheme's pension liabilities. The MFR test seeks to ensure that a defined benefit pension fund holds enough assets to balance its long-term pension liabilities, discounted over time. If the value of its assets are below the target level, then the fund has until 2003 to reach 90% of the MFR target level, and until 2007 to reach 100% of that level. Thereafter, if a fund falls below the target, then it is allowed one year to reach 90% of the target, and five years to reach 100% of the target.

The current MFR test values assets at market levels, while liabilities are discounted differently for those who have retired and for those who are yet to retire. For pensions already in payment, the discount rate is the prevailing market yield on a basket of gilts with a maturity of 15 years. For pension rights of members yet to retire, the discount rate is broadly the assumed long-term rate of return for UK equities before retirement and for gilts after retirement.

Over the past few years there has been increasing concern that the MFR has inappropriately influenced pension schemes' investment decisions. In particular, pension funds may hold more gilts as a hedge against short-term fluctuations in the MFR discount rate than would otherwise be the case. Furthermore, this increase in the demand for gilts appears to have been relatively price-insensitive. Together with the decline in the net issuance of gilts, excess demand has contributed to the inversion of the gilt yield curve since 1997. Reflecting these concerns, in March 1999 the Government commissioned the FIA to review the MFR.

The FIA's review recognised the above concerns, and also concluded that the current MFR formula does not suitably model future returns and risk on equities for assessing liabilities for pensions not yet in payment. The review recommended that if the MFR test is to continue to be used, it should be redesigned. In particular, it advocated that the liabilities for pensions in payment should be discounted using a composite index of gilts and investment-grade corporate bonds, while liabilities for pension rights not yet in payment should be discounted at a rate with a fixed premium of 1% per annum above this composite index.

The FIA recognised that it would be difficult to forecast what behavioural changes might occur if their proposals were implemented. For instance, some funds might take the more risk-averse route of switching out of equities into corporate bonds and gilts. They therefore recommended an extension of the time period allowed to bring the value of assets up to the MFR level, to help discourage a sub-optimal behavioural response to the regulations.

The Government's response to the FIA report indicated that it was willing to explore a more diverse range of possible solutions to the problem of security for occupational pensions. In particular, it noted that prudential supervision, compulsory insurance or a central discontinuance fund could replace or run alongside a revised MFR. The Government indicated that it would seek consultation in the context of the Myners' report on institutional investment, expected to be published in Q4. Market participants were surprised that the Government did not indicate its preferred future course of action more precisely, and that reforms would not be implemented more quickly.

(1) Available at: www.dss.gov.uk/publications/dss/2000/mfr/index.htm

## Table F
## DMO gilt auctions

**Index-linked**

| Date | Stock | Amount issued (£ millions) | Cover | Real yield | Strike price |
|---|---|---|---|---|---|
| 26.07.00 | 2½% Index-linked Treasury Stock 2013 | 425 | 1.94 | 2.18% | £195.45 |

**Switch**

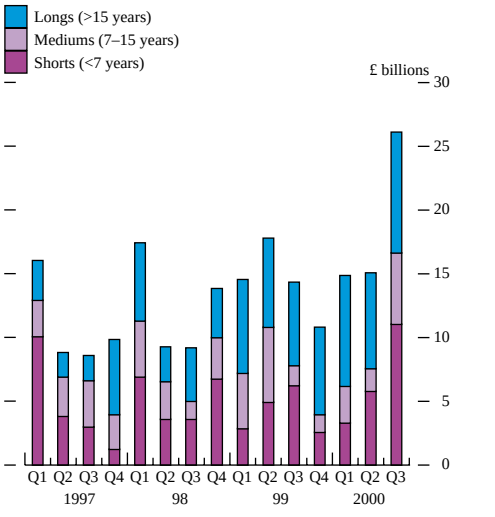
| Date | Source stock | Total nominal amount purchased (£ millions) | Cover | Destination stock | Total nominal amount created (£ millions) |
|---|---|---|---|---|---|
| 27.09.00 | 8% Treasury Stock 2015 | 1,500 | 1.61 | 4¼% Treasury Stock 2032 | 2,098 |

**Reverse**

| Date | Source stock | Total nominal amount purchased (£ millions) | Lowest accepted price | Highest accepted yield |
|---|---|---|---|---|
| 20.07.00 | 8% Treasury Stock 2003 | 381 | 105.39 | 5.94 |
| | 10% Treasury Stock 2003 | 357 | 111.48 | 5.93 |
| | 6¾% Treasury Stock 2004 | 0 | n.a. | n.a. |
| | 9½% Conversion Stock 2005 | 0 | n.a. | n.a. |
| 21.09.00 | 7¾% Treasury Stock 2006 | 130 | 110.11 | 5.72 |
| | 8½% Treasury Stock 2007 | 464 | 115.74 | 5.68 |
| | 9% Treasury Stock 2008 | 180 | 122.00 | 5.57 |

n.a. = not available.

## Chart 24
## Sterling-denominated non-government bond issuance




with £9.5 billion of over 15-year bonds issued in the quarter, more than 80% of which were fixed rate. However, the share of total issuance accounted for by shorter-maturity bonds also remained high for the second consecutive quarter, as expectations for the peak in UK short-term interest rates continued to fall and the degree of uncertainty about the peak diminished. The DMO's reverse auctions during the period (buying back stocks maturing between 2003 and 2008) are also likely to have contributed to the increased demand for short-dated sterling bonds.

There appears to have been a marked change in behaviour by UK institutional investors during the quarter, with increased demand for non-government securities. This has reportedly triggered some large-scale portfolio restructuring in favour of non-government bonds and away from equities and gilts. One reason for this shift in asset allocation is likely to have been the Minimum Funding Requirement (MFR) review, which was released on 14 September (see the box on page 334). The market had long anticipated that the report would recommend that the discount rate used in the calculation of defined benefit pension funds' liabilities should be based on a composite gilt and corporate bond index rather than a notional 15-year gilt yield. This probably encouraged greater investment in non-government sterling bonds in Q1 and Q2 this year and there was a further sharp increase in the issuance of such bonds in the second half of September. Fixed-rate bonds totalling £7.2 billion were issued in the four weeks after the report was released, compared with a monthly average of £3.8 billion in the first eight months of the year.

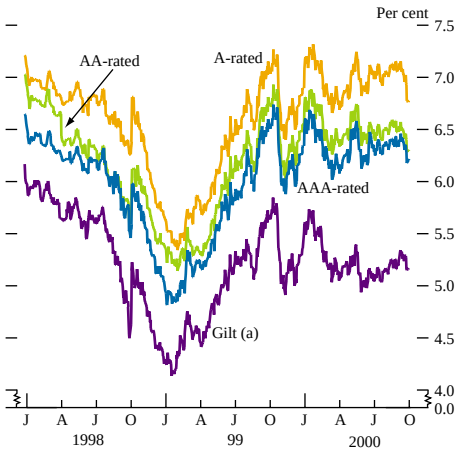
The narrowing of corporate bond spreads over the quarter (see below) and a greater willingness by pension funds and other investors to alter their portfolio allocations, even before the consultation period for the MFR review is complete, triggered significant orders to buy non-government sterling bonds. The relatively small size of the secondary market for sterling-denominated non-government bonds meant that these orders had to be accommodated largely by re-opening existing issues, with the new bonds either being pre-placed directly with end-investors or used to fill market-makers' short positions.

## Table G
## Sterling bond issuance in 2000 Q3

| | Number of issuers | Amount (£ billions) Total | By credit rating: AAA | AA/A | BBB and below |
|---|---|---|---|---|---|
| **Fixed-rate issues** | | | | | |
| UK corporates | 5 | 0.5 | 0.0 | 0.3 | 0.2 |
| UK financials | 9 | 2.2 | 0.2 | 2.0 | 0.0 |
| Supranationals | 8 | 5.2 | 5.2 | 0.0 | 0.0 |
| Overseas borrowers | 26 | 8.9 | 6.0 | 2.5 | 0.4 |
| **Total** | **48** | **16.8** | **11.4** | **4.8** | **0.6** |
| **FRNs** | | | | | |
| UK corporates | 3 | 0.6 | 0.0 | 0.5 | 0.1 |
| UK financials | 21 | 5.6 | 2.8 | 2.5 | 0.3 |
| Overseas borrowers | 16 | 3.1 | 0.3 | 2.8 | 0.0 |
| **Total** | **40** | **9.3** | **3.1** | **5.8** | **0.4** |

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

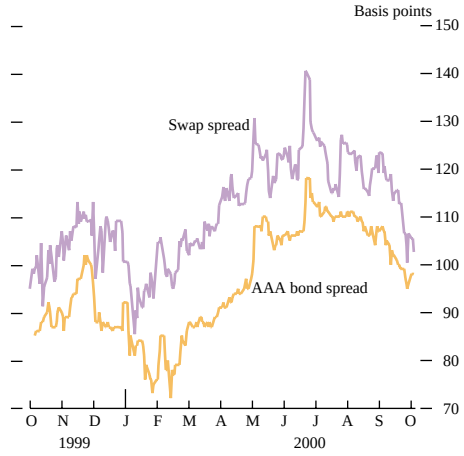
## Chart 25
## Ten-year sterling-denominated bond yields




Sources: Bank of England and Bloomberg.

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

## Chart 26
## Ten-year credit spreads versus gilts




Sources: Bank of England and Bloomberg.

Although fixed-rate issuance in Q3 was a record £16.8 billion, only £2.7 billion of this total was brought by UK firms (see Table G). The bulk of the £14.1 billion of sterling bonds brought by overseas borrowers was swapped into floating-rate liabilities denominated in dollars and euro.(1) As in previous quarters, this activity was largely driven by arbitrage opportunities in the swap market, together with the Libor-based funding targets of the borrowing institutions. Liquid AAA-rated bonds, issued via standardised medium-term note programmes, can be brought to the market quickly and with relatively little effort. In contrast, UK corporates are said to be slower to respond to investor demand, since they rarely have well-established medium-term note programmes in place and their new bonds often take longer to document and market. It is also suggested that UK investors tend to require more stringent covenants than international investors on sterling-denominated fixed-rate bonds; UK firms often prefer, therefore, to target international investors in the larger, more liquid US dollar and euro bond markets. Over the past two years, UK firms have raised only around one third of their bond financing in the sterling market.

The greater appetite for non-government sterling bonds triggered further index-linked bond issuance in the quarter. Tesco joined the limited number of UK firms issuing index-linked debt, bringing and then twice re-opening a 2016 bond to raise £200 million in total. However, as with conventional bonds during the period, much of the index-linked issuance (£460 million) was brought by AAA-rated international borrowers and swapped into floating-rate finance. This was facilitated by UK companies (mainly in the property and utility sectors) wanting to receive floating-rate interest to offset their funding costs, while matching their future expected real incomes against RPI-linked swap payments.

Though there has been demand to pay fixed in sterling swaps from UK borrowers raising funds in overseas asset markets, the upward pressure on UK swap rates seen in Q2(2) has been more than offset by the increased demand to receive fixed-rate interest by the AAA-rated borrowers mentioned above. As a result, longer-dated UK swap rates have fallen over the quarter, with much of the decline occurring after the release of the MFR review. Similarly, portfolio switching out of gilts and into non-government bonds in anticipation of, and following, publication of the review also led corporate bond spreads to narrow sharply in September (see Charts 25 and 26). The narrowing of corporate spreads, despite ongoing concerns about the financing needs of telecommunications companies to finance licence fees and other network-related investments, appears to have been the result of greater confidence among institutional investors.

Issuance of floating-rate notes also reached record levels in Q3. The mortgage and asset-backed bond market continued to grow, with several securitised deals being brought during the period, raising more than £4 billion. UK and overseas financials also issued almost £5 billion in short-dated notes in their own names, but issuance by UK and overseas corporates was negligible.

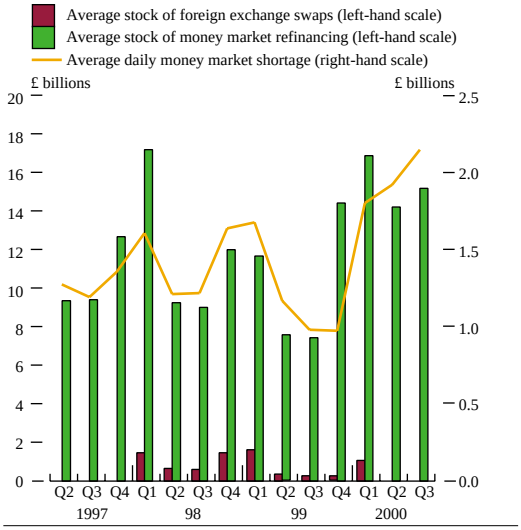
(1) Some of the £1.5 billion raised by overseas corporates may have been used to finance UK commercial operations, and some of the £5.2 billion bonds issued by supranationals may also have been swapped into floating-rate sterling for UK Treasury operations.
(2) See August 2000 *Quarterly Bulletin*, page 230.

### Table H
### Average daily money market shortages

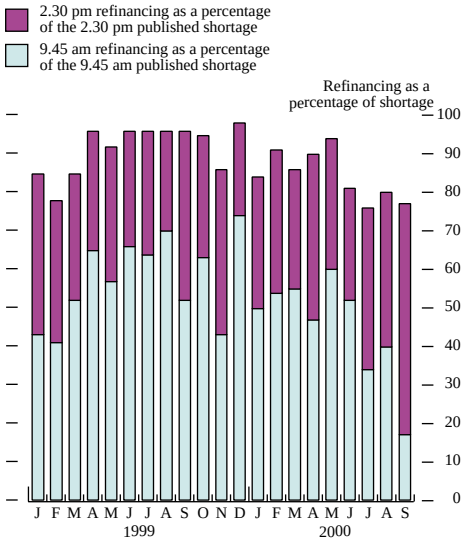
£ millions

| | | |
|---|---|---|
| 1996 | Year | 900 |
| 1997 | Year | 1,200 |
| 1998 | Year | 1,400 |
| 1999 | Year | 1,200 |
| 2000 | Q1 | 1,800 |
| | Q2 | 1,900 |
| | July | 2,000 |
| | August | 2,100 |
| | September | 2,300 |

### Chart 27
### Stock of money market refinancing and daily shortages




### Chart 28
### Refinancing provided at 9.45 am and 2.30 pm OMO rounds




## Market operations

*Open market operations*

The stock of money market refinancing held on the Bank's balance sheet averaged £15 billion in Q3 (see Chart 27), some £1 billion higher than in Q2, reflecting the growth of the outstanding stock of notes in circulation. Daily money market shortages averaged £2.1 billion in Q3 (see Table H and Chart 27), the largest quarterly average since the Bank's money market reforms in March 1997. Partly because the quantity of refinancing required by the money market was relatively stable during the quarter, the Bank did not use foreign exchange swaps as an additional means of supplying liquidity.

In early-July and mid-August, short-term money market rates traded further below the Bank's repo rate than normal. The Bank responded by temporarily increasing the amount by which it left the market short after the 9.45 am round of operations when the available refinancing was fully bid by market participants. This led to a narrowing of the spread between short-dated market rates and the Bank's repo rate.

During the first half of September, there were a number of days when the money market shortage was not fully refinanced until the Bank's late rounds of open market operations. On average, only 30% of the daily money market shortages in Q3 were refinanced at the 9.45 am round (well below the long-run average of around 55%); and only 77% of the shortages were refinanced by the conclusion of the 2.30 pm rounds, compared with a long-run average of 90% (see Chart 28). Refinancing at the late rounds is available only on an overnight basis and is usually at penal rates of interest, above the Bank's two-week repo rate. The average maturity of the Bank's outstanding money market operations declined slightly, generating greater turnover in the stock of refinancing and larger daily shortages. For example, during the week of 11 September, the shortages ranged from £2.5 billion to £5.2 billion, well above typical previous levels. Consequently, the average size of the spread between the sterling overnight index average (SONIA) and the Bank's repo rate narrowed to -3 basis points in Q3 (see Chart 29). Since 1997, the average spread (excluding the Y2K period) has been -6 basis points. The average spread between the two-week GC repo mid rate and the Bank's repo rate was -16 basis points in Q3, consistent with its long-run average.

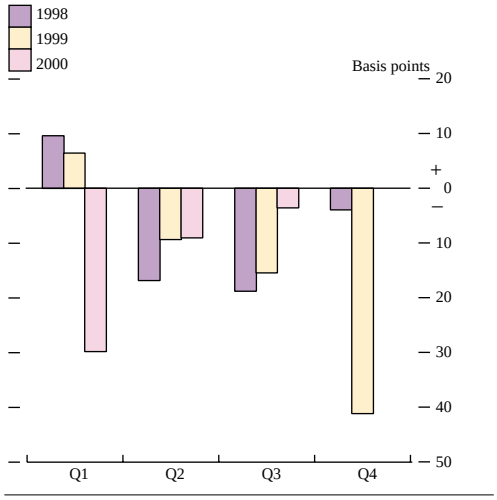
Gilt repo continued to account for around 70% of the collateral taken by the Bank in its open market operations in Q3. Euro-denominated eligible securities(1) accounted for 11% of the collateral (some £1.7 billion).

## Bank of England and HM Treasury euro issues

In Q3, the Bank of England continued to hold regular monthly auctions of €1 billion of bills, 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

(1) A list of eligible securities is available on the Bank's web site at: www.bankofengland.co.uk/markets/money/eligiblesecurities.htm

**Chart 29**
**Quarterly averages of SONIA minus the Bank's repo rate**




quarter. The auctions continued to be oversubscribed, with issues being covered an average of 5.3 times the amount on offer. During the quarter, bids were accepted at average yields of between euribid and euribid minus 6 basis points for the relevant maturity.

On 18 July, the Bank reopened the UK Government euro Treasury Note maturing on 28 January 2003 with a further auction for €500 million, raising the amount of this note outstanding with the public to €1.5 billion. Cover at the auction was 3.6 times the amount on offer and accepted bids were in a range of 5.30%–5.33%. Total notes outstanding with the public under the UK euro note programme thus rose from €5.0 billion at the end of the second quarter to €5.5 billion at the end of Q3. The final tranche of €500 million of the 2003 note was issued by auction on 17 October.

## UK gold auctions

On 3 March 2000, HM Treasury announced plans for a programme of six gold auctions in the financial year 2000/01. Two of these auctions took place in Q3, with 25 tonnes of gold sold at each. The auction on 12 July achieved a price of $279.75 and was 1.3 times covered; the auction on 19 September achieved a price of $270.60 and was 2.6 times covered. The next auction in the programme took place on 7 November.

# The international environment

- *This article discusses developments in the international environment since the August 2000* Quarterly Bulletin,[1] *as well as the outlook for inflation and output over the next two years.*

- *World GDP is estimated to have grown by 1.0% in the second quarter, a deceleration from 1.5% in the first quarter. Growth rates remained strong in the major economies, but fell in the emerging Asian economies. World industrial production growth has continued to rise.*

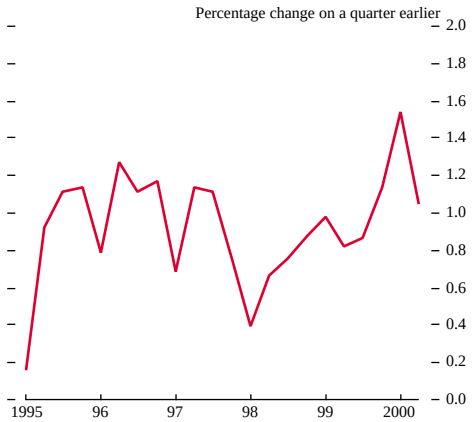
- *In the United States, GDP grew strongly in Q2 but slowed in Q3; final domestic demand growth moderated in both quarters. In the euro area, quarterly GDP growth in Q2 remained at 0.9% for the fourth consecutive quarter. The Japanese economy grew by 1.0% in Q2, the second consecutive quarter of positive growth.*

- *Oil prices have risen further, amid uncertainties about the future balance of demand and supply. Consumer price inflation rates have reflected this to a varying degree. Headline inflation has risen in the euro area but has fallen in the United States over the period. Non-energy inflation rates have risen in both economies, notably in the euro area.*

- *Official interest rates have risen in Japan and the euro area since the previous* Quarterly Bulletin. *The Bank of Japan ended its zero interest rate policy by raising rates to 0.25%, and the ECB increased rates in two steps, by 0.5 percentage points in total, to 4.75%. The FOMC has maintained the Federal funds target rate at 6.5%.*

- *The IMF has raised its projection of world GDP growth to 4.7% in 2000, the highest growth rate in more than ten years, and to 4.2% in 2001. These revisions reflect continued robust growth in the major economies, and a strengthening of economic fundamentals in many emerging markets. Since the previous* Quarterly Bulletin, *projections published by Consensus Economics for GDP growth in most regions have been revised upwards for 2000, though are mixed for 2001, perhaps partly reflecting the expected effects of higher oil prices. World trade is forecast by the IMF to grow by 10% in 2000, slowing to around 8% in 2001. The balance of risks around most forecasts remains on the downside, largely from the effects of a possible fall in asset market prices and from the uncertain impact on activity of higher oil prices.*

**Chart 1**
**World GDP**




Source: Bank of England.

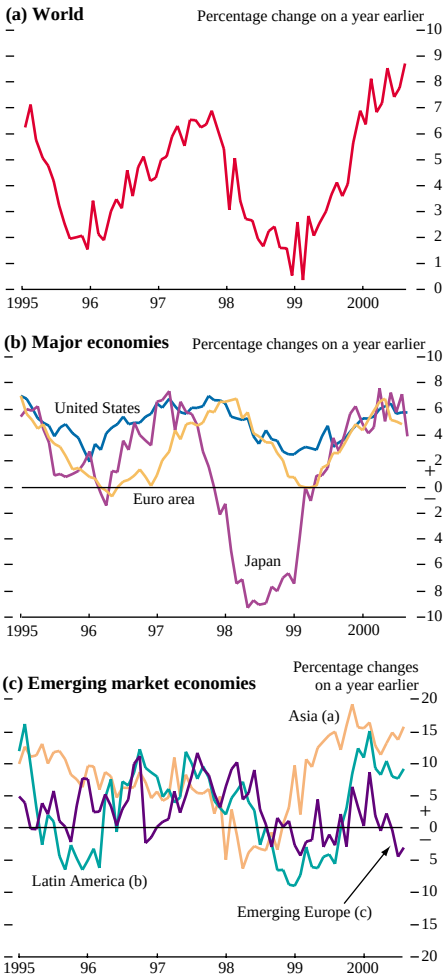
## Demand and output

### *Output growth*

World GDP is estimated to have grown by around 1.0% in 2000 Q2. This was slower than the quarterly growth rate of 1.5% in Q1, which was the highest growth rate for more than five years (see Chart 1).[2] The pattern of growth was quite evenly balanced across the major industrialised economies. In the United States, GDP rose by 1.4% in the second quarter, while in the euro area GDP growth remained at 0.9% for the fourth consecutive quarter. The Japanese expansion continued into its second quarter in Q2,

(1) Based on data up to 31 October (the August *Quarterly Bulletin* was based on data up to 28 July 2000).
(2) Numbers for world GDP growth are estimates based on quarterly data from national sources or quarterly data estimated from annual data reported in the IMF *World Economic Outlook*, September 2000.

## Chart 2
## Industrial production




Sources: Primark Datastream and Bank of England.

(a) India, Malaysia, South Korea, Taiwan and Thailand.
(b) Argentina, Brazil, Chile, Mexico, Peru and Venezuela.
(c) Czech Republic, Hungary, Poland, Russia and Turkey.

## Table A
## Forecasts for GDP growth

Per cent

| | IMF (a) | | | | Consensus Economics (b) | | | |
|---|---|---|---|---|---|---|---|---|
| | 2000 | | 2001 | | 2000 | | 2001 | |
| World | 4.7 | *+0.5* | 4.2 | *+0.3* | n.a. | | n.a. | |
| United States | 5.2 | *+0.8* | 3.2 | *+0.2* | 5.2 | *+0.4* | 3.6 | *+0.5* |
| Japan | 1.4 | *+0.5* | 1.8 | *+0.0* | 2.0 | *+0.5* | 2.0 | *+0.4* |
| Euro area | 3.5 | *+0.3* | 3.4 | *+0.2* | 3.4 | *+0.0* | 3.1 | *-0.1* |

n.a. = not available.

(a) IMF *World Economic Outlook*, September 2000; (differences from May 2000 in italics; percentage points).
(b) *Consensus Forecasts*, October 2000; (differences from July 2000 in italics; percentage points).

## Table B
## Consensus forecasts for GDP growth(a)

Per cent

| | 1999 | | 2000 | | 2001 | |
|---|---|---|---|---|---|---|
| North East Asia (b) | 7.6 | *+0.0* | 8.0 | *+0.2* | 6.6 | *+0.0* |
| South East Asia (c) | 3.2 | *+0.0* | 5.6 | *+0.5* | 4.9 | *-0.3* |
| Latin America (d) | 0.0 | *-0.1* | 3.9 | *+0.2* | 4.2 | *+0.1* |
| Eastern Europe (e) | 1.1 | *+0.0* | 5.0 | *+1.2* | 4.2 | *+0.2* |

(a) October 2000; (differences from July 2000 in italics; percentage points).
(b) Peoples' Republic of China, Hong Kong SAR, South Korea and Taiwan.
(c) Indonesia, Malaysia, Singapore, Thailand and the Philippines.
(d) 14 countries, including Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela.
(e) 19 countries, including the Czech Republic, Hungary, Poland, Russia and Turkey.

with GDP rising by 1.0%. In the emerging Asian economies, GDP growth is estimated to have slowed to 1.4% in Q2 from 2.3% in Q1. This may have reflected the impact of oil price rises on economic activity, but probably also the tailing-off of the earlier rapid recovery from the financial crises of 1997–98.

The annual growth rate of world industrial production has continued to rise, following the sharp recovery from the emerging market crises, and is estimated at 8.7% in August (see Chart 2a).(1) Since the previous *Quarterly Bulletin*, industrial production growth has moderated somewhat in the United States and the euro area. Japanese industrial production growth has been robust but erratic (see Chart 2b). In the emerging markets, industrial production growth has remained strong outside the emerging European economies, and has picked up in non-Japan Asia(2) (on the basis of data available up to August). (See Chart 2c.)

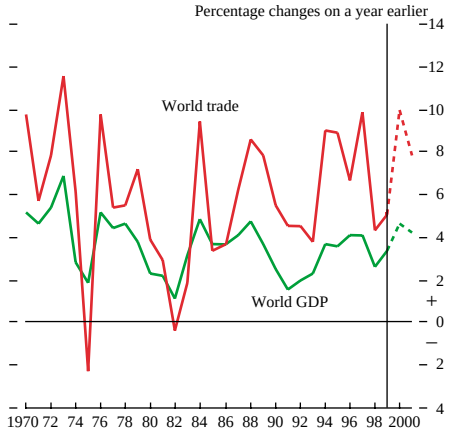
Oil prices have risen by about $5 per barrel to around $31 per barrel since the August *Quarterly Bulletin*. It is unclear to what extent higher oil prices have contributed to signs of moderating growth, though they would be expected to have a negative effect on world GDP growth. High oil prices would lead to a deterioration in the terms of trade for oil-importing countries, with higher prices dampening real incomes and consumption. These effects may not be fully offset by the corresponding increase in real incomes and demand in oil-exporting countries. Moreover, a higher oil price would increase inflationary pressures, which might precipitate policy tightening, particularly if it led to a persistent rise in inflation expectations. The IMF estimates that a sustained $5 per barrel increase in the price of oil would reduce output in the major industrialised countries by 0.2% after one year, and would increase consumer price inflation by 0.2–0.4 percentage points.(3)

The IMF has revised up its projections for world GDP growth since its previous forecast six months ago (see Table A).(4) This reflects strong growth outturns in the major economies, and a perceived improvement in economic fundamentals in the emerging markets. The IMF projects world growth of 4.7% in 2000, the highest rate of growth since 1988, slowing to a little over 4% in 2001. These forecasts are broadly in line with the Monetary Policy Committee's central projection in the November 2000 *Inflation Report*.

The IMF forecast for GDP growth in the United States has been revised upwards to 5.2% in 2000, 0.8 percentage points higher than the previous IMF forecast, but slowing to 3.2% in 2001 (see Table A). The IMF has also raised its growth projections for the euro area to around 3½% in both 2000 and 2001, expecting (as in their previous forecast) the euro area to grow more strongly than the United States in the second year. The IMF has raised its growth projection for Japan, and now expects GDP to rise by 1.4% in 2000 and 1.8% in 2001. The Policy Board of the Bank of Japan has published forecasts for Japanese GDP and prices. The majority of

(1) Numbers for industrial production growth are estimates based on data from Primark Datastream.
(2) Industrial production growth in the Peoples' Republic of China, which is not included in Chart 2c, has been particularly strong.
(3) Relative to a baseline assumption for oil prices of an average price of $26.53 in 2000 and $23.00 in 2001. The IMF simulation includes monetary policy reactions to higher inflation rates.
(4) IMF *World Economic Outlook*, September 2000.

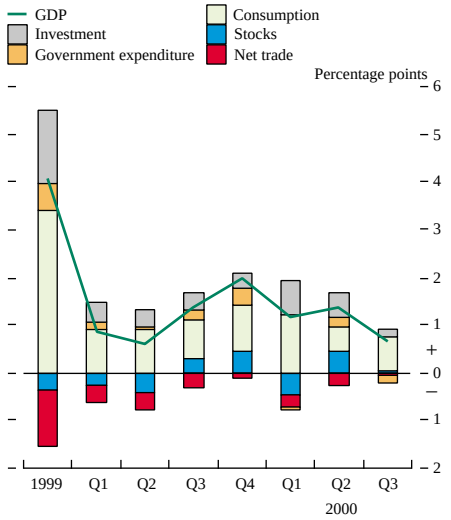
## Chart 3
## World trade and GDP growth




Note: Dotted lines shows projections from the IMF *World Economic Outlook*, September 2000.

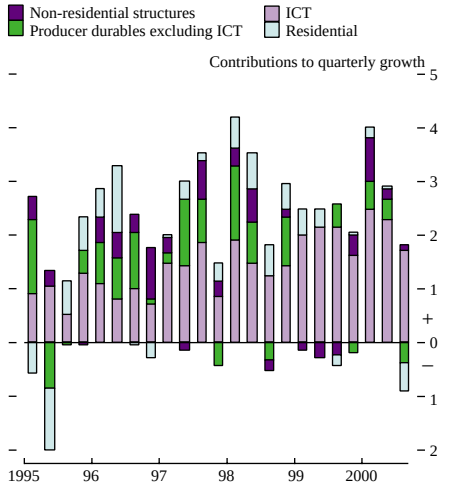
Source: IMF.

## Chart 4
## United States: contributions to GDP growth




Source: Primark Datastream.

## Chart 5
## US components of real investment




Source: Primark Datastream.

Board members projected GDP growth of between 1.9% and 2.3% in fiscal year 2000.(1)

Consensus Economics publish projections based on a survey of forecasters each month. During the past three months, Consensus projections for growth in 2000 have been revised up further, despite oil price rises (see Tables A and B). But revisions to growth projections for 2001 have been mixed, with upward revisions for the United States, Japan and non-Asian emerging markets partly offset by downward revisions to growth projections for the euro area and South East Asia. In contrast to the IMF projection, the Consensus forecast is for growth in the United States to remain above that in the euro area in 2001. The pattern of revisions to the Consensus forecasts may partly reflect expectations of different regional effects on real incomes and demand from recent oil price rises, though the downward revision to the South East Asian growth projection seems largely due to increased concern about the political situation in some countries.

World trade growth rose to an estimated quarterly rate of 3.2% in Q2 from 2.7% in Q1, in contrast to slowing world GDP growth. The IMF has revised up its forecast of world trade growth for 2000 as a whole by around 2 percentage points to 10%, but expects world trade growth to then slow to around 8% in 2001 (see Chart 3). Again, these projections are broadly similar to the assumptions underlying the MPC's central projection.

### *United States*

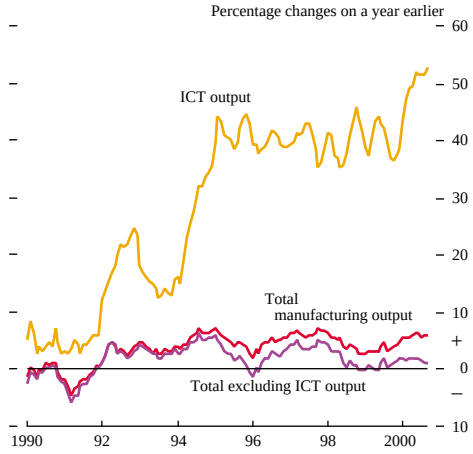
In the United States, quarterly GDP growth rose to 1.4% in Q2, from 1.2% in the first quarter (see Chart 4). Consumption growth slowed to 0.8% on the previous quarter, below the average quarterly growth rate of the previous year of 1.5%. Investment expenditure remained strong in Q2, despite slowing construction. Inventories and government spending, which have both been volatile in recent quarters, made strong contributions to quarterly GDP growth. In contrast, net exports continued to contribute negatively to quarterly GDP growth. According to the advance estimate, GDP growth slowed to 0.7% in Q3, partly reflecting a slowing of investment growth and a fall in government spending.

Consumption recovered somewhat in the third quarter, with the quarterly rate of consumption growth rising to 1.1%. However, consumer confidence fell in October to its lowest level in a year, perhaps reflecting equity price volatility. The determinants of US consumption growth are considered in more detail in the note on pages 348–50.

One of the notable features of the second quarter, and indeed the current US upturn overall, has been the strength of investment, which has been consistently stronger than historical relationships would have predicted. Recent work at the Federal Reserve Board(2) suggests that this is because of a strong increase in information and communications technology (ICT) investment (see Chart 5), driven by rapidly declining prices. The rise in ICT investment has been associated with increased capital deepening(3)—an increase in

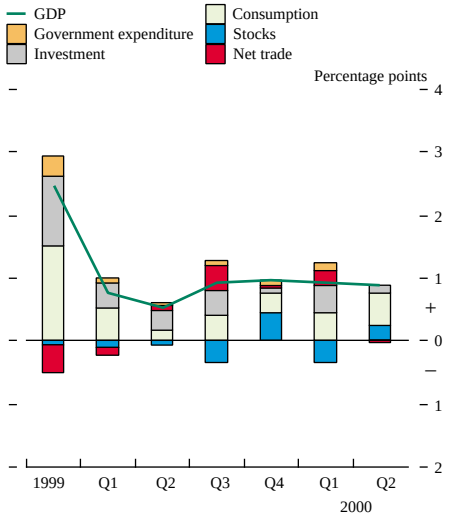
(1) 'Outlook and risk assessment of the economy and prices', Bank of Japan, Tokyo, 31 October 2000.
(2) 'Explaining the investment boom of the 1990s', Tevlin, S and Whelan, K, Federal Reserve Board, March 2000.
(3) See, for example, 'The resurgence of growth in the late 1990s: is information technology the story?', Oliner, S and Sichel, D, Federal Reserve Board, May 2000.

**Chart 6**
**US manufacturing growth**



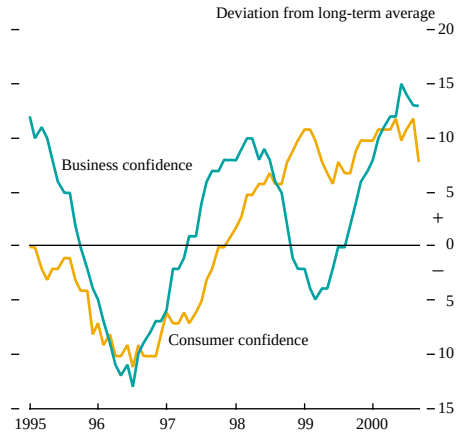

Source: Primark Datastream.

**Chart 7**
**Euro area: contributions to GDP growth**




Source: Primark Datastream.

**Chart 8**
**Euro-area business and consumer confidence**




Source: Primark Datastream.

capital stock per worker. Capital deepening has contributed to the pick-up in productivity growth since 1996. This has led the Federal Open Market Committee to note that 'an apparent continued acceleration in underlying productivity was boosting the economy's potential output growth'.(1) The annual rate of non-farm labour productivity growth rose to 5.3% in Q2, the highest rate since 1973 Q1.

Manufacturing production has continued to be driven by ICT-related sectors (see Chart 6).(2) Manufacturing output rose by 0.8% in the third quarter. But excluding ICT-related sectors, manufacturing output fell by 0.5%. Industrial confidence, as measured by the National Association of Purchasing Managers' index, has fallen further, to stand at 49.9 in September—a level that historically has been associated with falling manufacturing output.

### *Euro area*

Euro-area GDP grew by 0.9% in the second quarter, similar to growth in the previous three quarters (see Chart 7). Final domestic demand contributed 0.6 percentage points to quarterly growth in Q2. Stocks contributed 0.3 percentage points to growth, reversing the negative contribution of the first quarter. Government consumption was flat in Q2, as were net exports, despite the continued depreciation of the euro. The recent fall in the euro-area trade surplus is discussed further in the 'external balances' section of this article.

Indicators of activity in Q3 have been more mixed. Euro-area consumer confidence fell in September, albeit from a high level, perhaps reflecting the effects of oil price rises and the associated protests (see Chart 8). And euro-area business confidence has fallen (see Chart 8), particularly in Germany, where the IFO index of industrial confidence fell to 98.0 in September from 102.0 in May. This contrasts with German industrial orders data, however, which have remained robust.

The previous *Quarterly Bulletin* noted that during the past three years, German and Italian growth rates have been weak relative to the euro area overall. Growth in both these countries was robust in Q1, but in Q2 their growth rates diverged sharply, with quarterly German growth rising from 0.8% to 1.1% but Italian growth falling from 1.1% to 0.3%. French quarterly growth remained at 0.7%.

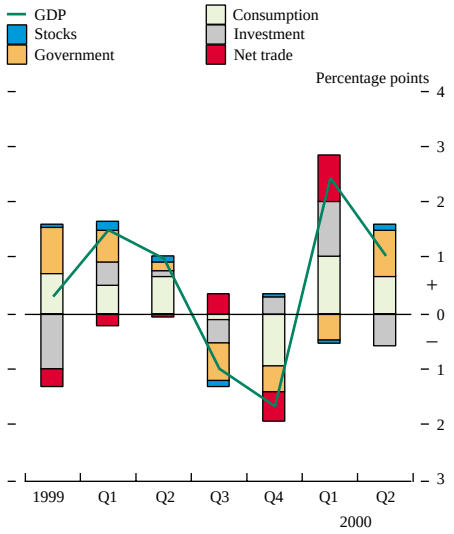
### *Japan*

In Japan, the economy continued to recover in Q2, with GDP rising by 1.0% following a rise of 2.5% in the previous quarter (see Chart 9). As in Q1, growth was supported by private consumption, which rose by 1.1% on the quarter. Private investment spending was weak, but public investment was strong, rising by 13.6% on the quarter. Net exports were flat on the quarter.

In 1999, Japanese GDP rose strongly in both Q1 and Q2 but then fell in Q3 and Q4, with particularly weak contributions from private domestic demand. Prospects now seem better than a year ago, however. Corporate profits rose by 40% on a year earlier in 2000 Q2 (see Chart 10), and machinery orders have risen. Both

(1) Minutes of the Federal Open Market Committee, Washington DC, 22 August 2000.
(2) ICT is defined here as computers, communications equipment and semiconductors.

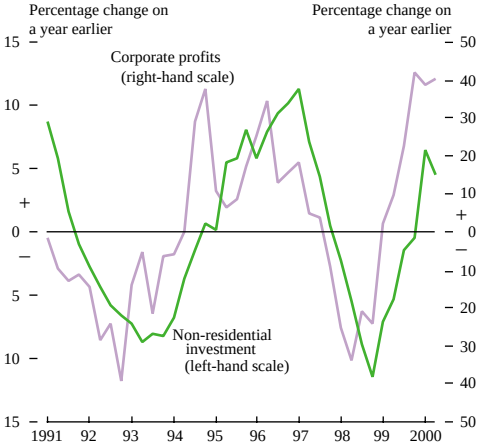
**Chart 9**
**Japan: contributions to GDP growth**




Note: Government includes both consumption and investment.

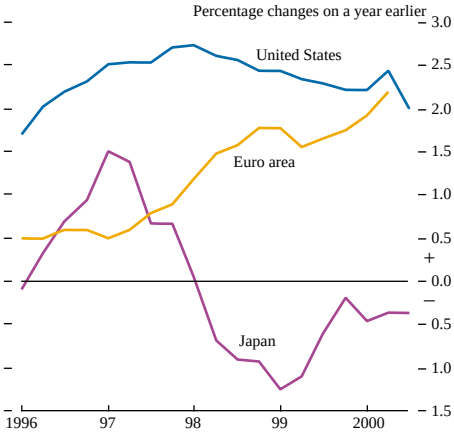
Source: Primark Datastream.

**Chart 10**
**Japan: corporate profits and business fixed investment**




Source: Primark Datastream.

**Chart 11**
**Employment growth**




Sources: Primark Datastream and Eurostat.

orders and production data suggest that in Japan, as in the United States, ICT sectors are driving manufacturing growth. Indicators of consumption remain more mixed than for investment, though the rate of decline of nominal wage income has eased since last year. One issue is the degree to which the fiscal stimulus seen in the second quarter has continued into the second half of the year. Although the Japanese authorities have announced plans for a further supplementary budget, involving additional expenditure of ¥3.9 trillion, the effects of this are unlikely to feed through until 2001.

The Bank of Japan Tankan Survey for September showed an improvement in business conditions for the seventh consecutive quarter. The number of corporate bankruptcies has risen during the past year, but the number of new business start-ups has also risen, suggesting that this reflects a pattern of industrial restructuring, as well as weak demand. Japan's potential growth over the longer term will partly depend on the success of economy-wide corporate restructuring in reallocating resources to the most productive sectors.

## Labour markets

### *Employment and unemployment*

Employment growth has continued to moderate in the United States (see Chart 11). Private sector payrolls increased by a monthly average of 154,000 in Q3, compared with monthly averages of 212,000 since 1995 and 175,000 during 2000 so far. It remains unclear whether this reflects easing labour demand growth or constraints in raising labour supply. The indicators do not show a clear picture; for instance, the Conference Board's help-wanted index has fallen, but the Manpower employment outlook survey rose over the third and fourth quarter of 2000, showing the strongest year-end demand in its 25-year history. The unemployment rate fell to 3.9% in September. With the exception of a similar outturn in April, unemployment has not been this low since January 1970.

In the euro area, employment growth has been revised up for the period since 1991, reflecting the inclusion of German part-time workers. Employment growth increased further in the euro area in Q2, rising by 2.2% on a year earlier (see Chart 11). The euro-area unemployment rate stood at 9% in August for the third consecutive month, compared with an average of around 10% in 1999. In Japan, the unemployment rate stood at 4.7% in September, unchanged from the June figure. The annual rate of decline of Japanese employment has been stable in recent months (see Chart 11), and the job offers to applicants ratio has risen.

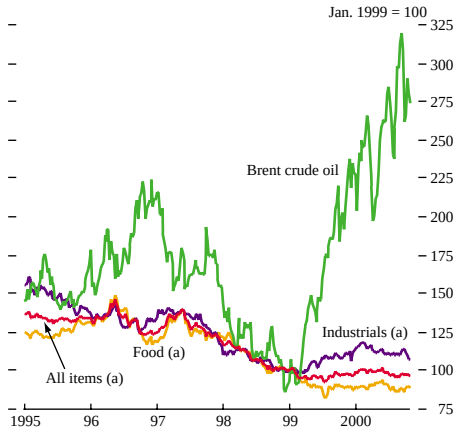
### *Labour costs*

In the United States, labour cost pressures have remained subdued. Hourly compensation has remained robust, rising by 4.7% in the year to Q2. But this has been more than offset by the strength of productivity growth, so that in Q2 the annual growth rate of unit labour costs fell below zero for the first time since 1984 Q1.

Euro-area annual hourly whole-economy labour costs growth(1) rose to 3.7% in Q2 from 3.6% in Q1, remaining above the average

(1) Excluding agriculture, public administration, education and health.

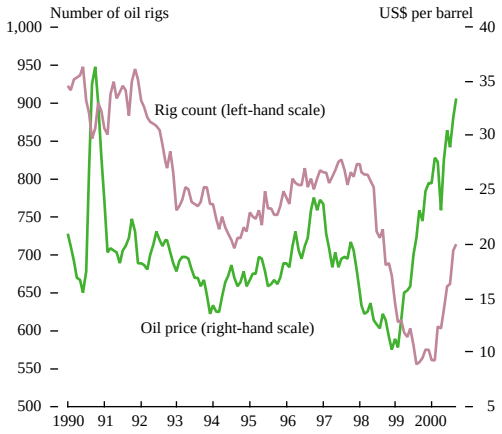
**Chart 12**
**Commodity prices**




Source: Primark Datastream.

(a) The *Economist* index, all items and industrials excluding oil.

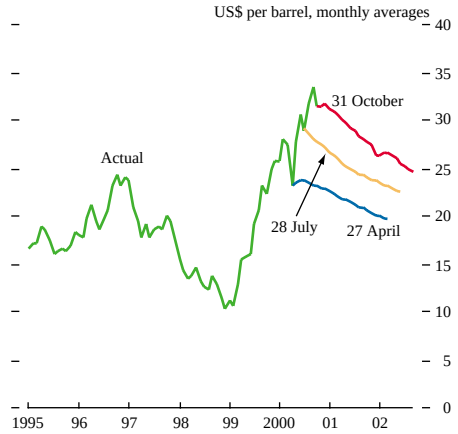
**Chart 13**
**Rig count(a) and the oil price**




Sources: Baker Hughes and Primark Datastream.

(a) Oil rigs outside the United States.

**Chart 14**
**Oil futures**




Source: Bloomberg.

annual rate of 2.4% in the second half of 1999. But the annual growth rate of euro-area whole-economy unit labour costs remained subdued in Q2 at 0.5%. Japanese unit labour costs in manufacturing remained weak, falling by 7.3% in the year to August.

## Prices

### *Commodity prices*

Oil prices have risen further since the previous *Quarterly Bulletin*: the price was $31.3 per barrel for Brent crude on 31 October, compared with $26.7 per barrel on 28 July (see Chart 12). The Brent price peaked at $37.6 per barrel on 7 September, but has since fallen back following a number of positive announcements on supply. In September, members of the Organisation of Petroleum Exporting Countries (OPEC) agreed to increase production further by 800,000 barrels per day, bringing their production quotas to a total of 26.2 million barrels per day. Production quotas were 23.0 million barrels per day at their low point in 1999. Also, the US Department of Energy announced the release of 30 million barrels of oil from its Strategic Petroleum Reserve, amid concerns about low inventories of heating oil in the United States and the impending winter. In late September, Saudi Arabia announced its readiness to increase supply in order to bring the price back towards OPEC's preferred band of $22–$28 per barrel.

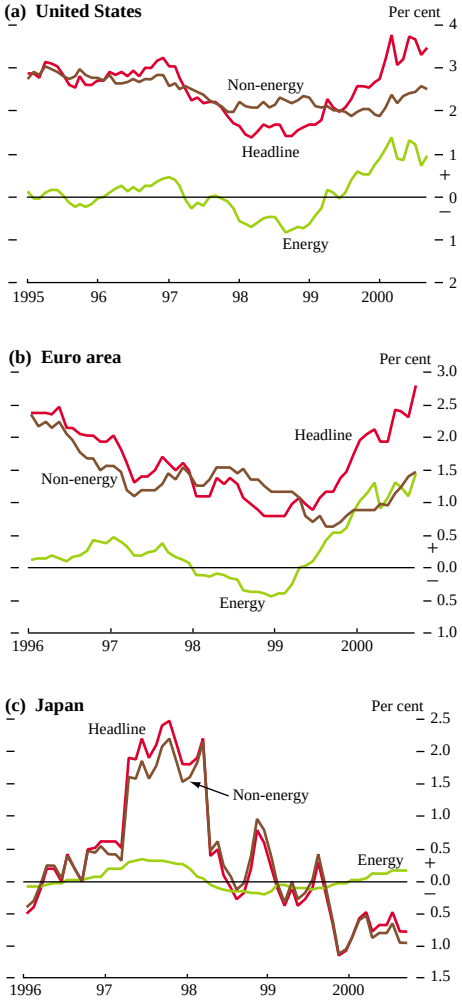
It seems likely that the rise in oil prices since 1999 reflects shifts in both the demand for and supply of oil. As oil prices fell to historically low levels in late 1998 and remained weak in early 1999, oil industry investment and oil production were cut back. Since then, world GDP growth projections have been revised upwards, implying that the demand for oil may have strengthened by more than market participants expected. Oil production has subsequently risen, albeit with a lag, and oil industry investment has begun to recover, as evidenced by the increasing number of operative oil rigs (see Chart 13). Nonetheless, there are lags before this new capacity comes on-stream. In the meantime, short-term supply constraints are close to being reached in the oil industry, with the refinery sector operating at high rates of capacity utilisation, and with low spare OPEC production capacity (non-OPEC oil-producing countries typically do not maintain spare production capacity). Moreover, inventories have fallen to a low level. Given the outlook for oil demand and supply, most market participants expect the price of Brent crude to fall to around $25 per barrel during the next two years. This is reflected in the futures curve for 31 October, which shows price increases in contracts for all delivery dates since the previous *Quarterly Bulletin* (see Chart 14).

Non-oil commodity prices have remained subdued since the previous *Quarterly Bulletin*. Industrial commodity prices have fallen by 3% and food commodity prices have risen by 1% (see Chart 12). This suggests that the rise in oil prices since the August *Quarterly Bulletin* reflects, to a considerable degree, industry-specific supply factors.

### *Producer prices*

In the United States, producer price inflation has fallen from its recent peak in March. Producer prices rose by 3.3% in the year to

## Chart 15
## Contributions to CPI inflation




Sources: Primark Datastream and Eurostat.

## Table C
## Forecasts for CPI inflation

Per cent

| | IMF (a) | | | | Consensus Economics (b) | | | |
|---|---|---|---|---|---|---|---|---|
| | 2000 | | 2001 | | 2000 | | 2001 | |
| United States | 3.2 | *+0.7* | 2.6 | *+0.1* | 3.3 | *+0.1* | 2.7 | *+0.1* |
| Japan | -0.2 | *-0.3* | 0.5 | *-0.4* | -0.6 | *-0.2* | -0.1 | *-0.1* |
| Euro area | 2.1 | *+0.4* | 1.7 | *+0.1* | 2.2 | *+0.3* | 2.0 | *+0.3* |
| North East Asia (c) | | | | | 1.0 | *-0.1* | 2.3 | *+0.0* |
| South East Asia (d) | | | | | 2.8 | *-0.3* | 4.5 | *+0.2* |
| Latin America (e) | | | | | 6.9 | *-0.1* | 5.8 | *+0.0* |
| Eastern Europe (f) | | | | | 24.9 | *+1.3* | 15.6 | *+0.6* |

(a) IMF *World Economic Outlook*, September 2000; (differences from May 2000 in italics; percentage points).
(b) *Consensus Forecasts*, October 2000; (differences from July 2000 in italics; percentage points).
(c) Peoples' Republic of China, Hong Kong SAR, South Korea and Taiwan.
(d) Indonesia, Malaysia, Singapore, Thailand and the Philippines.
(e) 14 countries, including Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela.
(f) 19 countries, including the Czech Republic, Hungary, Poland, Russia and Turkey.

September. Core producer price inflation, which excludes food and energy, fell in September to 1.2%. Euro-area producer price inflation stood at 5.6% in August for the third consecutive month, continuing to reflect strong intermediate goods price inflation. In Japan, the domestic wholesale price index fell by 0.1% in September and rose by 0.1% on a year earlier, with rises in energy prices offsetting continued falls elsewhere.

### *Consumer prices*

Recent oil price rises have been reflected in inflation rates in the major industrialised economies to a varying degree (see Chart 15). Inflation has fallen in the United States since the previous *Quarterly Bulletin*, reflecting a fall in energy price inflation, partly because of earlier energy price increases at a similar stage in 1999. But in the euro area, energy price inflation has risen further. Non-energy inflation rates have risen in the United States and, more notably, in the euro area. This may partly reflect the indirect effect of oil price rises. A key concern for the inflation outlook is whether oil price rises become embedded in inflation expectations.

In the United States, headline consumer price inflation fell from 3.7% in June to a low of 3.3% in August, and then rose to 3.5% in September. And non-energy inflation has risen slightly to stand at 2.6% in August and September, the highest rate in over three years. Euro-area headline inflation rose to 2.8% in September, its highest rate since May 1994, and above the maximum inflation rate that the ECB considers consistent with price stability (2%). The European Commission's survey of consumer price expectations has risen since the previous *Quarterly Bulletin*. Non-energy inflation rose to 1.6% in September, continuing the upward trend seen during 2000 so far.

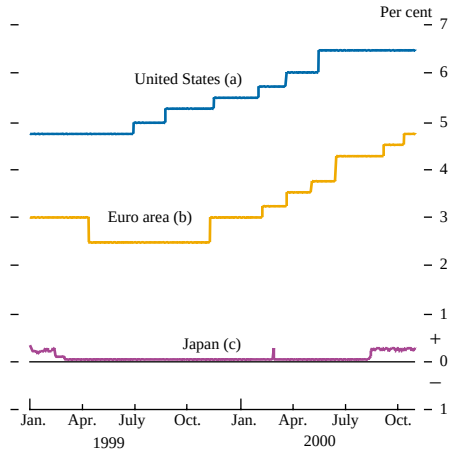
In Japan, headline consumer prices were 0.8% lower in September than a year earlier. Deflationary pressures have been strongest for consumer goods prices, which fell by 1.5% in the year to September; service prices have been broadly stable in the past year. This difference may partly reflect differing trends in productivity growth, as well as the effect of lower imported goods prices because of the appreciation of the yen. Consumer energy prices in Japan have risen by less than in the United States or euro area, perhaps reflecting increasing competitive pressures in the Japanese economy.

Inflationary pressures have remained muted in emerging Asian economies, despite rising oil prices. But higher oil prices are likely to add to the inflationary risks from rising capacity utilisation rates in the region, and inflation rates are expected to rise in 2001. In Latin America, inflation rates have remained stable, but continue to show substantial divergences between countries, reflecting different demand conditions.

Looking forward, the IMF has revised upwards its forecast for inflation in the United States in 2000 from 2.5% to 3.2% (see Table C).[1] But the IMF now expects Japanese consumer prices to fall overall in 2000, before rising in 2001. The IMF has raised its forecast for euro-area inflation, to 2.1% in 2000 and to 1.7% in 2001. Consensus Economics has also raised its forecast for

(1) IMF *World Economic Outlook*, September 2000.

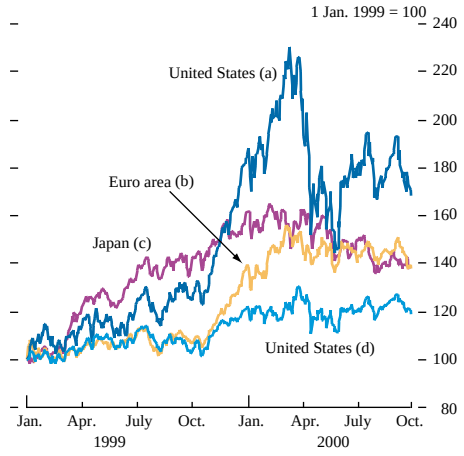
**Chart 16**
**Official interest rates**




Source: Primark Datastream.

(a) Federal funds target rate.
(b) Refinancing rate.
(c) Uncollateralised overnight rate (market rate).

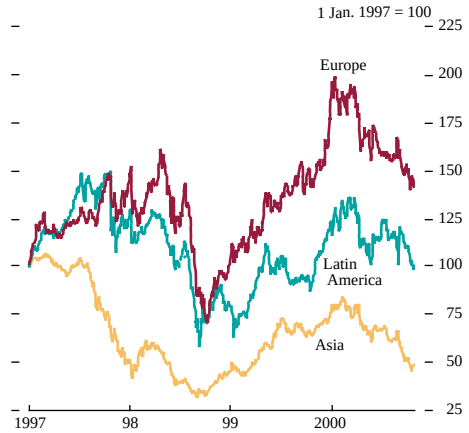
**Chart 17**
**Equity indices**




Sources: Primark Datastream and Bloomberg.

(a) Nasdaq.
(b) Euro Stoxx.
(c) TOPIX.
(d) Wilshire 5000.

**Chart 18**
**Emerging market equity indices (US$)**




Source: Morgan Stanley.

euro-area inflation for both 2000 and 2001, projecting inflation of 2.0% in the second year. Consensus forecasts for inflation in 2000 in the emerging regions have fallen since July (see Table C), with the exception of Eastern Europe. But projections for emerging market inflation in 2001 have been raised, perhaps reflecting the further recent rise in the oil price.

## Monetary policy and financial markets(1)

Official interest rates have increased by 0.5 percentage points in the euro area since the August *Quarterly Bulletin*. The zero interest rate policy has been lifted in Japan. In the United States, the Federal funds target rate has remained unchanged at 6.5% (see Chart 16). Interest rate futures suggest that many market participants now expect US interest rates to fall during the first half of 2001. Government ten-year bond yields have fallen in the United States, have risen in Japan, and have remained little changed in the euro area over the period.

The ECB has raised its refinancing rate to 4.75% since the previous *Quarterly Bulletin*. Rates were raised by 0.25 percentage points on both 31 August and on 5 October. These increases followed an earlier rise of 0.5 percentage points on 8 June (see Chart 16). The ECB explained its October decision as aimed at ensuring that consumer price pressures, 'mainly from oil prices and the exchange rate of the euro', do not result in more permanent inflationary tendencies, noting also that M3 growth remained above its reference value alongside strong credit growth.(2) The ECB pointed to broadly similar factors in explaining its August rate rise. Official interest rates in the euro area have risen by 2.25 percentage points since November 1999. Interest rate futures contracts suggest that the market expects a rise in official rates to 5% by the end of the year.

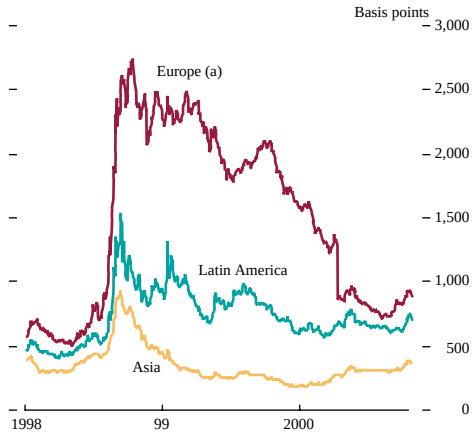
The Bank of Japan (BoJ) raised its target for the uncollateralised overnight call rate to 0.25% on 11 August (see Chart 16). This ended the zero interest rate policy that had been in place since February 1999. The BoJ noted that 'Japan's economy has reached the stage where deflationary concern has been dispelled, the condition for lifting the zero interest rate policy.'(3) The rate rise has been reflected by increases in interest rates across the Japanese yield curve.

Equity prices have been volatile in the major markets since the August *Quarterly Bulletin*, particularly in the high-technology sectors (see Chart 17). In the United States, volatility has partly reflected concern about corporate profits and, perhaps underlying this, the possible effects of oil price rises. Quarterly growth of US post-tax corporate profits(4) slowed to 2.1% in Q2 from 5.4% in the first quarter. In the United States and the euro area, corporate bond spreads have widened, particularly for high-yield bonds.

In emerging markets, financial conditions have tightened. Equity indices have continued to fall, particularly in Asia where stock prices are 38% lower than at the start of the year (see

(1) For details on movements in foreign exchange, equity and bond markets see the 'Markets and operations' article on pages 321–38.
(2) ECB *Monthly Bulletin*, Frankfurt, October 2000.
(3) Bank of Japan press release, Tokyo, 11 August 2000.
(4) National Accounts measure.

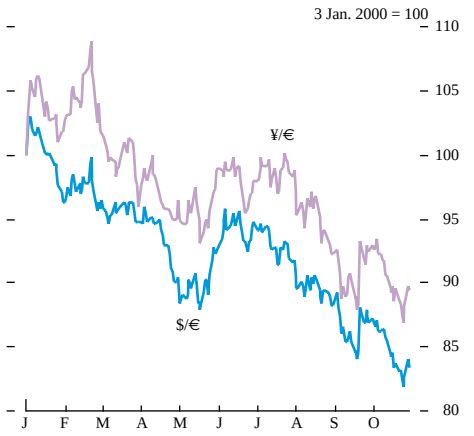
### Chart 19
### Sovereign bond yield spreads by region




Source: J P Morgan.

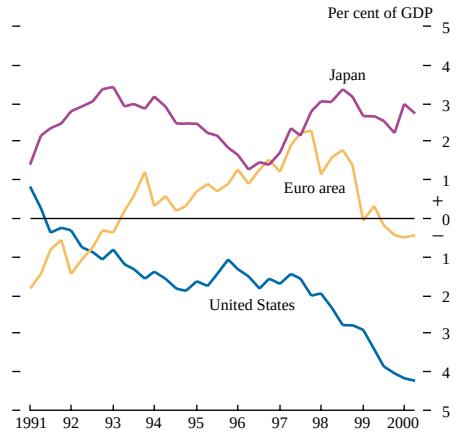
(a) Russian principal loans and interest rate arrears loans (both restructured commercial bank loans) were taken out of the index on 14 April and replaced by eurobonds to be issued in exchange.

### Chart 20
### Euro exchange rate




Source: Primark Datastream.

### Chart 21
### Current account balances




Source: Primark Datastream.

Chart 18). This reflects concerns about the pace of corporate restructuring in some markets, but may also reflect the possible effect of oil price rises on corporate profits. Since the August *Quarterly Bulletin*, spreads over US Treasuries have risen in the emerging markets, though they remain well below levels achieved during the emerging market crisis period (see Chart 19).

The euro has depreciated by around 9% against both the US dollar and the Japanese yen since the previous *Quarterly Bulletin* (see Chart 20). The ECB announced concerted central bank intervention in the foreign exchange markets on 22 September, in response to 'shared concern about the potential implications of recent movements in the euro exchange rate for the world economy'.(1) The euro initially appreciated in response, but then fell to reach a record low against both the US dollar and Japanese yen on 26 October. By the end of the period the euro had recovered to around pre-intervention levels against both currencies.

## External balances

In the United States, the current account deficit widened further to 4.3% of GDP in 2000 Q2 (see Chart 21). The rate of increase has slowed in 2000, however, partly reflecting the effect on US exports of the global recovery. The Japanese current account surplus fell from 3.0% of GDP in 2000 Q1 to 2.8% in Q2. In the euro area, the current account has moved from surplus to deficit in recent years, despite the depreciation of the euro. Much of the weakness in the current account during the past year is explained by the effect of oil price rises on import values. And strong euro-area domestic demand may have boosted imports.

Current account surpluses persist across non-Japan Asia, though are projected to fall as domestic demand growth picks up and external demand moderates. By contrast, sizable current account deficits persist in Latin America. Since the May *World Economic Outlook*, the IMF has doubled the projected current account surplus for 2000 for the Middle East and non-transitioning emerging European countries(2) to $44 billion, reflecting the effect of increased oil prices.

(1) ECB press release, Frankfurt, 22 September 2000.
(2) Cyprus, Malta and Turkey.

# Wealth effects on consumption in the United States

*During the past five years US real net financial wealth has risen by around 64%, while the strength of consumption has reduced the savings rate to near zero from around 5½%. Net wealth increases should lead consumers to raise their spending, but the likely size of the effect is unclear. This note looks at the size and distribution of household wealth in the United States, and assesses the empirical evidence for wealth effects on US consumption. This work suggests significant effects on consumption from both financial and housing wealth. Nevertheless, US consumption since 1999 seems to have been stronger than would be expected on the basis of historical relationships.*

## The theoretical role of wealth in consumption

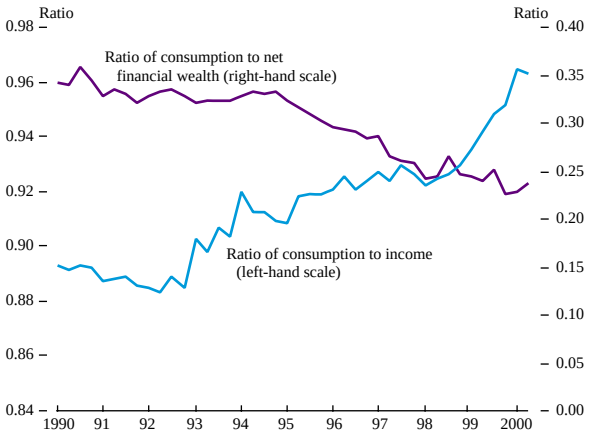
One widely used theory of household consumption is the life-cycle/permanent income model. Under this theory households look not at just their current income when deciding how much to spend, but also at other available resources in the form of their physical and financial wealth and their future likely income. So they will save when current income is unusually high and borrow when it is unusually low. An unexpected increase in wealth, say from a rise in equity or house prices, will not be spent at once, but spread over the consumer's lifetime. But increases in housing wealth may have different implications for consumption compared with financial wealth, partly because a rise in house prices also raises the costs facing first-time buyers or those trading up to larger properties, which may curb overall non-housing expenditures. Housing wealth could have indirect effects on non-housing expenditures, however, for example by affecting the spending of those who need to use their house as collateral against borrowing, or for those who find the cost of borrowing on unsecured loans too high.

## Empirical evidence

US real net household financial wealth rose by 64% during the five years to 2000 Q2. In the same period, real consumption rose by 24%, well above the rise in real disposable income of 18%. As a result, the ratio of consumption to income has increased, while the ratio of consumption to net financial wealth has fallen (see Chart A). The savings ratio has fallen to around zero.

The effects of rising net financial wealth may depend on its distribution (see Table 1). Wealth effects on consumption might be expected to be larger for lower-income households, as they tend to have a higher marginal propensity to consume. The results of the Survey of Consumer Finances(1) show that the share of US households holding equity wealth increased from 31.6% in 1989 to 48.8% in 1998, with the figure rising across all income groups. But the distribution of wealth remains heavily skewed towards higher-income groups. And the median real value of equity wealth in the lowest-income group has fallen by around 15% since 1989. This may have reduced the effect of wealth increases on consumption relative to a more even distribution of financial wealth gains.

**Chart A**
**US consumption**




Source: Primark Datastream.

The effect of an increase in equity wealth may also have been reduced by an increase in the proportion of equity wealth held indirectly, eg as pensions. Households may not view these long-term savings as disposable wealth for consumption, or may be less aware of the value of these holdings. Between 1989 and 1998 the share of total equity held in pension funds rose from 25.4% to 32.9%.

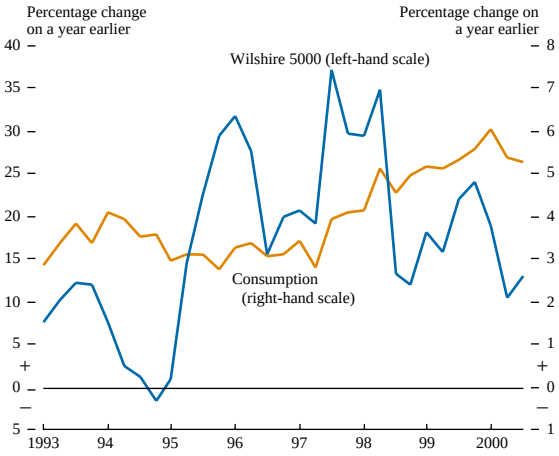
**Table 1**
**Distribution of US household equity wealth**

| Household income | Percentage of households holding equity | | Median real value of holdings (1998 US$ '000s) | | |
|---|---|---|---|---|---|
| | 1989 | 1998 | 1989 | 1998 | Percentage change |
| <$25,000 | 9.1 | 19.0 | 9.5 | 8.0 | -15.8 |
| $25,000–$50,000 | 31.5 | 52.7 | 6.0 | 11.5 | 91.7 |
| $50,000–$100,000 | 51.5 | 74.3 | 10.2 | 35.7 | 250.0 |
| $100,000–$250,000 | 82.3 | 90.0 | 45.8 | 121.5 | 165.3 |
| >$250,000 | 79.1 | 95.6 | 366.7 | 524.5 | 43.0 |

Source: Bertaut and Starr-McCluer (2000).

(1) 'Household portfolios in the United States', Bertaut, C and Starr-McCluer, M, Federal Reserve Board, April 2000.

**Chart B**
**US consumption and equity prices**




Source: Primark Datastream.

Housing wealth has been rising less quickly than financial wealth (see Chart C). But many US households, particularly lower-income households, continue to hold most of their wealth in the form of housing: housing wealth accounts for more than 50% of total wealth in the bottom three wealth quartiles, compared with just 20% for the top wealth quartile. So any housing wealth effects may be more concentrated than financial wealth effects on lower-income households, who are generally thought to have higher marginal propensities to consumer than higher-income households.(1)

**Chart C**
**US wealth accumulation**


Sources: Primark Datastream and Bureau of Economic Analysis.

## An econometric equation for US consumption

Estimating a simple consumption function may help to determine the importance of different factors in explaining recent consumption patterns. This note looks at the results of a simple econometric equation for consumption, based on the permanent income hypothesis. In the long run, consumption depends on income, wealth and the interest rate. The specification also includes short-run dynamic terms in income, the interest rate and, to capture consumer confidence effects, the unemployment rate.

## The size and timing of wealth effects

The estimated wealth elasticity of consumption from the equation is 0.156 which, given the size of wealth, implies that an extra 3¼ cents is consumed for each extra dollar of wealth. This estimate for the wealth effect on US consumption is perhaps towards the lower end of the range of outside estimates, which are generally between 2 and 7 cents per dollar.(2) The May *Quarterly Bulletin* reviewed the recent literature on wealth effects on US consumption.

When the equation is estimated using housing and financial wealth as separate variables, the coefficients for the two wealth terms—the estimated consumption elasticities—were statistically identical. But given the larger size of net financial wealth, this implies a marginal propensity to consume of around 6¼ cents in the dollar for housing wealth, compared with 2¼ cents for net financial wealth.

The equation also suggests that the lags between wealth and consumption are significant. Around a third of the long-run effect of a change in wealth is estimated to occur within one quarter. However, it takes eight quarters before 95% of the long-run effect has occurred.

## Explaining recent consumption growth

The results of the equation may also be used to estimate the contribution to consumption growth from each explanatory variable. Chart D shows these contributions to annual consumption growth during the past 25 years. Income clearly dominates but, importantly, the contribution from wealth has increased significantly in the past four years. This is consistent with the sharp rise in equity prices flowing through to consumption over this period.

Chart E looks at the past five years on a quarterly basis. The equation residual becomes increasingly positive during 1999. This would suggest that under the parameters of the equation, recent increases in income and wealth have not been sufficient to explain the strength of consumption since the start of 1999. For 2000 Q2, the equation underpredicts annual consumption growth by around 2 percentage points.

While this may reflect noise in the data, an omitted variable, or some kind of recent structural parameter change, there are a number of other possible explanations. One is that the prolonged upturn in equity prices has led consumers to see more of these gains as permanent, and

(1) As noted in a speech by Chairman Alan Greenspan (November 1999), 'Mortgage markets and economic activity', at a conference on Mortgage Markets and Economic Activity, sponsored by America's Community Bankers, Washington DC.
(2) By contrast, Ludvigson, S and Steindel, C, 'How important is the stock market effect?', July 1999, Federal Reserve Bank of New York, finds no stable relationship between US wealth and consumption during the post-war period.

**Chart D**
**Contributions to annual consumption growth; yearly basis**

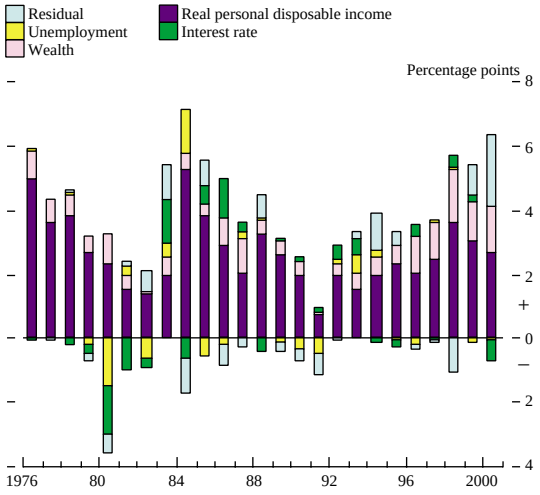



**Chart E**
**Contributions to annual consumption growth; quarterly basis**

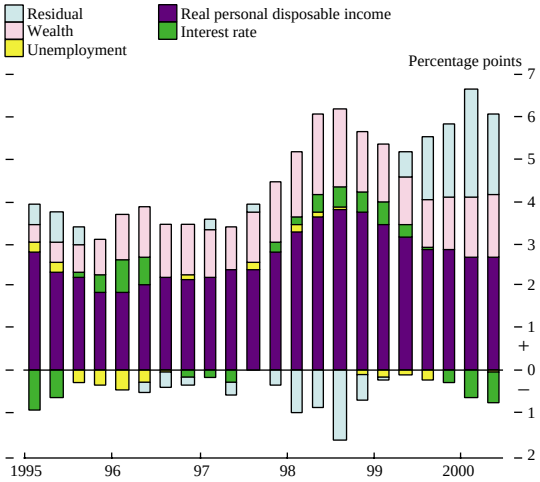
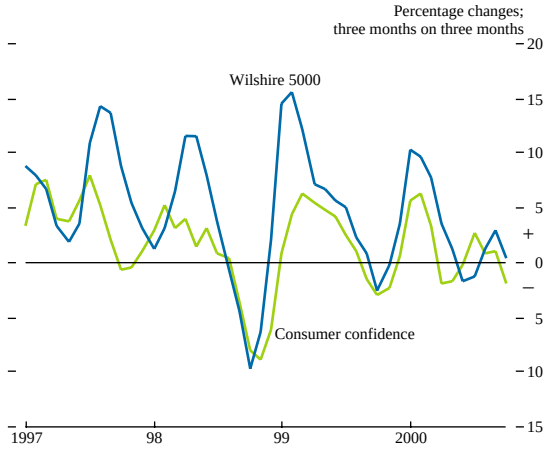



**Chart F**
**US consumer confidence**




Source: Primark Datastream.

hence to spend more out of wealth than has been the case in previous years. But there is little evidence of a direct relationship between financial wealth volatility and consumption. A more likely explanation is that households are consuming more of their income on the basis of some form of 'confidence' effect generated by the success of the economy and the strength of the stock market (see Chart F).[1] In particular, the acceleration of US productivity may have led to an upward revision to expectations of households' future earnings that has not been fully captured by the model.

In conclusion, we find evidence of significant effects from financial and housing wealth on consumption growth in the United States. Our estimate for the size of these effects falls within the range of estimates found by others, but is probably towards the lower end of that range. Further, the strong growth in consumption in 1999 and the first half of 2000 is higher than would be predicted based on the historical relationship between consumption, income and wealth.

(1) The unemployment rate has remained fairly flat since 1999, and so may have become a less accurate proxy for consumer confidence. However, including a confidence measure explicitly in the equation does not eliminate the positive residual in 1999.

# The external balance sheet of the United Kingdom: implications for financial stability?

By Stephen Senior of the Bank's G10 Financial Surveillance Division and Robert Westwood of the Bank's Monetary and Financial Statistics Division.

*This article looks at developments in the UK external balance sheet in the wider context of the UK economy and financial system. UK net external liabilities increased sharply in the late 1990s. This largely reflected changing asset values, including exchange rates, rather than financial flows. The currency composition of UK external assets and liabilities means that, other things being equal, a falling exchange rate would reduce UK net external liabilities via valuation changes. In addition, the way foreign direct investment is valued could mean that UK external assets are significantly underestimated. The article also analyses the impact of banking sector business on the UK external balance sheet. UK external short-term debt is large because of the scale of international banking activities. A comparatively small proportion of this is carried out by UK-owned banks.*

## Monitoring country balance sheets for financial stability

One lesson from recent international financial crises has been how important it is for national authorities to monitor risk exposures in their country's external balance sheet. The structure of the stocks of financial assets and liabilities that results from capital flows can be as important for risk management as the capital flows themselves. First, it affects a country's ability to withstand economic shocks. For example, a country with a large foreign currency exposure carries a risk of loss (or profit) from sudden changes in exchange rates. And second, the structure of the balance sheet may itself be a source of financial shocks. For example, a country with large short-term net external liabilities is exposed to refinancing risk, and could in the extreme suffer a liquidity crisis.

Problems with the structure of external balance sheets were important in a number of recent financial crises, including Mexico in 1994, Korea and Indonesia in 1997, Russia in 1998, and Brazil in early 1999.(1) For Mexico, Russia and Brazil, mismatches in the maturity and interest rate structure of public sector debt posed particular difficulties, whereas for Korea, liquidity mismatches in the banking sector contributed to the financial crisis. In both the Korean and Indonesian crises, the maturity structure of non-financial corporate sector debt also played an important role.

As risks can arise in a number of areas, it is advisable for authorities to monitor a range of balance sheet indicators, focusing on variables and relationships that have in the past indicated financial fragility.(2) The adequacy of a country's foreign exchange reserves and the size and structure of the economy's foreign currency debt are particularly relevant, especially for countries on a fixed exchange rate regime. Sound risk management by the public sector warrants particularly high priority. National authorities need to adopt prudent strategies and practices in managing their own debt liabilities and financial and other assets. They should identify the main economic risks to which they are exposed, either directly or indirectly (via the economy as a whole).(3) Bank regulators should measure and monitor liquidity

### What is an external balance sheet?

The external balance sheet of a country is a summary of its financial relationship with the rest of the world. It is closely related to the balance of payments, and can be viewed as combining the stock of residents' financial investments in the rest of the world (assets) and the stock of financial investments into the country from the rest of the world (liabilities).

The external balance sheet of the United Kingdom is published annually by the Office for National Statistics (ONS) as part of the *United Kingdom Balance of Payments Pink Book*. Contingent assets and liabilities are not included, an increasingly important omission as the use of financial derivatives becomes more widespread.

The latest edition of *The Pink Book* was published in August 2000 showing data up to end-1999.(1)

(1) The ONS produces quarterly estimates of the UK external balance sheet. The latest quarterly data are for 2000 Q2; these have been used in this article where appropriate.

(1) See 'Improving the stability of the international financial system', Drage, J and Mann, F, *Bank of England Financial Stability Review*, June 1999.
(2) See 'Debt and reserves-related indicators of external vulnerability', IMF, 23 March 2000. Available at www.imf.org/external/np/pdr/debtres/index.htm
(3) See 'Report of the working group on capital flows', Financial Stability Forum, 5 April 2000. Available at www.fsforum.org/Reports/RepCF.html

mismatches in banks, in the domestic currency and foreign currencies. If necessary, governments should act to strengthen banking systems and prudential regulation. Other parts of the private sector are generally not regulated, but they should be subject to accounting and disclosure standards which require transparency about the structure of their financial obligations and claims.

An adverse signal from any individual indicator does not mean that a country inevitably faces crisis. Rather, indicators should be employed as warning lights, highlighting potential problems and prompting further investigation. A series of warnings may reflect escalating risks.

## External balance sheets of developed economies

Although much of the recent international interest in external balance sheets has focused on emerging market economies, the analysis is also potentially useful for developed economies.(1) For example, a significant deterioration in a country's external balance sheet could indicate current account imbalances and might, in principle, lead to a loss of confidence in that economy. More generally, external balance sheets are useful for assessing the likely impact on particular sectors or institutions of a variety of external shocks such as global interest rate or business cycle shocks.(2)

There are a number of caveats, however, which should be kept in mind, particularly for large economies with complex financial systems, such as the United Kingdom.

First, in the National Accounts, the UK economy is defined on a residency basis: the activities of all institutions located within the United Kingdom's political frontiers are 'UK', those outside are 'non-resident'. However, the activities of some types of institution located in the United Kingdom may be less intimately connected than others with the stability of the UK financial system as a whole, and they may react differently to certain shocks.

Foreign banks and securities dealers operating in London are one possible example. Foreign institutions locate in London because it is the leading international financial centre in its time zone, which gives them access to deep and liquid markets, as well as local expertise. The business booked in London by these institutions will affect the UK external balance sheet. Some of their counterparties are outside the United Kingdom, they may provide financial intermediation predominantly for non-residents, and developments in their domestic economies may be more important than their activities in the United Kingdom to their financial health. The impact within the United Kingdom if they were to experience difficulties would differ from problems at a domestic bank; it would probably depend to an important extent on counterparty interlinkages within the financial system.

In contrast, the liabilities of, say, a Frankfurt branch of a domestic bank may not appear in the UK external balance sheet. As a complement to residency-based balance sheet analysis, it would be useful to be able to analyse a 'balance sheet' composed on a 'worldwide consolidated' basis, focusing on the activities of UK-owned institutions wherever they may be located.(3)

A second caveat is that balance sheet pressures do not arise from the external sector alone. In times of crisis, the risk of domestic capital flight can be high. It has sometimes occurred first, perhaps because domestic residents can be better informed about developments in an economy than are non-residents.

Third, an external balance sheet is the aggregation of the positions of many institutions. Even though, in aggregate, a sector may not be exposed to liquidity or currency mismatches, at a micro level some institutions may be. In the event of crisis, funds will not necessarily flow freely within the economy, so some institutions may face difficulties in an otherwise apparently robust sector.

Finally, the relationships between economic sectors and the rest of the world are complex. Developments should be evaluated in the context of the country's economy as a whole (eg prospective growth) and its position in the world financial system; that can be difficult for advanced industrial economies. The box opposite looks at a method of placing developments in the UK external balance sheet within the context of a UK national balance sheet.

### *Limitations of external balance sheet data*

There are also technical limits on how much detail external balance sheets can provide. Compiling the external balance sheet of a major open economy such as the United Kingdom is a significant undertaking, involving a series of large-scale censuses and/or sample surveys of institutions and economic agents. A degree of imprecision is inevitable; given the immense sums involved (UK gross external assets and liabilities both exceeded £2 trillion at end-1999), margins of error can run into millions, if not billions, of pounds. So it is important not to place too much emphasis on precise figures or small changes over time.

*Net* figures should be treated with caution: a small error in gross figures can translate into significant inaccuracies when gross figures are netted. For example, between the 1999 and 2000 issues of *The Pink Book*, data for end-1998 were revised. The estimate of UK gross assets was revised down by 1.8%, and that of gross liabilities was revised up by 0.6%. These modest revisions led to a 74% increase in the estimate of net external liabilities to £118 billion.

(1) As recognised in the IMF's Special Data Dissemination Standard.
(2) Such an assessment needs also to draw on hypotheses about how debtors and creditors will behave in the face of the various shocks.
(3) Analogous to the Bank for International Settlements (BIS) international banking data, published on both a locational and a worldwide consolidated basis.

## Placing the external balance sheet in the context of a national balance sheet

A narrow focus on the UK net external balance sheet position may give an incomplete picture of the United Kingdom's overall position relative to the rest of the world. One alternative is to consider the external position in the context of a national balance sheet.

J Y Henderson(1) defines a theoretically ideal national balance sheet. He states that, '*It would show values for land; known mineral wealth in the ground; all physical assets produced with human intervention such as producer durables, consumer durables and business inventories, including mineral wealth extracted from the ground; intangible assets … all contractual financial claims for which a regular owner-issuer relationship exists, and a capitalised value of human wealth*'.

In this context, capitalised human wealth can be viewed as the current market value of the store of economically productive abilities and information embodied in the population. For an individual, that could be thought of as the present discounted value (pdv) of the person's lifetime income stream minus the pdv of the income that they could have earned in the absence of any human capital—all other factors held unchanged.

With this in mind, one can characterise the United Kingdom as a conglomerate. Money GDP can then be thought of as the dividend paid by the conglomerate, and the dividend yield on the FTSE All-Share index can be used to calculate a very approximate market value for UK plc.(2)

Between 1996 and 1999, UK money GDP rose from £756 billion to £891 billion. The average dividend yield was 3%. This gives national balance sheet asset values of £25.2 trillion in 1996 and £29.7 trillion in 1999.(3) So while UK measured net external liabilities increased by £156 billion over the period, this is heavily outweighed by the £4.5 trillion increase in the value of total assets on the national balance sheet.

(1) 'The possible uses and scope of a national balance sheet for Australia', Henderson, J Y, *The Economic Record* (September 1972), The Australian National University.
(2) Of course, there are a number of important caveats to this method. For example, the dividend yield on the FTSE All-Share index will reflect the activities all over the world of companies listed on the London Stock Exchange. Also, the dividend yield will depend to some extent on the tax incentives to retain or distribute earnings.
(3) National balance sheet asset value = money GDP/dividend yield.

External balance sheet data for the United Kingdom are compiled from a series of institutional surveys conducted by the Office for National Statistics (ONS) and the Bank of England. The ONS has assessed the accuracy and reliability of data obtained from different sources. In general, data for the public and banking sectors are believed to be of the highest quality, followed by data for insurance companies and pension funds, and finally securities dealers (which is a concern given their scale), the corporate and household sectors. Annual data are generally of higher quality than quarterly data because some quarterly levels data are estimated imperfectly by cumulating financial flows and revaluing the result using relevant price indices.

When shocks occur, contingent assets and liabilities, such as derivatives, can have important consequences for international flows and asset price changes. However, at present, derivatives are treated as off balance sheet in the UK external balance sheet. This will change with the publication of the 2001 issue of *The Pink Book*, when the UK National Accounts become BPM5-compliant.(1) The inclusion of derivatives positions will inflate gross claims and obligations significantly. Data for banks currently available give some idea of the scale of the increase. They show that banks' external gross derivatives assets and liabilities positions were £390 billion and £388 billion respectively at end-1999.

Finally, not all asset stocks are recorded at comparable market values. Most significantly, stocks of foreign direct investment (FDI) are recorded in the accounts at book value, as discussed below.

## Recent developments in the UK external balance sheet

At end-1999, UK gross external assets were £2.3 trillion, an increase of 11% (£231 billion) on the previous year, and UK gross external liabilities were £2.5 trillion, an increase of 12% (£261 billion); see Table A. Chart 1 shows that in both real and nominal terms the UK external balance sheet has grown very strongly for most of the past decade. UK external assets were some 180% of GDP in 1990, but are now more than 260% of GDP.

(1) Balance of payments manual (5th edition), published by the IMF. The aim of BPM5 is '...developing and promulgating appropriate international guidelines for the compilation of sound and timely balance of payments statistics'.

## Table A
## UK external balance sheet(a)

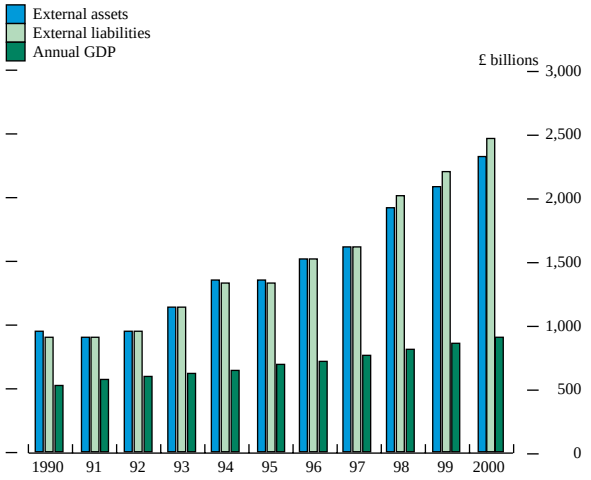
£ billions

| | 1990 | | 1997 | | 1998 | | 1999 | | 2000 H1 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Assets | Liabilities | Assets | Liabilities | Assets | Liabilities | Assets | Liabilities | Assets | Liabilities |
| Direct investment | 121 | 114 | 226 | 167 | 301 | 193 | 419 | 243 | 567 | 276 |
| Portfolio investment | | | | | | | | | | |
| Debt | 96 | 130 | 344 | 282 | 382 | 274 | 372 | 307 | 416 | 337 |
| Equity | 101 | 59 | 282 | 306 | 304 | 412 | 400 | 576 | 404 | 653 |
| Other investment | 556 | 602 | 1,066 | 1,269 | 1,103 | 1,351 | 1,131 | 1,365 | 1,354 | 1,633 |
| Reserve assets | 22 | | 23 | | 23 | | 22 | | 23 | |
| **Total** | **896** | **905** | **1,942** | **2,025** | **2,113** | **2,231** | **2,343** | **2,491** | **2,763** | **2,898** |
| Memorandum items: | | | | | | | | | | |
| Balance of payments | | | | | | | | | | |
| Current account | | -19.5 | | 6.6 | | -0.1 | | -11.0 | | -2.5 |
| Capital account | | 0.5 | | 0.8 | | 0.5 | | 0.8 | | 0.7 |
| Financial account | | 17.5 | | -13.2 | | -4.7 | | 5.9 | | -0.0 |
| Errors and omissions | | 1.5 | | 5.8 | | 4.3 | | 4.4 | | 1.8 |

(a) For definitions of balance sheet instruments see the glossary on page 364.

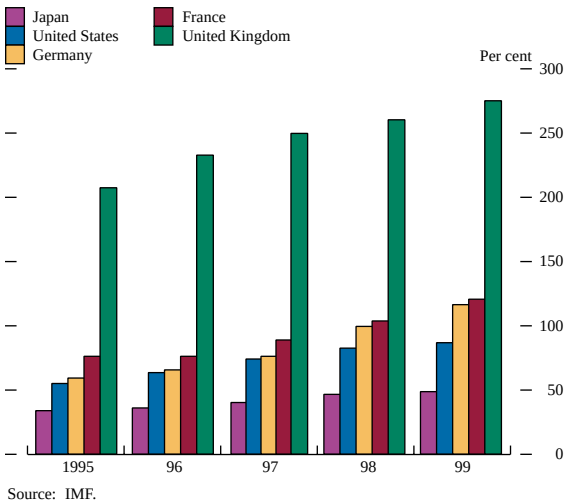
Furthermore, UK external assets and liabilities are very large by international standards. Chart 2 shows international liabilities as a share of GDP for Japan, the United States, Germany, France and the United Kingdom. The chart highlights how much larger UK external liabilities are (as a share of GDP) than for the other major economies.

## Chart 1
## UK gross external assets and liabilities




Source: ONS.

## Chart 2
## Major economies' gross external liabilities as a percentage of GDP




Source: IMF.

With the exception of Japan, there has been a marked rise in external liabilities as a proportion of GDP over the past five years. This would seem to point to a further deepening of international capital markets in the second half of the 1990s despite periods of turbulence. A large current account surplus and a lack of international demand for Japanese assets (as a result of domestic economic weakness and low nominal rates of return) together probably explain the modest increase in Japan's external liabilities. Table B gives the cumulative change in gross external liabilities for each of the major economies over the past five years.

## Table B
## Cumulative changes in external liabilities 1995–99

US$ billions

| | |
|---|---|
| United States | +3,944 |
| United Kingdom | +1,653 |
| Germany | +970 |
| France | +536 |
| Japan | +369 |

### *Net balance sheet position*

At end-1999, the United Kingdom had net external liabilities of £148 billion (some 17% of annual GDP), an increase of £30 billion from end-1998. Although the United Kingdom has had net external liabilities since 1996, this is unusual in recent UK economic history. During the two decades up to 1996, the United Kingdom had net external assets in every year except 1990. However, as Chart 3 shows, since 1993 there has been a steady shift in the balance of external assets and liabilities.

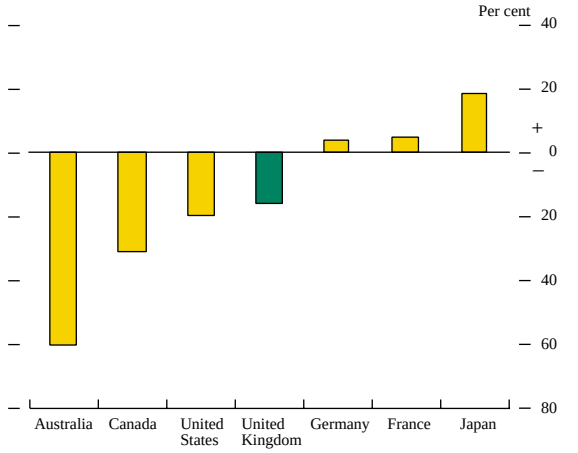
Chart 4 shows the ratio of net external assets to GDP for a number of developed economies. The chart shows that the United Kingdom has a similar net liability position to the United States, but a much smaller net liability position than Canada or Australia. France and Germany have modest, and Japan very large, net external asset positions.

For the United States and Japan, their respective net deficit and surplus positions have been well established since the start of the 1990s. Germany's net asset position has remained fairly stable, while the French position has switched from one of marginal net deficit to a net surplus (see Chart 5).

**Chart 3**
**UK net external balance sheet position**

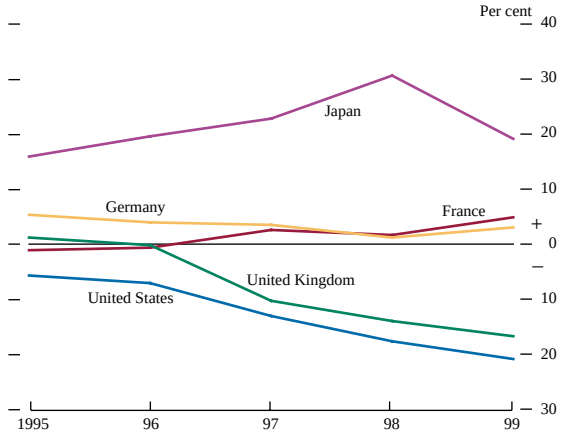

Source: ONS.

**Chart 4**
**International comparison of countries' net external balance sheet positions as a share of GDP (end-1999)**




Source: IMF.

**Chart 5**
**International comparison of countries' net external balance sheet position as a share of GDP**




Source: IMF.

Developments in a country's net external position can often be traced to the evolution of the current account. This is because the financial account (international capital flows that increase or decrease a country's external assets and liabilities) plus the much smaller capital account are the counterpart to the current account.(1) For example, in order to finance a current account deficit, domestic residents take in funds from non-residents or run down external assets, or some combination, and hence their net external liabilities increase.

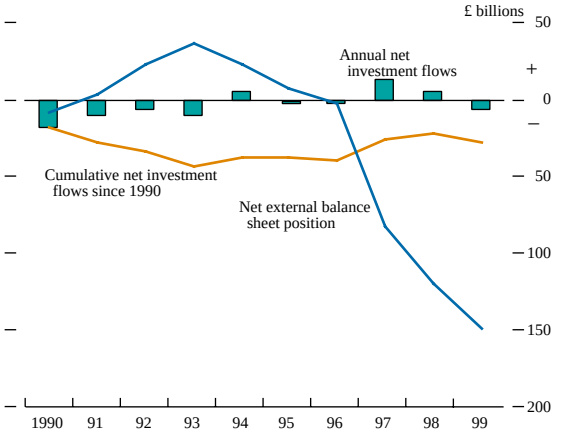
In Germany, there was a cumulative current account deficit of $54 billion in the five years to end-1999, during which Germany's net external asset position fell by $131 billion. In the United States, current account deficits over the period summed to $946 billion. This equates to around half of the $1,741 billion increase in net external liabilities.

For the United Kingdom, the link between the external balance sheet position and the current account position is less clear. The United Kingdom's large current account deficits in the early 1990s led to large net financial inflows to the UK economy (see Chart 6), but the UK net external asset position increased. Since 1993, the UK current account has been fairly close to balance (though there was a current account deficit of £11 billion in 1999), and net financial inflows have been modest. Yet, since 1993, UK net external liabilities have increased by nearly £200 billion. Revaluations—changes in the value of the *stock* of existing assets and liabilities—are therefore the key.

### *Revaluations*

Chart 7 shows changes in the UK net external balance sheet position broken down into international investment flows and revaluations of existing assets and liabilities.(2) The

**Chart 6**
**UK external balance sheet and international financial flows**

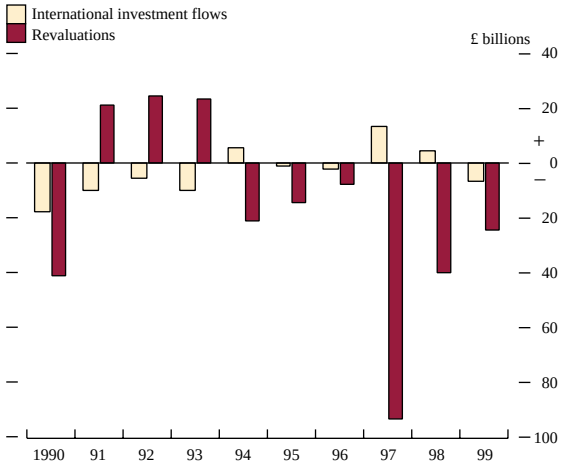



Source: ONS.

(1) In the UK National Accounts, any difference between the financial account and current account is attributed to 'errors and omissions'. Errors and omissions can often be large, highlighting the caution with which all national accounts data should be treated. According to the ONS, errors and omissions are most likely to reflect misreporting of the financial account. For definitions of current, capital and financial accounts, see the glossary on page 364.
(2) Revaluations are determined by residual, ie any change in the gross position not attributable to a financial flow is a 'revaluation'.

chart shows that revaluations have been more important than financial flows in determining the net change in the external balance sheet position in every year of the past decade. Revaluations boosted UK net external assets in 1991, 1992, and 1993, more than offsetting the net financial inflows caused by the current account deficits. In the latter part of the 1990s, revaluations had a strongly negative impact on the net external position.

**Chart 7**
**Changes in UK net external assets**




Source: ONS.

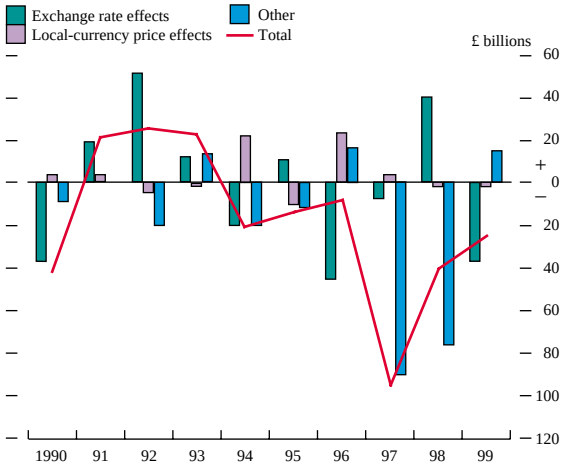
It is possible to decompose revaluations into local-currency price effects, exchange rate effects and other effects. This process is not exact (the 'other' category is a residual and can be substantial). Nevertheless it does give some indication of the relative importance of the factors that have been driving these revaluations.

Chart 8 sets out the Bank's estimates of this decomposition of net revaluations over the past decade. The chart shows how, in the early 1990s, sterling's depreciation led to positive currency revaluations in the UK net external balance sheet. In the latter part of the 1990s, as sterling strengthened, currency revaluations generally had a negative impact on the UK net external balance sheet. For example, in 1996 sterling strengthened by around 10% against both the US dollar and the (synthetic) euro, and in 1999 sterling appreciated by around 12% against the euro (remaining broadly unchanged against the US dollar). In both years the currency revaluations were sharply negative.

This inverse relationship reflects the fact that, with the exception of cross-border banking business, which is broadly exchange rate neutral,(1) the majority of UK external liabilities are denominated in sterling and the majority of UK external assets are denominated in foreign currencies. Other things being equal, a rise in the value of sterling will lead to a fall in the sterling value of foreign currency denominated assets—hence the sterling value of UK external assets falls in relation to the sterling value of the liabilities.

The second type of revaluation shown in Chart 8 is the effect of changes in local-currency asset prices. These made a positive contribution to UK net external assets in 1996, generated by the difference in performance between the domestic and overseas equity markets. The value of UK holdings of overseas equities (predominantly US and continental European equities) rose by more than the value of overseas holdings of UK equities. (The US and major continental equity markets rose by more than 20% in 1996, compared with an increase of 12% for the UK equity market.)

**Chart 8**
**Revaluations of the UK net external asset position**




Source: ONS.

The 'other' valuation category was very large in 1997 and 1998. In 1997, this reflected the finding by the ONS triennial Share Register Survey that substantial non-resident holdings of UK equities had not been included in the estimates for 1995 and 1996. The ONS is aiming to undertake a substantial revision of back-data over the coming year. As a result, the 1995 and 1996 estimates of equity portfolio investment in the United Kingdom are likely to be subject to upward revisions. The cause of the large 'other' effect in 1998 has not yet been identified.

Another way of viewing revaluations is as capital gains on the external assets and liabilities. The box on pages 358–59 looks at rates of returns generated on the external balance sheet, taking into account both investment income earned/paid and capital gains/losses on the balance sheet.

## Disaggregating the external balance sheet

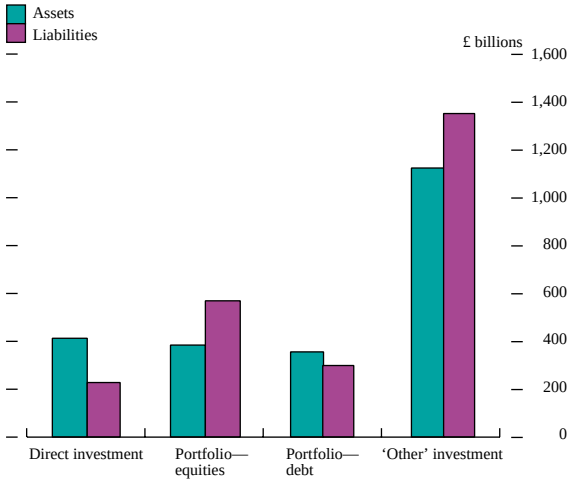
Insights can be gained into the development of the UK external balance sheet by disaggregating the data according to the type of financial instrument used to carry out the investment. Chart 9 shows UK gross external assets and liabilities for the four main types of international investment (for their definitions see the Glossary).

At end-1999, some 18% (£419 billion) of gross UK external assets and some 10% (£243 billion) of gross UK external

(1) See the section on external banking in the United Kingdom on pages 361–63.

liabilities were in direct investment. Portfolio investment accounted for around a third of UK gross external assets and liabilities (£772 billion and £883 billion respectively). For both assets and liabilities, portfolio holdings of equities were larger than portfolio holdings of debt securities. The largest category on both sides of the balance sheet is 'other' investment (largely international banking claims and obligations), which accounted for approximately half of both external assets and liabilities at end-1999 (£1.1 trillion and £1.4 trillion respectively). The final, smallest, category of the UK international investment position is UK reserve assets (not shown in Chart 9), which stood at £22 billion at end-1999.

**Chart 9**
**UK gross external assets and liabilities by instrument type (end-1999)**




Source: ONS.

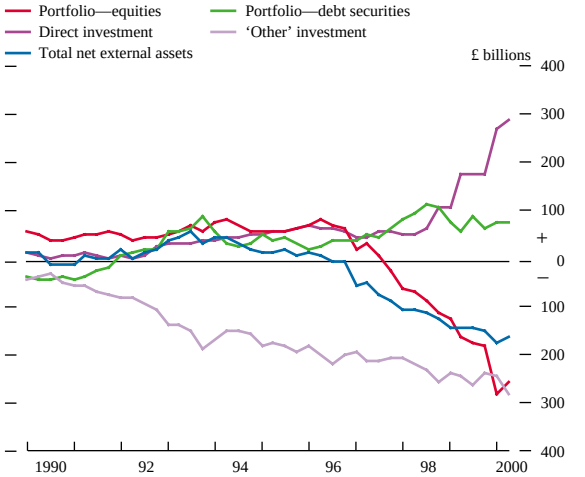
In net terms, the United Kingdom is 'long' direct investment and portfolio holdings of debt securities, but 'short' portfolio holdings of equities and 'other' investment. At end-1999, the United Kingdom had net direct investment assets of £175 billion, net holdings of debt securities of £65 billion, but net equity security liabilities of £176 billion and net 'other' investment liabilities of £235 billion.

As Chart 10 shows, the United Kingdom has had a large and growing net liability position in 'other' investment for a decade. However, this does not, in itself, explain why the UK overall net liability position has increased so markedly over the past four years. Rather, the aggregate movements of the other types of investment are the key. Before 1996, the growth in portfolio plus direct investment offset the decline in the 'other' investment balance. It is only since 1996, when net positions for both groups of instruments have been falling, that the UK net liability position has started to increase rapidly. The analysis below looks first at developments in direct and portfolio investment, before turning to 'other' investment.

### *Direct and portfolio investment*

One of the most interesting trends in the UK net external position is the substantial rise in UK net direct investment abroad to £175 billion at end-1999, and the similar fall in UK net portfolio holdings of overseas equities over the past few years to -£176 billion. These developments have been related and reflect the recent, rapid growth in the value of international mergers and acquisitions activity (M&A).

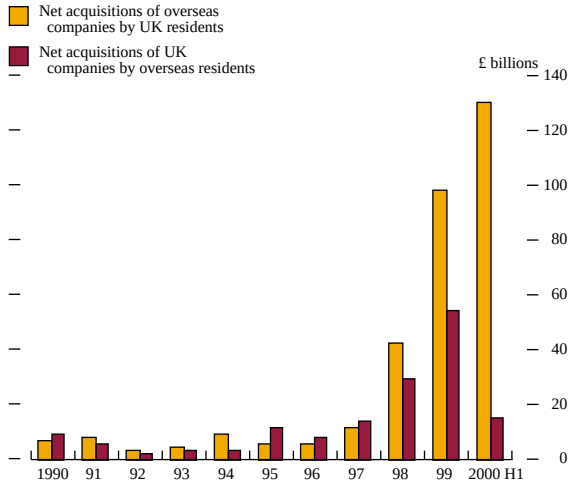
**Chart 10**
**UK net external assets by instrument type**




Source: ONS.

Though the number of mergers and acquisitions has not been unusual, M&A activity by value has grown to record highs in each of the past three years (see Chart 11). Furthermore, UK companies have been particularly acquisitive. UK acquisitions of overseas companies outstripped acquisitions of UK companies by overseas companies by £43 billion in 1999 and a remarkable £115 billion in the first half of 2000. Table C shows a list of the largest international acquisitions involving UK companies over the past two and a half years.

**Chart 11**
**International mergers and acquisitions involving UK companies**




Source: ONS.

International mergers and acquisitions typically affect the external balance sheet in two places. For the United Kingdom, the acquisition of an overseas company is

## Rates of return

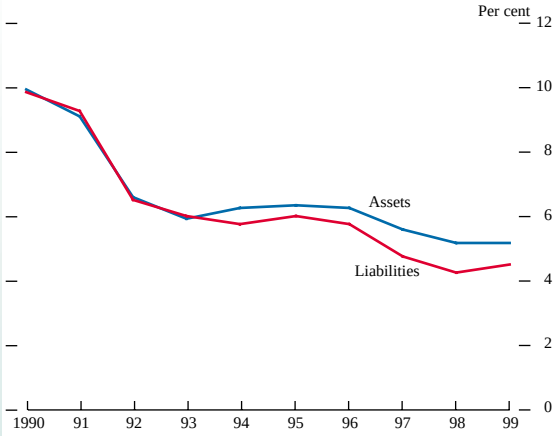
One of the most interesting links in the National Accounts is that between the external balance sheet and the investment income account. The investment income account covers earnings, for example profits, dividends, and interest payments and receipts arising from foreign investment and external financial assets and liabilities. By dividing credits and debits paid on assets/liabilities by the stocks of assets and liabilities, the implied rates of return can be calculated.

In 1999, the United Kingdom earned £109 billion on its overseas assets (unchanged from 1998); given external assets of £2,113 billion at end-1998, this suggests an annual rate of return of 5.2%. Payments abroad on external liabilities rose to £101 billion in 1999 (from £95 billion in 1998); given external liabilities of £2,231 billion, this suggests an annual rate of return of 4.5%. Chart A shows how these nominal rates of return declined over the 1990s as inflation fell in the major economies.

Chart B shows full rates of return on assets and liabilities, which take into account both income received/paid and capital gains/losses on the assets and liabilities during the period. The chart demonstrates that there was no clear pattern over the period. (The spike in returns on liabilities in 1997 reflects a revision to overseas holdings of UK equities in the 1997 Share Register Survey. We calculate that this added 3.8 percentage points to the full rate of return on liabilities, without which it would have been broadly equal to that on assets.)

Returning to 'income only' rates of return, Chart A shows that since 1994 the yield on assets has clearly exceeded that on liabilities. For 1994–97 inclusive, higher returns on direct investment and portfolio investment debt assets relative to liabilities explained the outperformance. In 1998–99 returns on 'other' investment assets moved ahead of those on 'other' investment liabilities to maintain the differential. Income earned on other investment makes up nearly a half of the total income debits and credits included in the current account. In order to examine this item in greater detail it is necessary to focus on the banking sector's external balance sheet.

**Chart A**
**UK external assets and liabilities rates of return (income only)**




Source: ONS.

recorded as direct investment abroad. However, when the purchase is paid for wholly or partly with equity, the acquisition will also boost overseas portfolio holdings of UK equities. The (predominantly) overseas shareholders in the overseas company receive shares in the UK company as payment, and hence have made a portfolio investment in the United Kingdom.(1) Overseas holdings of UK equities will therefore be boosted for as long as overseas investors retain an increased investment in the UK equity market.

As international mergers and acquisitions tend to have an offsetting impact on the two sides of the UK external balance sheet, they boost both *gross* external assets and liabilities, but will not, in themselves, affect the *net* external position. However, differences in the way they are measured mean that they are likely to have an impact on the net position over time. This is because, whereas portfolio investment is recorded at market value and is revalued every quarter, direct investment is recorded at book value and will be revalued only infrequently. Over time, the recorded value of the portfolio investment is likely to exceed the recorded value of the direct investment, and by a growing margin. The fact that direct investment may be under-recorded compared with the rest of the balance sheet is particularly important for the United Kingdom, as it has typically had net direct investment assets (as Chart 10 illustrates).

**Table C**
**Major cross-border acquisitions involving UK companies 1998–2000 H1**(a)

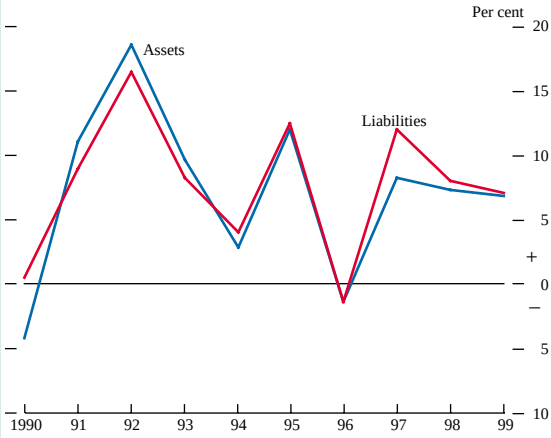
| Acquirer | Acquired | Value (b) £ billions |
|---|---|---|
| **1998** | | |
| BP | Amoco | 33 |
| **1999** | | |
| Zeneca | Astra | 21 |
| Vodafone | Airtouch | 39 |
| BAT | Rothmans Intl BV | 5 |
| Deutsche Telekom | One 2 One | 7 |
| Mannesmann | Orange | 20 |
| Wal-Mart Stores | Asda | 7 |
| **2000 H1** (c) | | |
| Vodafone Airtouch | Mannesmann | 101 |
| BP Amoco | Atlantic Richfield | 18 |

Source: ONS.

(a) Major acquisitions defined as those valued at £5 billion and above. UK companies shown in blue, overseas companies in red.
(b) As reported in the Press.
(c) Deals completed by end-June 2000.

(1) For example, assume the UK company is a wholly UK business, and the German company is a wholly German business. The German shareholders swap a holding in a wholly German business for a holding in a mixed UK/German business which, in the data, shows up as an investment in the United Kingdom.

**Chart B**
**UK external assets and liabilities rates of return (income plus capital gains)**

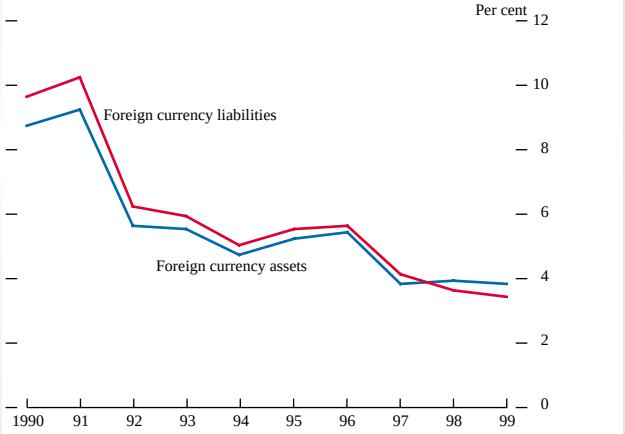



Source: ONS.

At the end of 1999 the UK banking sector had external assets and liabilities of £1,124 billion and £1,215 billion respectively. These levels are close to a half of the total assets and liabilities on the UK external balance sheet. Of the banks' holdings, both assets and liabilities are dominated by 'other' investments—these stood at £841 billion and £1,028 billion at the year-end. Of these other investments, almost 85% of each is made up of foreign currency loans and deposits. The income generated by these foreign currency assets/liabilities accounts for close to 30% of the United Kingdom's total credits/debits on overseas assets and liabilities.

Chart C contrasts the 'income only' rates of return on banks' 'other' investment foreign currency assets and liabilities. It shows that at the start of the decade the yield on liabilities was close to 1 percentage point higher than that on assets. The difference subsequently fell and in 1998–99 the return on assets exceeded that on liabilities.

**Chart C**
**'Other' investment foreign currency assets and liabilities rates of return (income only)**




Source: ONS.

The narrowing and subsequent crossover of rates of return is probably due to the reversal over the decade of the differential between the interest paid by UK borrowers on overseas liabilities and that on claims by UK banks on debtors in the rest of the world.

### *Valuing direct investment*

Previous *Quarterly Bulletin* articles in this series have highlighted the fact that calculating direct investment at market valuation might significantly increase the United Kingdom's net external asset position. The box overleaf discusses the issue of calculating direct investment and updates an early-1990s study for the CSO,(1) aimed at producing estimates of direct investment at market value. The results suggest that, using market values, UK net direct investment assets at end-1999 would increase from £175 billion, perhaps to more than £800 billion. On this basis, the United Kingdom would have total net external assets of more than £450 billion, compared with the net external liabilities of £150 billion on the current valuation measure.

It should be noted that the large increase in the UK net direct investment position over the past three years has been driven by a relatively small number of large UK companies acquiring overseas assets. In future years this pattern could easily be reversed, and the measured direct investment gap could narrow.

### *Overseas holdings of UK equities*

Another (related) trend in the UK external balance sheet is the rising share of the UK equity market held by overseas residents. In 1994, overseas residents held less than 15% (by value) of the total UK equity market. By end-1999, this figure had risen to more than 30%. The most important factor driving this trend has been the pattern of M&A activity described above. A second factor has been the move to UK residency of a number of international, particularly South African, companies. For example, Anglo American, Old Mutual and South African Breweries (total market capitalisation of £26 billion at end-1999) all moved residency from South Africa to the United Kingdom during 1999. These companies have retained, initially at least, a predominantly non-British investor base, boosting measured overseas investment in the UK equity market.(2)

The growth in cross-national holdings of equities can be seen as part of a trend of international investor diversification. For example, European and euro-area equity indices are becoming increasingly popular and institutions are starting to analyse European companies on a sectoral

(1) The CSO was the predecessor to the ONS.
(2) The South African operations of these companies have boosted the stock of outward direct investment from the United Kingdom.

# FDI valuation at market prices

Direct investment is investment that '*adds to, deducts from or acquires a lasting interest in an enterprise operating in an economy other than that of the investor, the investor's purpose being to have an effective voice in the management of the enterprise. An effective voice is taken as equivalent to a holding of 10% or more in the foreign enterprise*'.(1)

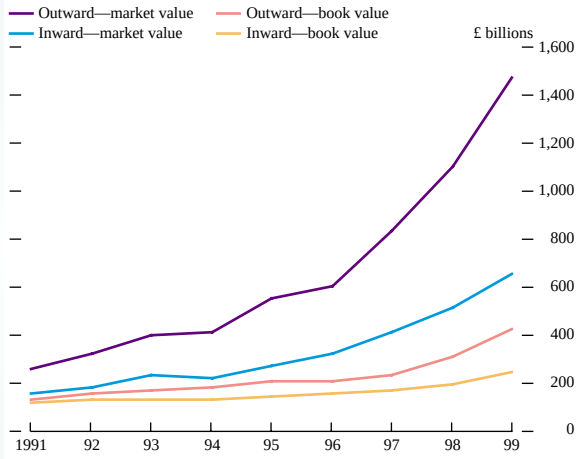
Direct investment is usually more costly to reverse than portfolio investment. This suggests that its determinants will generally be of a longer-term nature than those motivating portfolio investment. The higher relative cost of reversing direct investment suggests that it may provide more information on longer-term trends in international economic integration. The problem is measurement. The ONS Business Monitor states '*The levels of (direct) investment are at book value and these are likely to be significantly different from current market values, as book values tend to reflect values at earlier periods when assets were acquired or subsequently revalued*.'

Below we update a study by Pratten aimed at producing estimates of direct investment at market value.(2) For a fairly large sample of companies (more than 160 in each direction), Pratten used proportions of profits generated domestically and overseas to subdivide market values into domestic and overseas components. These were compared with aggregate book values collected in surveys to derive ratios of the relationship between market and book value. (Pratten estimates that for 1991 the market value of the stock of outward direct investment was 2.05 times book value, and for inward was 1.25 times.)

Repeating Pratten's exercise over a number of years to produce a time series is impractical. We have therefore revalued his estimates forward to 1999 using changes in equity market indices as a proxy for changes in the market value of direct investment stocks. In addition, outward direct investment is adjusted for estimated exchange rate movements.

The chart compares the published book values of direct investment with an estimate of their market values. The chart shows how much higher figures for market value are than book value, and also shows a growing divergence between the two measures during the past four years. For end-1999, the book value of UK direct investment assets is £419 billion, but the market value estimate is £1,473 billion. The corresponding figures for liabilities are £243 billion and £658 billion. As a result, UK net direct investment assets would be more than £800 billion using market values, compared with the published £175 billion for book values.

**UK direct investment: book value and market value estimates**



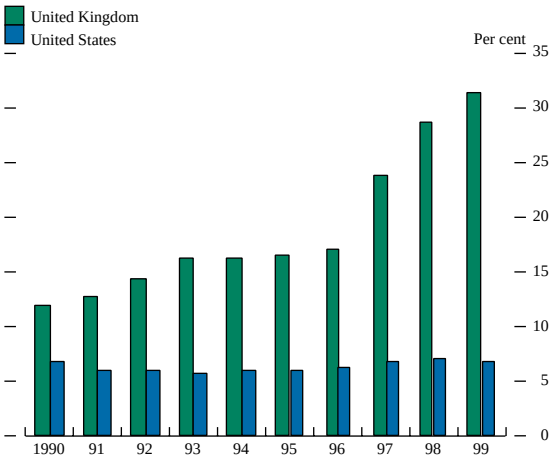

Sources: ONS and Bank of England.

Exchange rate movements are not responsible for the difference between book and market values. Between end-1995 and end-1999, sterling appreciated by 33% against the euro(3) and by 5% against the US dollar, depressing the sterling value of UK direct investment assets relative to liabilities. Rather, it is the very strong growth of equity prices in recent years, and the underperformance of the UK equity market relative to those in some other major economies, that has been key. While the UK market (FTSE 100) rose by 88% between end-1995 and end-1999, the US (S&P 500) and continental European (FTSE Eurotop 100) equity markets rose by 139% and 173% respectively.

(1) ONS Business Monitor MA4 (Overseas direct investment 1998), page 100.
(2) 'The valuation of outward and inward direct investment: a report for the CSO', Pratten, C, Department of Applied Economics, University of Cambridge, 1994. The CSO was the predecessor to the ONS.
(3) A synthetic euro was used for 1996–98.

rather than a national basis. However, the very strong rise in overseas holdings of UK equities over the past decade has not been replicated in the US equity market, for example (see Chart 12).

**Chart 12**
**Non-resident holdings of domestic equities (as share of total market capitalisation)**




Sources: ONS and Board of Governors of the Federal Reserve System: 'Flow of funds accounts of the United States'.

Some have argued that large overseas holdings of domestic equities could be a source of instability for the United Kingdom if, for example, overseas investors lose confidence in the UK economy. However, it is often the case that domestic investors react quickest during a crisis because they tend to have access to better information than overseas investors. Overseas holdings of UK equities also pose a different type of risk from overseas holdings of UK debt securities. This is because, with equity, there is no obligation to service the liability or repay the principal. So falls in the value of equity holdings are less likely to put institutions directly under liquidity pressure, though they can still erode collateral values and increase the cost of capital.

### *'Other' investment*

Though the term 'other' investment suggests a minor, residual category, it is in fact the largest component of the UK external balance sheet. The United Kingdom's 'other' investment assets were £1.1 trillion at end-1999 and other investment liabilities were £1.4 trillion. 'Other' investment is important for financial stability purposes because it includes various types of external bank lending, which are the most liquid forms of investment and can therefore be moved rapidly. Furthermore, financial institutions are especially vulnerable in crises because they are usually highly geared and are often exposed to maturity and other mismatches.

'Other' investment consists of all bank lending and deposits between UK residents and non-resident banks, and between UK banks and non-residents.(1) By far the largest and most important component is the external business of UK banks, which accounted for £1.0 trillion of the United Kingdom's £1.4 trillion total 'other' investment liabilities at end-1999. The UK non-banking sectors had £329 billion of borrowing from overseas banks at end-1999. Of this, around £207 billion was attributable to securities dealers, and £107 billion to other financial institutions, and the corporate and household sectors.

The following section, using additional data published in *Bank of England Monetary and Financial Statistics*, but not published in *The Pink Book*, looks at the international business of the UK banking sector in more detail.

## External banking in the United Kingdom

Deposits by non-residents with UK banks stood at £1,027 billion at end-1999. This total is very large by international standards, and easily exceeds annual UK GDP. For many countries (particularly emerging market economies), similar-sized 'other' investment liabilities (either in absolute terms or relative to GDP) would be considered a significant source of risk. However, for a country with a large financial centre, such as the United Kingdom, the interpretation is less clear, and the financial stability risks depend on the interaction between the international banking business and the domestic financial system.

A comparatively small percentage of UK external banking is carried out in sterling (ie in the domestic currency). At end-1999, non-residents had deposited £167 billion in sterling with UK banks, less than 20% of the UK banking sector's total external borrowing. This is significantly lower than the proportion of deposits denominated in either US dollars or euro.

UK-owned banks carry out a comparatively small proportion of UK external banking business. The United Kingdom is home to offices of hundreds of foreign banks, many of which use London to conduct the majority of their wholesale business. As such, only around 20% (some £200 billion as at end-1999) of the overseas deposits placed with banks in the United Kingdom were placed with UK-owned banks. In comparison, deposits by foreign residents with UK offices of banks from other EU countries were around £400 billion at end-1999, some 40% of the total (see Chart 13).

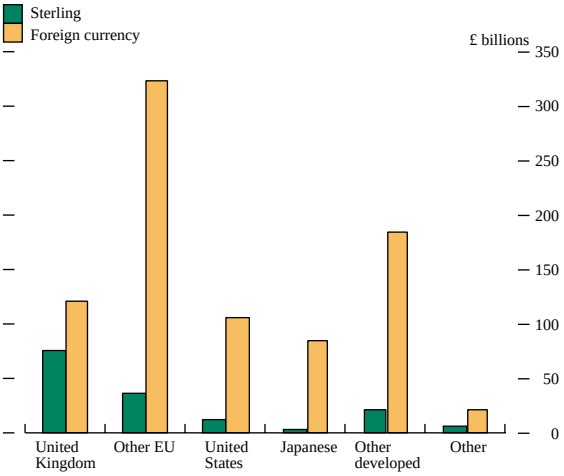
In fact, UK external banking is dominated by transactions between UK offices and non-resident offices of the same institutions. Approximately a half of all deposits by overseas residents with UK banks are placed by non-resident offices of the UK banks in question. A similar percentage of the lending of UK banks abroad is to the banks' non-resident offices.

Given the dominance of international interbank and intra-institution lending in the data, the concept of gross external debt does not seem to be particularly revealing in

(1) Plus corporate-to-corporate trade credit.

terms of the domestic UK economy. International interbank business creates financial risks, but they are as much risks to the international financial system as they are to the national external balance sheet *per se*. Given London's position as a large international financial centre, the Bank of England's financial stability responsibilities require that attention be paid to these international as well as specifically domestic risks. Nevertheless, for the purposes of analysing direct risks to the UK domestic economy from the UK external balance sheet, it is useful to focus on the net borrowing by banks in the United Kingdom from overseas, ie the extent to which UK banks are dependent on non-resident institutions for funds.

**Chart 13**
**External borrowing by UK banking sector; end-1999**




Source: Bank of England.

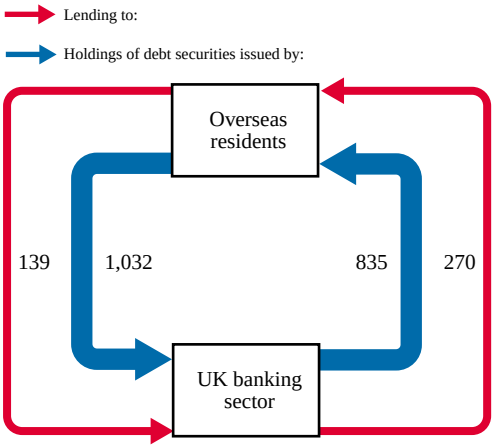
### *Net borrowing*

At end-1999, *net* UK bank borrowing from abroad stood at some £195 billion, accounting for most of the United Kingdom's net liability position in 'other' investment. Of this, some £65 billion was denominated in sterling and £130 billion in foreign currency. However, rather than these funds being used directly in the UK economy, most are redirected abroad. This reflects the fact that banks in the United Kingdom are substantial net borrowers from non-residents, but are also net investors in debt securities issued by non-residents. This is particularly true for foreign currency borrowing.

Including holdings of debt securities (both non-resident holdings of UK bank debt securities and UK banks' holdings of debt securities issued by non-residents), the net debt of the UK banking sector to non-residents was some £70 billion at end-1999, significantly lower than the net *borrowing* total of £195 billion (see Chart 14). Indeed, on this basis, the UK banks had in effect a flat position in foreign currency, with virtually all of the £70 billion net debt position being denominated in sterling.

In effect, the UK banking system is carrying out maturity transformation in foreign currency—taking short-term deposits from abroad and investing the funds in long-term debt securities issued by non-residents. This could potentially expose the banking system to liquidity risk. However, any risks will be mitigated if the bonds held are tradable in deep and liquid markets, and so could be liquidated at little cost.

**Chart 14**
**International assets and liabilities[a] of the UK banking sector; end-1999**




Source: Bank of England.

(a) Debt only.

In contrast, the £70 billion sterling net debt of the UK banking sector can largely be linked to the UK current account deficit (and particularly the deficits of the early 1990s described earlier). This is because UK residents can finance current account deficits either through direct borrowing overseas or indirectly though the domestic banking system. Many smaller firms and households are likely to have limited access to overseas financial markets, so, to the extent that these residents rely primarily on the banking system, the UK banking sector's net borrowing from overseas will rise with the UK current account deficit. Thus the stock of net external bank debt will tend to increase with cumulative current account deficits/surpluses.

Though the concept of external lending is useful for analysing the banking sector, it is as important to assess the banking sector in other ways too. For example, the foreign currency position of the UK banking sector is important irrespective of whether the foreign currency liabilities are to UK residents or non-residents. Taking into account all on balance sheet assets and liabilities, the UK banking sector usually runs a neutral foreign currency position. For example, at end-1999, the UK banking sector had net foreign currency assets of £2.5 billion compared with total foreign currency assets of £1,322 billion.

Of even greater importance for financial stability is the liquidity structure of the banks' balance sheets. If banks have significant short-term liabilities and long-term assets denominated in either sterling or foreign currency, they face the risk of a liquidity squeeze. These risks will be mitigated

to the extent that the banks manage their liquidity prudently.(1)

## Reserves and the public sector

The other key element of the national balance sheet for financial stability purposes is the public sector. Though the United Kingdom has relatively low foreign currency reserves by international comparisons (less than 3% of annual GDP), this is more than offset by the very strong position of the rest of the UK public sector.

The UK public sector has little external debt. Overseas holdings of British government stocks were £55 billion at end-1999, 17% of the total stock of gilts. This ratio is lower than in most other developed economies.

The UK public sector also has little foreign currency debt, just 2.7% of total debt at end-1999 (compared with 3.5% at end-1998). Furthermore, a breakdown of central government liabilities by maturity shows that liabilities of less than one year represent less than a quarter of the total (and largely consist of National Savings obligations). For both sterling and foreign currency, the great majority of gilts have a residual maturity of more than one year, and the average maturity of gilts is around ten years. So the maturity or currency structure of public sector debt is unlikely to be a source of vulnerability.

## Implications for financial stability?

The United Kingdom has seen a sharp increase in its net external liabilities over the past few years, and this article has outlined three factors that help to explain why this has happened. First, current account deficits in the late 1980s and early 1990s led to financial flows into the United Kingdom, primarily via the banking sector. Second, revaluation effects have been particularly important. The weakness of sterling in the early 1990s led to positive revaluations of UK external assets. This partly masked the decrease in UK net external assets accompanying the current account deficits of the late 1980s/early 1990s.

Subsequently, the strength of sterling since 1996 has led to downward revaluations in UK external assets, and so to an increase in net liabilities. Revaluations were also affected by the United Kingdom having become 'short' equities, which have outperformed other forms of investment in recent years. Finally, measurement issues are important. The United Kingdom has large and growing net direct investment assets, but direct investment is recorded at book value—this probably means that UK external assets are now significantly understated.

Given these developments, it is important to assess the financial stability implications of the structure of the UK external balance sheet, and whether it could trigger or exacerbate any adverse shocks. One important feature of the balance sheet is that the United Kingdom is 'long' foreign currency assets and 'short' sterling assets.(2) So a fall in the exchange rate would, all things being equal, tend to *boost* the net external position. So if the exchange rate were to fall because of a portfolio shift away from UK assets, this is unlikely to be exacerbated by fears of increasing UK net external liabilities. This is also the case with an adverse terms of trade shock, which would be likely to lead to a mark-down of UK equities.

Furthermore, the United Kingdom does not, at present, have a problem servicing its net external liabilities (interest/profit/dividends are currently positive—see the box on pages 358–59 on rates of return). But the size of gross assets and liabilities does mean that small changes in portfolio choices can have large effects, speeding up financial account adjustments to any shocks.

The key to the financial stability implications of the UK external balance sheet lies in the banking sector. UK external short-term debt is large, but this reflects the specialisation in international banking activities. Ultimately, the financial stability risks posed by the banking sector depend on the health of the institutions themselves, on their risk management policies and practices, on market discipline, and on official prudential supervision.

(1) Bank liquidity management will be discussed in the December 2000 issue of the Bank's *Financial Stability Review*.
(2) In contrast, many emerging market crisis countries were 'short' foreign currency assets (ie they had net foreign currency liabilities) in the run-up to the 1997–98 crises.

# Glossary

*Balance of payments*: A record of the transactions between the residents of a country and the rest of the world over a specified period of time.

*Capital account*: The account of capital transfers and acquisition/disposal of non-produced, non-financial assets (ie copyrights).

*Current account*: The record of transactions in respect of trade in goods and services, income and current transfers.

*Direct investment*: When residents of one country gain a lasting interest in the activities of a subsidiary or associated company in another country. (Defined in the 1993 *IMF Balance of Payments Manual*, fifth edition, as a stake of 10% or more of the equity capital.)

*Financial account*: The account of transactions in external assets and liabilities, including direct investment, portfolio investment, other investment and reserve assets.

*International investment position*: The record of end-period balance sheet levels of a country's external assets and liabilities.

*Other investment*: All investment other than that defined as portfolio or direct. The major components are deposits and loans.

*Portfolio investment*: Investment in equity and debt securities issued by overseas companies, other than that classed as direct investment, plus equity and debt issued by overseas governments. Debt securities includes bonds and notes, certificates of deposit, commercial paper and Treasury bills.

Sources:
*IMF Balance of Payments Manual* (5th edition)
Office for National Statistics, *The Pink Book* 2000

# Economic models at the Bank of England

*In April 1999, the Bank of England published* Economic models at the Bank of England, *a book that described the economic modelling tools that help the Monetary Policy Committee (MPC) in its work. It was made clear at the time that economic models should not be thought of as fixed in form or content, and that model development is a continual process. An update to the book was published in September 2000 covering model developments over the past 18 months, particularly in relation to the Bank's main macroeconometric modelling tool. The update, while giving details of the core macroeconometric model, also refers to other work within the Bank that has added to the range of models used by the MPC.*

In April 1999, the Bank of England published *Economic models at the Bank of England*, setting out the economic modelling tools that help the Monetary Policy Committee (MPC) in its work. The book included a complete listing of the Bank's core macroeconometric model (MM), and outlined other members of the suite of models used for various aspects of monetary policy analysis. It was made clear at the time that neither the MM nor the other models in use should be thought of as fixed in form or content. Indeed, many aspects of the models are regularly reviewed, and new approaches to modelling aspects of the economy are continually investigated.

An update to *Economic models* was published in September 2000.(1) This provides an update of the changes incorporated into the MM over the past 18 months and a written listing of the MM, to accompany its simultaneous release of the model code in electronic form. It also refers to some other work within the Bank that has added to the range of models in the suite and that is already publicly available.

This note(2) outlines the Bank's modelling philosophy, describes the key features of the MM, highlights the main ways in which the MM has changed since April 1999, and identifies some other relevant modelling work.

## Models, policy analysis and forecasting

The Bank's core macroeconometric model (MM) is the main tool for producing projections of GDP growth and inflation shown in the *Inflation Report*. The MM is built around a number of estimated econometric relationships, but some of the model properties—notably the long-run properties—are imposed in the form of parameter restrictions for theoretical consistency. There is a continual need to evaluate and update various components of the MM. Estimated MM econometric relationships may have broken down or have changed in some way, so that research is required to investigate the causes and to test alternatives that may eventually be incorporated in the MM itself.

The Bank continues to use a range of models. Some provide inputs into the quarterly projections, while others are used to analyse specific policy questions that cannot be handled adequately within the MM. Some research may prove difficult or impossible to incorporate in the MM—for example, it may involve a different level of aggregation. It would then be run in parallel to provide a comparison with MM outputs, or to provide insights into aspects of the economy that the MM cannot address.

Occasionally, specific new policy issues arise that cannot be analysed using the existing framework, and models are set up specifically to examine the key features of the issue at hand. Examples have included the impact of the National Minimum Wage, the implementation of the Working Time Directive, and the assessment of the impact on consumer spending of the windfalls from building society demutualisations. In some cases, a purpose-built model may cease to be of use once the issue it addresses no longer has monetary policy significance. But in other cases the work is incorporated in tools that are used to assess issues of continuing relevance.

Each forecasting round requires assumptions to be made about a wide range of exogenous variables. Auxiliary models are often used to inform these judgments. Some relate, for example, to the world economy or some element of it, such as commodity prices or the level of world trade. For the assessment of world economic activity and inflation,

(1) The book and the September 2000 update are available from the Bank's web site at www.bankofengland.co.uk/modcobook.htm Copies are also available from Publications Group, Bank of England, Threadneedle Street, London, EC2R 8AH; tel 020 7601 4030; fax 020 7601 3298; e-mail: mapublications@bankofengland.co.uk

(2) Based on the introduction to the September 2000 update. Sections 2 and 3 of the update explain the structure of the MM in more detail; Section 4 outlines the changes to the MM; Section 5 discusses the MM simulation properties; and Sections 6 and 7 provide a complete model listing, including diagnostics on estimated equations and data sources.

the MPC uses a model[1] of the world economy provided by the National Institute of Economic and Social Research to help form its judgments. Other models relate to aspects of the domestic economy that are not formally modelled in the MM, but where parameters may be varied or restricted as a result of the auxiliary analysis. In all cases, the assumptions incorporated in any specific forecast are a combination of those suggested by the auxiliary model and the application of the MPC's judgment. Profit margins and house prices are examples of areas where forecast assumptions are influenced by both supplementary modelling and MPC judgment.

Where the Bank does not have the tools to hand for analysing a specific issue, it will seek out the best available analysis from the academic literature or from the research work of other central banks and research institutes. For this reason, Bank staff are encouraged to keep abreast of the relevant academic literature and to contribute to it by publication of working papers,[2] contributions to professional journals, and presenting their work at conferences. The Bank also runs a seminar series, addressed both by outside experts and by internal staff. The general philosophy with which the Bank approaches modelling and forecasting in particular, and monetary policy analysis in general, is one of pluralism and openness.

## General characteristics of the macroeconometric model

The Bank's core macroeconometric model (MM) consists of about 20 key equations determining endogenous variables. There are a further 90 or so identities defining relationships between variables, and there are about 30 exogenous variables whose paths have to be set, as discussed above.

GDP is determined in the short term by the components of aggregate demand—private consumption, investment (including inventory investment), government consumption, and net exports.

In the longer term GDP is determined by supply-side factors, which determine potential output. Domestic firms are modelled as producing a single composite good using an aggregate production function of the Cobb-Douglas form. So output is determined in the long run by evolution of the capital stock, the labour supply and total factor productivity. These variables are assumed to be unaffected by the price level or the inflation rate (so the model exhibits long-run monetary neutrality and super-neutrality).

Price level dynamics and the adjustment of actual output towards potential are broadly determined by the interaction between aggregate demand and supply, augmented by explicit relationships for aspects of wage and price-setting. These relationships are consistent with the view that firms set domestic output prices as a cyclically varying mark-up over unit labour costs. RPIY is determined by an equation linking retail prices to domestic output prices and import prices. Firms are also assumed to determine the level of employment, and real wages are determined by bargaining in an imperfectly competitive labour market. Inflation expectations have an explicit role in wage determination. But price responses are sluggish, so there is slow adjustment towards both real and nominal equilibria.

The appropriate assumptions under which to run the model depend on the exercise at hand. For example, short-run forecasting typically requires different assumptions from those used for long-run simulations, and for either purpose a wide range of alternative assumptions could be made. For the main *Inflation Report* forecasts, nominal short-term interest rates are assumed to be constant over the forecast period, but an alternative is also presented in which rates follow the path implied by market expectations. When using the MM for simulation purposes, the short rate can be set according to a policy rule linking short-term nominal interest rates to the monetary policy target but the nature of this rule can take many different forms. Different exchange rate assumptions can be used in both the construction of projections and for simulations. A range of possible treatments is also available for the evolution of net financial wealth, and for inflation expectations.

A further example of where different assumptions may be used for different purposes relates to government spending. The *Inflation Report* projections incorporate announced government spending plans, but some alternative assumption is needed in longer-term simulations, as spending plans are not announced for more than a few years at a time. In this case, a common assumption is that government consumption growth is fixed either in nominal or real terms.

## Changes to the MM

The main areas of the MM in which changes have been introduced since the *Economic models* book was published in April 1999 are:

- The consumption function now incorporates a new measure of labour income, which includes self-employment incomes (mixed incomes). Gross housing wealth and net financial wealth now have a separate role in the dynamics. And the real (short) interest rate matters in the long run, while nominal short rates affect the dynamics.

- There is a new equation for house prices, which depend on average earnings and the long real rate in the long run, while GDP enters the dynamics (in addition to earnings).

(1) The National Institute Global Economic Model (NiGEM).
(2) A list of recent working papers is provided on pages 425–26. A full list is available on the Bank's web site at www.bankofengland.co.uk/workingpapers/index.htm, where abstracts of all papers may also be found. Papers published since January 1997 are available in full in PDF format.

- Both export and import equations have been modified as a result of estimation on new data, the main effect being to lower slightly the relative price elasticities.

- RPIY is determined by a modified relationship that weights domestic and import prices.

In addition, there are other small modifications resulting from data revisions and definitional changes affecting the capital stock, investment, trade prices, earnings, employment, non-labour income and the GDP deflator. There are minor changes to the treatment of value-added tax and special duties (affecting the link from RPIY to RPIX), and a new equation for the government expenditure deflator has been introduced.

The simulation properties of the MM, in terms of both timing and scale of responses, have not been affected substantially by the recent changes. For example, an unanticipated change in the short-term interest rate for four quarters still has its maximum impact on inflation after about nine quarters, and the order of magnitude is similar to that shown in the book. The current MM suggests that unanticipated changes in interest rates have a slightly faster impact on real GDP than previously, with the peak impact being felt after four rather than five quarters. The size of the impact is comparable with the earlier version of the MM.

## Other models added to the suite

There has been a large amount of work within the Bank of England over the past two years designed to throw light on specific monetary policy related issues. Some of this research feeds into the background analysis prepared as input to the quarterly forecasting round, while other work feeds into monthly briefings to highlight specific issues on an *ad hoc* basis. Specific examples can be found in the papers published in the Bank's working paper series; a selection of such research is highlighted here.

- A series of papers has investigated the impact of model uncertainty on actual and optimal monetary policy.(1)

- Further work using structural vector autoregressions has been done. One example was aimed at identifying monetary policy shocks from the many other shocks that hit the economy, by imposing *a priori* restrictions.(2) Another example used related methods to investigate the empirical relationship between different measures of 'gaps' (output, employment, and capacity utilisation) by the imposition of restrictions implied by economic theory.(3)

- Small-scale aggregated models have also been used to investigate the relationship between optimal monetary policy and inflation projections.(4)

- Optimising models have been used to investigate several issues of relevance to monetary policy. For example, one model has been used to investigate the determinants of the changing behaviour of mark-ups over time.(5) Another paper has examined the potential impact of the labour market reforms of the 1980s on the wage-setting and employment decisions of firms.(6)

- Further work has been done on Phillips curve type models; this work may be published in due course.

- There has also been considerable work on developing tools for extracting and interpreting information from financial markets, for example about interest rate and inflation expectations.(7)

(1) Hall, Salmon, Yates and Batini (1999), 'Uncertainty and simple monetary policy rules—an illustration for the United Kingdom', *Bank of England Working Paper*, No 96; Martin and Salmon (1999), 'Should uncertain monetary policy-makers do less?', *Bank of England Working Paper*, No 99; and Martin (1999), 'Caution and gradualism in monetary policy under uncertainty', *Bank of England Working Paper*, No 105.
(2) Dhar, Pain and Thomas (2000), 'A small structural empirical model of the UK monetary transmission mechanism', *Bank of England Working Paper*, No 113.
(3) Astley and Yates (1999), 'Inflation and real disequilibria', *Bank of England Working Paper*, No 103. (This paper was referred to in the April 1999 book, but was published subsequently.)
(4) Batini and Nelson (2000), 'Optimal horizons for inflation targeting', *Bank of England Working Paper*, No 119.
(5) Britton, Larsen and Small (2000), 'Imperfect competition and the dynamics of mark-ups', *Bank of England Working Paper*, No 110.
(6) Millard (2000), 'The effects of increased labour market flexibility in the United Kingdom: theory and practice', *Bank of England Working Paper*, No 109.
(7) Anderson and Sleath (1999), 'New estimates of the UK real and nominal yield curves', *Bank of England Quarterly Bulletin*, November, pages 384–92; Clews, Panigirtzoglou and Proudman (2000), 'Recent developments in extracting information from options markets', *Bank of England Quarterly Bulletin*, February, pages 50–60; and Bliss and Panigirtzoglou (2000), 'Testing the stability of implied probability density functions', *Bank of England Working Paper*, No 114.

# International financial crises and public policy: some welfare analysis

By Michael Chui, Prasanna Gai and Andy Haldane of the Bank's International Finance Division.

*This article describes a model of financial crisis and explores its implications for public policy. The framework nests the key features of earlier models but is better able to address international architecture questions in a welfare setting. In particular, this framework is used to assess the welfare costs of creditor coordination failure and several recent public policy proposals on reforming the international financial architecture. The costs of creditor coordination failures are found to be high. But policies that improve sovereign liquidity management or that stall creditor runs—such as payments standstills—can mitigate these costs.*

## Introduction

During the 1990s, a number of emerging market economies experienced well-publicised financial crises: Mexico in 1994/95; South East Asia during 1997; Russia in 1998; and, most recently, Brazil in 1999. On some estimates, the frequency of financial crisis has increased since the 1980s. For example, the World Bank documents 69 instances of 'systemic' crisis since the late 1970s.(1) These crises have afflicted developed and developing countries alike.

There have been a number of recent attempts to measure the output costs of these crises—either the direct fiscal costs (such as the cost of recapitalising banks), or the indirect opportunity costs (of below-trend growth) associated with crisis. These cost estimates are large, often lying between 10% and 20% of annual pre-crisis GDP. The GDP contractions are also often protracted, averaging—on some estimates—more than four years for industrial countries and around three years for emerging economies.(2)

The cost and frequency of financial crises suggests that crisis prevention and crisis resolution are major international public policy concerns. In recent years, this has been reflected in a debate on what has become known as the reform of the 'international financial architecture'.(3) There are many facets of this debate. What are the causes of financial crisis? What public policy measures best address these frictions? And what are the welfare implications of crisis and of different approaches to dealing with them?

Rigorous answers to such questions require an analytical evaluation of the determinants of crises and a quantitative assessment of the welfare implications of policy measures to resolve them. In the next section, some existing analytical models of financial crisis are outlined. The subsequent section sketches an alternative model, which builds on earlier models but which is better able to assess the welfare implications of crisis and public policy intervention.(4) We then assess, from a welfare perspective, various recently proposed public policy measures for averting or resolving crises, including improved sovereign liquidity management and better data disclosure.(5) A final section suggests some research avenues for the future.

## Models of financial crisis

Broadly speaking, there have until recently been two strands of the literature on financial crises.(6) Both have tended to focus on models of currency crisis, though the same framework can often be applied generically to liquidity crises in any financial market.

'First-generation' models were motivated by the financial crises of the late 1970s and 1980s, in particular in Latin America. These crises were often preceded by over-expansive macroeconomic (in particular fiscal) policies, which eventually served to prompt the collapse of an exchange rate peg. First-generation models provided an analytical foundation for this phenomenon.(7) In these models, the actual and expected deterioration of fundamentals—say, domestic credit expansion—*pushes* an economy into crisis. Macroeconomic policy in the medium term is inconsistent with maintaining the peg. And with rational expectations about these fundamentals among atomistic investors, the currency collapse is anticipated and so brought forward to today.

(1) See Caprio and Klingebiel (1996, 1999).
(2) For example, Hoggarth, Reis and Saporta (2001), and IMF (1998).
(3) For a summary evaluation, see, for example, Eichengreen (1999).
(4) This draws on Chui, Gai and Haldane (2000).
(5) Drage and Mann (1999) provide a summary of the many recent public policy initiatives aimed at reforming the international financial architecture.
(6) See Flood and Marion (1998).
(7) For example, Krugman (1979), and Flood and Garber (1984).

Such models provide a set of fairly conventional policy recommendations. The best way of lowering the probability of crisis is to pursue prudent monetary and fiscal policies. This policy prescription has clearly been taken on board by many national authorities and the international financial institutions over the past two decades. It is questionable, however, whether monetary and fiscal prudence is a *sufficient* condition to avert a currency collapse, even if it is a *necessary* one. For example, the Asian crisis countries had, in the main, pursued a course of monetary and fiscal prudence ahead of their recent problems. Broader sets of 'fundamentals'—embracing micro-prudential as well as macroeconomic policies—might also need to be included to make sense of these crises.

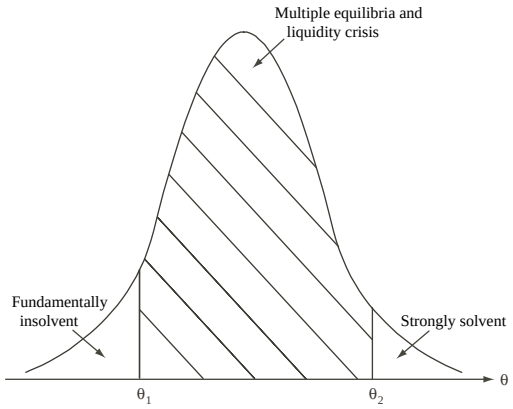
A second strand of the crisis literature—'second-generation' models—suggests that fundamentals, on any definition, may be neither sufficient nor indeed necessary conditions to determine the likelihood of a crisis.(1) According to second-generation models, crises can occur even with robust fundamentals. The crisis mechanism is instead a coordination failure among creditors, whose expectations and actions are affected importantly by the actions of other creditors. In other words, creditors behave strategically rather than atomistically. If some random event is sufficient to alter adversely these collective expectations, then they can become self-fulfilling. In this way, an economy can be *pulled* into crisis by the actions of fleeing creditors, independently of fundamentals. An economy can be subject to a 'run' in much the same way as a bank. Because countries can be driven into crisis independently of fundamentals, these types of models admit multiple equilibria. There is a range of fundamentals over which an economy is susceptible to liquidity crisis.

There are at least two problems with models of this second-generation variety. First, they are silent on precisely why and when a crisis might strike. The trigger for crisis is a random, unpredictable event—a 'sunspot'. This hinders public policy analysis somewhat because it is difficult for these models to determine what policy measures might best be put in place to avert crisis. Second, with multiple equilibria, it is difficult to conduct meaningful welfare analysis of crisis or of public policy measures to resolve crisis, because equilibrium is not precisely identified.

The two generations of crisis model can be illustrated schematically in a diagram, as in Chart 1. The parameter $\theta$ is a summary measure of fundamentals, which are assumed to be random and normally distributed. Below $\theta_1$, the economy is assumed to be 'fundamentally insolvent'. So the zone to the left of $\theta_1$ defines the range of fundamentals over which the economy might be subject to a first-generation crisis, with $\theta_1$ the trigger value for such a crisis. It is the zone of *solvency* or *fundamentals-based* crisis.

The area to the right of $\theta_2$ defines the range of fundamentals over which the economy is solvent irrespective of investors' expectations—the economy is 'strongly solvent' in that it can withstand a run. Between $\theta_1$ and $\theta_2$ lies the range of fundamentals within which self-fulfilling expectations might result in crisis, even though the economy's fundamentals by themselves suggest solvency. With fundamentals in the range $\{\theta_1, \theta_2\}$, an economy is susceptible to *liquidity* or *beliefs-based* (rather than solvency or fundamentals-based) crisis. The fact that this is a range reflects the possibility of multiple equilibria.

**Chart 1**
**A classification of fundamentals**




Most recently, a 'third generation' of crisis models has emerged.(2) These aim to mitigate some of the problems of the first two generations of crisis model outlined above. For example, some third-generation models define fundamentals more broadly, to include micro-prudential policies. Accordingly, they allow explicitly for a banking and/or corporate sector, which is subject to frictions such as moral hazard induced by government guarantees. Other models allow for an explicit interaction between fundamentals and beliefs, so that crises can be partly fundamentals-based and partly beliefs-based, rather than one or other in isolation. Most of these models still result in multiple equilibria, which limits their usefulness for policy analysis. By making different informational assumptions, however, some recent crisis models are able to resolve this problem.(3) Using the same informational assumptions, the model developed below has a unique equilibrium and so is more amenable to policy analysis, while at the same time embracing some of the key features of third-generation models.

## An alternative model of crisis

We sketch a model of sovereign liquidity crisis that builds on the insights of earlier models, but which addresses specific questions in the architecture debate.(4) There are assumed to be two sets of agent: a single debtor, and a set of creditors that is large in number. The debtor can be thought of as a sovereign borrower (in an emerging market economy) and the creditors a set of international lenders.

(1) For example, Obstfeld (1996).
(2) For example, Krugman (1999), and Chang and Velasco (1999).
(3) See Morris and Shin (1998).
(4) Technical details of the model are given in Chui *et al* (*op cit*).

The debtor invests in an investment project that takes two periods to complete. The project is financed from the debtor's own resource endowment (illiquid assets, $E$) and from foreign borrowing ($L$). Both of these inputs are fixed prior to the investment project commencing. The returns to the investment project depend on the factor inputs ($E$ and $L$) and on the outcome of some random productivity shock. Since productivity is the only random fundamental factor in the model, we denote it $\theta$, as in Chart 1. So gross income from the project ($y$) is given by:

$$y = \theta (E + L) \qquad \textbf{(1)}$$

Creditors in the model lend to the debtor at an interest rate of $r_L$. The debt contract between the debtor and creditors is assumed to take a particular form. Specifically, it gives creditors the option to withdraw their funds after one period—that is, before the investment project is completed. In other words, the project is financed with short-term loans that need to be rolled over. If creditors choose to exercise their option and refuse to rollover their loan ('flee'), they face an exit cost, $c$. If creditors choose to stay for the full two periods ('stay'), then they receive repayment with interest if the debtor is solvent ('repay'), but nothing if the debtor is insolvent and forced to 'default'. The payoff matrix for each representative creditor under the four possible scenarios is shown in Table A.

**Table A**
**Payoff matrix for creditors**

| | | | Debtor action | |
|---|---|---|---|---|
| | | Time of payoff | 'repay' | 'default' |
| Creditor action | 'flee' | Stage 1 | $L(1-c)$ | $L(1-c)$ |
| | 'stay' | Stage 2 | $L(1+r_L)$ | 0 |

Some of the assumptions underlying this model are worth emphasising because they are important to the outcome of the debtor/creditor game. First, the quantum of foreign lending is fixed up front, together with the other endowments. Second, the model assumes that the monies leaving the project when creditors flee cannot be replaced; there is no secondary market in the debt contracts. Third, the model assumes that the debtor does not default strategically, so will repay if able to do so.(1)

In the model, the debtor's ability to pay depends on the returns to the investment project. This, in turn, depends crucially on two factors: the outcome for the productivity shock, $\theta$; and the proportion of creditors that flee at the intermediate stage, denoted $\lambda$. In the event of creditors fleeing, the debtor meets these payments by drawing down its liquid reserve assets, $A$.(2) But fleeing also causes disruption to the investment project. This can be thought to be the cost of prematurely liquidating the investment project—a half-built bridge or abandoned factory. The marginal cost of this disruption is denoted $k$. So the solvency constraint facing the debtor at the end of the game, which determines the ability to repay, is:

$$\theta (E + L) - k \lambda L + (1 + r_A)(A - \lambda L) \geq (1 - \lambda) L (1 + r_L) \qquad \textbf{(2)}$$

The left-hand side of equation **(2)** defines the debtor's return on the project at the end of period two, while the right-hand side defines the debtor's debt repayments. Default will only occur when the inequality in equation **(2)** is violated, namely when gross repayments exceed gross income.

We can also use the solvency constraint in equation **(2)** to determine the regions of 'fundamental insolvency' (below $\theta_1$) and 'strong solvency' (above $\theta_2$, where the debtor is solvent irrespective of creditors' expectations and actions), as defined in Chart 1. For example, the trigger value for 'fundamental insolvency', $\theta_1$, is given by:

$$\theta_1 = [(1 + r_L) L - (1 + r_A) A] (E + L)^{-1} \qquad \textbf{(3)}$$

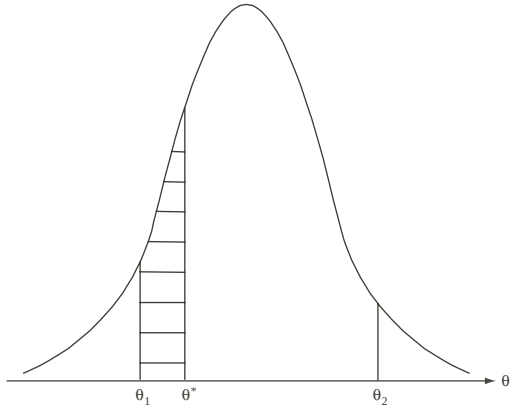
In essence, this insolvency trigger is determined by the debtor's gross gearing and gross reserve asset ratios—or, more generally, by the debtor's net liquidity position. This underlines the importance of adequate liquidity management by borrowers, which is discussed as a public policy measure below.

If we assume that the debtor and creditors all have the same information on the random fundamental, $\theta$, then this model is simply a hybrid first/second-generation model. Below $\theta_1$ the economy behaves as in first-generation models. Between $\theta_1$ and $\theta_2$ the economy behaves as in a second-generation model: there are multiple equilibria and even fundamentally solvent borrowers can be driven to default by a beliefs-based crisis resulting from a creditor coordination failure. Because of this multiplicity of equilibria, the model with perfect information about fundamentals across creditors cannot reach very precise welfare conclusions.

But a slight modification of the basic model helps to sharpen these conclusions. Specifically, assume instead that there is *imperfect* information across creditors about the state of fundamentals. This seems to be a reasonable assumption because in practice common knowledge across creditors is unlikely. With imperfect information across creditors, the model has a unique equilibrium within the fundamentals range $\{\theta_1, \theta_2\}$.(3) Creditors' views converge on a particular equilibrium $\theta^*$. The result is illustrated in Chart 2. Here $\theta^*$ denotes the unique value for fundamentals at which crisis is triggered. This lies above $\theta_1$, the value at which a fundamentals-based solvency problem would occur. So the shaded area between $\theta^*$ and $\theta_1$ defines the zone where beliefs-based liquidity crises strike.

(1) A different strand of the literature considers the effects of strategic sovereign default (see Eaton, Gersovitz and Stiglitz (1986))—willingness rather than ability to pay.
(2) Which pay a rate of interest $r_A$.
(3) See Morris and Shin (1998) for a general derivation, and Chui *et al* in the context of the model presented here.

**Chart 2**
**Unique equilibrium**




The framework combines elements of beliefs and fundamentals-based crises. Indeed, expectations and fundamentals are not independent, but instead now interact in important ways. For example, the probability of pessimistic investor expectations becoming self-fulfilling is greater, the weaker is the state of fundamentals. So an economy is more susceptible to a creditor run—is more financially fragile—the weaker the underlying macroeconomic outlook. Crises are not the product of poor fundamentals or pessimistic expectations, but a subtle interaction of the two. This better squares with the evidence from recent crises, where both fundamentals and expectations seem to have played a role.(1) It also means that we are better able to define the types of shock that might trigger creditor runs in the first place; they are no longer unpredictable 'sunspots'.

This type of framework also allows us to address public policy questions. For example, it allows us to assess the welfare costs to the debtor of creditor coordination problems. This welfare loss is based on expected income and is related directly to the shaded zone in Chart 2, where beliefs-based crises operate. The model also allows us to assess the welfare implications of different public policy measures, and to decompose these welfare effects into their impact on the probability of a fundamentals-driven (first-generation) crisis and of a beliefs-driven (second-generation) crisis. Specifically, the effect on welfare ($W$) of a policy change can be decomposed thus:

$$W - W' = \alpha\,[(\theta^{*\prime} - \theta^{*}) - (\theta_1' - \theta_1)] \qquad \textbf{(4)}$$

where ' denotes values of parameters after the policy change.(2) The first term on the right-hand side of equation **(4)** quantifies the impact of the policy change on the probability of a beliefs-based liquidity crisis, and the second term the impact on the probability of a fundamentals-based solvency crisis. The model thus nests both types of welfare friction and allows a decomposition of their effects.

## Public policy proposals

In this section we attempt a quantification of the welfare effects of various policy measures, using illustrative values of the model's parameters. Clearly any precise quantification of costs is difficult, as welfare effects are sensitive to the parameterisation of the model. Nevertheless, some broad conclusions can be reached.

### *The welfare costs of creditor coordination failures*

The welfare costs depends importantly on the parameter $k$, which measures the marginal disruption cost of creditor runs. This parameter is difficult to gauge, so we consider a range of values. When $k = 0.06$—that is, every dollar withdrawn by creditors reduces the return on investment by 6 cents—the welfare costs of creditor coordination failure are around 10% of *ex ante* income, taking illustrative values of the other parameters. If $k = 0.4$, the welfare cost rises to 66% of *ex ante* output. These costs are non-trivial. Although difficult to pin down precisely, they suggest that the welfare effects of creditor coordination failures are significant. Policy measures that reduce creditor panics are potentially valuable from a welfare standpoint.

One possible proposal in this regard is for countries to establish 'country clubs'. These are standing committees of creditors that might serve as a coordination device for creditors' actions. They can also be used to share information between the debtor and creditors and among creditors themselves. The official sector has recently supported the introduction of country clubs by emerging market borrowers.(3) If these helped creditor coordination problems, they could deliver a potentially significant welfare benefit according to the model.

### *Sovereign liquidity management*

A number of theoretical models are based on the belief that (lack of) foreign currency liquidity played a key role in the genesis and propagation of recent financial crises.(4) In parallel work, a number of recent empirical studies have shown that various measures of foreign currency liquidity serve as a good in-sample predictor of crisis—as good, in fact, as most other macroeconomic variables.(5)
Policy-makers have also recently emphasised the importance of prudent liquidity management in averting crisis. The G22 working group on strengthening financial systems, which reported in October 1998, and the recent Financial Stability Forum working group on capital flows, which reported in March 2000, both proposed a risk-management framework for national balance sheet monitoring and management. More specifically, Greenspan (1999) has proposed that, as a rule of thumb, countries should hold enough foreign exchange reserves to cover a year's maturing foreign currency obligations.

(1) For example, Fischer (1999).
(2) See Chui *et al* for a derivation.
(3) For example, the communique by G20 Finance Ministers and Central Bank Governors, October 2000.
(4) For example, Chang and Velasco (1999).
(5) For example, Berg and Pattillo (1999), and Bussiere and Mulder (1999).

To illustrate the point, Table B considers the ratio of short-term debt (with a residual maturity of one year or less) to foreign exchange reserves for a selection of countries that have recently experienced crisis. The ratio is shown on two dates, immediately prior to crisis and at the end of 1999. It is striking that, for each of these countries, the short-term debt/reserves ratio stood at or above one—sometimes considerably so—immediately prior to crisis. Inadequate foreign currency liquidity was a harbinger of currency and in some cases banking crisis. Looking at the ratios more recently, a number of countries, most notably Korea, have clearly made considerable efforts to improve their net liquid foreign currency position, most often by stockpiling reserves. There has been active management of foreign currency liquidity.

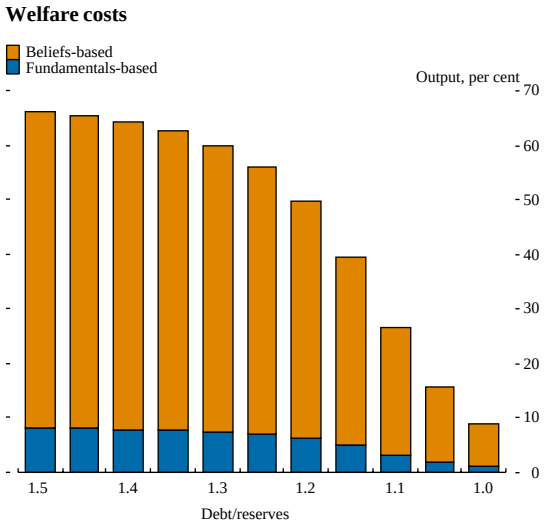
**Table B**
**Short-term debt/reserves ratio for crisis countries**

| | Before crisis | End-1999 |
|---|---|---|
| Mexico | 5.00 | 0.74 |
| Korea | 1.96 | 0.25 |
| Thailand | 1.18 | 0.41 |
| Indonesia | 1.75 | 0.70 |
| Russia | 1.47 | 0.88 |
| Brazil | 0.91 | 0.95 |

Sources: BIS and national sources.

The model underlines the importance of these policies in mitigating the costs of crisis.(1) In the model, a lower ratio of short-term debt to reserves has a dual effect. It improves fundamentals, because the trigger for solvency crisis depends importantly on net liquidity. It also reduces the probability of beliefs-based crises, however, by positively shaping expectations of eventual repayment. Chart 3 decomposes the welfare benefits of an improvement in the debt/reserves ratio into these two components. It suggests two conclusions.

**Chart 3**
**Welfare effects of changes in the debt/reserves ratio**




First, the welfare benefits of even relatively modest improvements in the debt/reserves ratio can be sizable. For example, lowering the ratio from 1.5 (around its level for some of the countries in Table B before their crisis) to around 1.0 (as suggested by Greenspan) lowers welfare costs significantly, by a factor of around seven.(2) Second, most of this welfare gain derives from a fall in the probability of beliefs-based crisis. So, naturally enough, improvements in liquidity management serve to reduce significantly the risk of a liquidity run. This would seem to help explain the importance attached to sound country liquidity management by policy-makers in recent years; and why central banks and supervisory agencies more generally have for many years emphasised prudent liquidity management by banks.

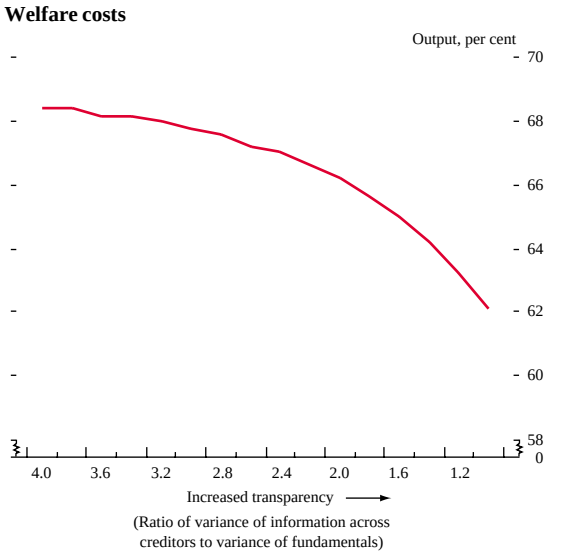
### *Data disclosure and transparency*

Improved information provision and transparency have been at the heart of recent attempts to improve the international financial architecture. The G22 working group on transparency and accountability published its report in October 1998. And since then there have been significant strides forward: through the IMF's Special Data Dissemination Standard (SDDS); through codes of transparency for monetary, fiscal and financial policies; through pilot publication of IMF Article IV country reports; and, most recently, through pilot Reports on the Observance of Standards and Codes (ROSCs).(3)

But how do improvements in data availability and transparency affect the welfare costs of crisis? Chart 4 plots these welfare costs against the degree of informational imperfection across creditors—one obvious measure of transparency.(4) The effect of reducing informational imperfections across creditors is to raise welfare. In the stylised example, doubling the precision of creditor information (relative to fundamentals) succeeds in reducing the expected output loss. But the effects are small. Transparency helps, but is no panacea for financial crisis in the model. The point here is a general one. If crisis is rooted in a coordination failure, greater information provision, by itself, need not increase the probability of coordination and hence reduce the probability of crisis.(5) Turning on the lights will not necessarily stop creditors running for the door. Indeed, in theory, transparency could even hasten their exit. When there is perfect information across creditors, we are back to the multiple equilibria, second-generation world described earlier. This set-up can deliver outcomes that may be worse, in a welfare sense, than

(1) The model does not distinguish between domestic and foreign currency liquidity. But if we interpret the debtor as a sovereign and the creditors as foreign lenders, then liquidity is most naturally thought to be foreign currency denominated.
(2) The precise size of the welfare cost depends on the parameterisation of the model. In Chart 3, we set $k = 0.4$.
(3) See King (1999).
(4) More precisely, it takes as the transparency measure the ratio of the variance of information across creditors to the variance of fundamentals.
(5) See Morris and Shin (1999).

**Chart 4**
**Welfare effects of transparency**




the model with informational imperfections. So, in general, policies seeking greater information disclosure are unlikely, by themselves, to be decisive in averting sovereign liquidity crises induced by creditor coordination failure. Different models and/or different definitions of transparency might, however, deliver a different answer.

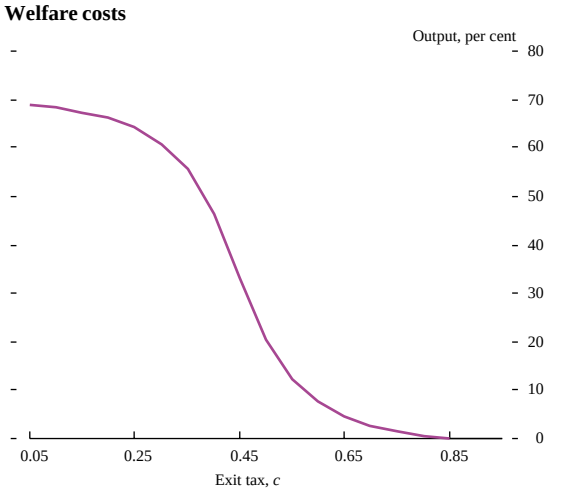
### *Capital controls and payments suspensions*

There is an active public policy debate about the efficacy of capital controls.(1) Most of this debate has focused on the effects of imposing restrictions or taxes on capital *in*flows as a means of pre-empting potential liquidity crises, or imposing an orderly queue of otherwise indigestibly large inflows. Chile has operated controls of this type.(2) Among academics, the jury is still out on the usefulness of these types of control. There has been rather less academic and official sector support for controls on capital *out*flows in the face of a liquidity crisis. Payments suspensions, or standstills, can be thought to be the limiting case of controls on capital outflow, where the effective tax rate is unity ($c = 1$). There has been some recent discussion of the case for international payments suspensions, in both academic and official circles.(3) Some have argued that standstills can play a useful role in mitigating the effects of creditor panics.

So can controls on capital outflow—and, in the limiting case, payments standstills—be potentially welfare-enhancing? The model can provide only partial answers to this question, because it does not consider the effects of controls on the initial lending decision nor other potential spillover effects of controls.(4) The model does, however, capture the potential merits of controls in stemming a creditor panic once it has taken hold. In these circumstances, controls or standstills can enforce creditor coordination through quantitative restrictions on portfolio behaviour.

Chart 5 shows the effect on the welfare costs of crisis of changes in the exit tax, $c$, for a given parameterisation of the model. Small values of the exit tax deliver only small welfare benefits. At high values of the exit tax, however, the welfare gains become substantial. A payments standstill ($c = 1$) completely offsets the *ex post* welfare costs of coordination failure (in this example equal to around two thirds of *ex ante* output). While these quantitative estimates need to be interpreted cautiously, the qualitative implications of the model—that taxes on outflows or payments suspensions can be useful in mitigating the coordination costs of creditor panics—is clear-cut. There is more work to be done on whether the potential (*ex ante* and *ex post*) spillover costs of standstills could offset these benefits.(5)

**Chart 5**
**Welfare effects of exit taxes**




## Conclusions

Analytical models can be useful in assessing public policy means of preventing and resolving crisis. They allow quantified, welfare-based policy analysis. We have outlined one particular model of crisis and used it to explore the welfare costs of crisis and the implications of certain policy measures to resolve crisis. The results of this exercise are only as robust as the model from which they are drawn. But that is of course true of all public policy analysis. The merits of the model outlined are that it is spelt out explicitly, builds on existing models of crisis and, as a result, nests their most important features.

(1) See, for example, Cooper (1999).
(2) See, for example, Edwards (1998).
(3) See Eichengreen (2000) and Gai, Hayes and Shin (2000) on the former, and IMF (2000) and Clementi (2000) on the latter.
(4) Gai *et al* (*op cit*) consider this issue in the context of a model of standstills. They find that, although standstills may result in lower *ex ante* lending, they can lead to higher *ex ante* welfare.
(5) See IMF (2000) on this point.

Future research might usefully consider relaxing some of the more restrictive assumptions in the model. First, we assume that the quantum of debt and the form of the debt contract is fixed in advance. Debt size and debt structure might be affected importantly by some of the public policy measures considered here. Second, the model uses a simple measure of welfare and side-steps difficult issues about the distribution of gains and losses between different parties. Third, only a sub-set of the myriad policy proposals currently on the table are considered here. It would be useful to explore these and other extensions in a quantitative, welfare-theoretic, setting.

## References

**Berg, A and Pattillo, C (1999)**, 'What caused the Asian crises: an early warning system approach', *mimeo*, IMF.

**Bussiere, M and Mulder, C (1999)**, 'External vulnerability in emerging market economies—how high liquidity can offset weak fundamentals and the effects of contagion', IMF WP/99/98.

**Caprio, G and Klingebiel, D (1996)**, 'Bank insolvencies: cross-country experience', *World Bank Policy and Research WP 1574*.

**Caprio, G and Klingebiel, D (1999)**, 'Episodes of systemic and borderline financial crisis', *mimeo*, World Bank.

**Chui, M K, Gai, P S and Haldane, A G (2000)**, 'Sovereign liquidity crises: analytics and implications for public policy', *Bank of England Working Paper*, No 121.

**Chang, R and Velasco, A (1999)**, 'Financial crises in emerging markets: a canonical model', in Bernanke, B and Rotemberg, J (eds), *NBER Macroeconomics Annual 1999*, Vol 14, MIT Press, Cambridge, Mass.

**Clementi, D C (2000)**, 'Crisis prevention and resolution—two aspects of financial stability', *Bank of England Financial Stability Review*, forthcoming.

**Cooper, R N (1999)**, 'Should capital controls be abolished?', *Brookings Papers on Economic Activity*, pages 89–125.

**Drage, J and Mann, F (1999)**, 'Improving the stability of the international financial system', *Bank of England Financial Stability Review*, Issue 6, pages 40–77.

**Eaton, J, Gersovitz, M and Stiglitz, J (1986)**, 'The pure theory of country risk', *European Economic Review*, Vol 3(30), pages 481–513.

**Edwards, S (1998)**, 'Capital flows, real exchange rates, and capital controls: some Latin American experiences', *NBER Working Paper*, No 6800.

**Eichengreen, B (1999)**, 'Toward a new international financial architecture: a practical post-Asia agenda', Institute for International Economics.

**Eichengreen, B (2000)**, 'Can the moral hazard caused by IMF bailouts be reduced?', Centre for Economic Policy Research.

**Fischer, S (1999)**, 'Reforming the international financial system', *Economic Journal*, Vol 109(459), F557–76.

**Flood, R P and Garber, P M (1984)**, 'Collapsing exchange rate regimes: some linear examples', *Journal of International Economics*, Vol 17, August, pages 1–13.

**Flood, R P and Marion, N P (1998)**, 'Perspectives on the recent currency crisis literature', *IMF Working Paper 98/130*.

**Gai, P S, Hayes, S and Shin, H (2000)**, 'The role of sovereign debt standstills in crisis management', *Bank of England Working Paper*, forthcoming.

**Greenspan, A (1999)**, 'Testimony before the Committee on Banking and Financial Services, May', US House of Representatives.

**Hoggarth, G, Reis, R and Saporta, V (2001)**, 'Costs of banking system instability: some empirical evidence', *Bank of England Working Paper*, forthcoming.

**International Monetary Fund (1998)**, *World Economic Outlook*.

**International Monetary Fund (2000)**, 'Involving the private sector in the resolution of financial crises, attachment 2—standstills', www.imf.org/external/np/pdr/sstill

**King, M (1999)**, 'Reforming the international financial system: the middle way', *Bank of England Financial Stability Review*, Issue 7, pages 203–11.

**Krugman, P (1979)**, 'A model of balance of payments crises', *Journal of Money, Credit and Banking*, Vol 11, pages 311–25.

**Krugman, P (1998)**, 'Saving Asia: it's time to get radical', *Fortune Magazine*, (7).

**Krugman, P (1999)**, 'Balance sheets, the transfer problem and financial crises', *mimeo*, MIT.

**Morris, S and Shin, H (1998)**, 'Unique equilibrium in a model of self-fulfilling currency attacks', *American Economic Review*, Vol 88(3), pages 587–97.

**Morris, S and Shin, H (1999)**, 'Coordination risk and the price of debt', *mimeo*, Oxford University.

**Obstfeld, M (1996)**, 'Models of currency crises with self-fulfilling features', *European Economic Review*, Vol 40, pages 1,037–47.

# Central banks and financial stability

By P J N Sinclair, Director, Centre for Central Banking Studies.

*Many central banks have seen a recent increase in their autonomy in monetary policy, and also a transfer of supervisory and regulatory responsibilities to other bodies. But the maintenance of financial stability is, and remains, a core function for all central banks. This paper presents details of 37 central banks' functions and powers as they stood in March 2000. It goes on to discuss financial crises and the morbidity of banks, the trade-off between competition and safety in the financial system, the international dimension to financial crises, the many links between financial stability policy and monetary policy, and the nature of the work of those charged with safeguarding financial stability.*(1)

## 1 Introduction

Each year the Governors of many central banks are invited to the Bank of England for a symposium. The subject this year was financial stability. This article is based on *Financial Stability and Central Banks*, a written report(2) presented to the 2000 Central Bank Governors' Symposium, held at the Bank on 2 June 2000.(3)

Among other things, the report analyses the results of a survey of central banks, outlining the scope and diversity of their financial stability activities; this is discussed in Section 2 of this article. Section 3 focuses on banking crises and the morbidity of banks, Section 4 looks at the trade-off between competition and safety for banks, and Section 5 considers international capital movements and financial crises in the open economy. Section 6 returns to the topic of the central bank's role in financial stability, with a discussion of the links between financial stability policy and monetary policy. Section 7 offers some observations about the different nature of the tasks confronting central bankers operating in these two areas. Section 8 presents conclusions.

## 2 Financial stability functions in central banks

The report to the Central Bank Governors' Symposium included an analysis of the results of a survey of 37 central banks,(4) covering responsibilities and various aspects of financial stability activities, as well as the institutional structure of regulation and supervision. The main focus of this survey is upon the *powers* and *formal functions* of the central banks, as they were in March 2000.

It is worth stressing that the survey presents answers from central banks only, and not from any other bodies that may be charged with financial regulatory responsibilities.

The sample consists of 13 industrial, 16 developing and 8 transition countries. Every country is in some sense in development and transition, and none lacks industrial activity. The criteria for grouping were that transition countries had recently emerged from a prolonged period of communist government, while all the developing countries, unlike their industrial counterparts, had GDP per head of below US$10,000 in 1998.

Tables A, B and C summarise the responses to the questionnaire. The thick vertical line in each table splits countries whose central banks exercise regulatory and supervisory functions (to the left of the line) from those that do not (to the right). A summary of the key findings is as follows. All respondents have payments systems responsibilities. All but four central banks provide emergency liquidity assistance to depositories, and also to the market. The exceptions are Argentina, Bulgaria and Estonia, which operate currency boards and do not, generally, act as lenders of last resort, and Peru, whose role is restricted to monetary regulation, specifically excluding rescues. Euro-zone central banks' emergency liquidity provision is now coordinated by the European Central Bank. The position is more complex for emergency liquidity assistance to non-depositories. In six industrial and two developing countries, central banks may provide some form of such assistance, at least in principle, suggesting some potential widening of their role as lender of last resort role.

(1) The author thanks Bill Allen, Charles Bean, Alex Bowen, Alec Chrystal, Gill Hammond, Juliette Healey, Gabriel Sterne, Paul Tucker, and an unnamed referee for very helpful comments on a previous draft.
(2) A revised and extended version of the report, entitled *Financial Stability and Central Banks*, is to be published by Routledge in 2001.
(3) The report contained six papers, each devoted to a different aspect of the subject, written by Richard Brealey, Juliette Healey, Glenn Hoggarth and Farouk Soussa, David Llewellyn, Peter Sinclair, and Peter Sinclair and Shu Chang. Richard Brealey, Alastair Clark, Charles Goodhart, David Llewellyn and Peter Sinclair gave verbal presentations to the Symposium.
(4) Prepared by Juliette Healey of the CCBS.

## Table A
## Industrial economies: degree of central bank involvement in financial stability 'functions'

| Financial stability function | Description | Singapore | Netherlands | Ireland | Hong Kong |
|---|---|---|---|---|---|
| **Payments system services** | Some or all of: currency distribution and provision of settlement balances, electronic payments, check clearing and general oversight of payments system | ✔ | ✔ | ✔ | ✔ |
| **Safety net provision/crises resolution** | | | | | |
| Emergency liquidity assistance to the market (a) | Provision of liquidity to the money markets during a crisis | ✔ | ✔ (a) | ✔ (a) | ✔ |
| Emergency liquidity assistance to depositories | Direct lending to individual illiquid depositories | ✔ (b) | ✔ | ✔ | ✔ |
| Emergency solvency assistance to depositories | Direct lending to individual insolvent depositories | ✘ | ✘ | ✘ | ✘ |
| Emergency liquidity assistance to non-depositories | Direct lending to individual illiquid non-depository institutions | ✘ | ✘ | ✘ | ✘ |
| Emergency solvency assistance to non-depositories | Direct lending to individual insolvent non-depository institutions | ✘ | ✘ | ✘ | ✘ |
| Honest brokering | Facilitating or organising private sector solutions to problem situations | ✔ | ✔ | ✔ | ✔ |
| Resolution | Conducts, authorises or supervises sales of assets and other transactions in resolving failed institutions | ✔ | ✔ | ✘ | ✘ |
| Legal | Resolves conflicting legal claims among creditors to failed institutions | ✘ | ✘ | ✘ | ✘ |
| Deposit insurance | Insures deposits or other household financial assets | ✘ | ✔ (c) | ✘ | ✘ |
| **Regulation and supervision** | | | | | |
| Bank regulation | Writes capital and other general prudential regulations that banks (and other deposit-taking institutions) must adhere to | ✔ | ✔ | ✔ | ✔ |
| Bank supervision | Examines banks to ensure compliance with regulations | ✔ | ✔ | ✔ | ✔ |
| Bank business code of conduct | Writes, or monitors banks' compliance with, business codes of conduct | ✔ | ✔ | ✔ | ✔ |
| Non-bank financial regulation | Writes capital and other general prudential regulations that non-banks must adhere to | ✔ | ✔ (d) | ✔ (e) | ✘ |
| Non-bank financial supervision | Examines non-banks (although not necessarily all) to ensure compliance with regulation | ✔ | ✔ (d) | ✔ (e) | ✘ |
| Non-bank business code of conduct | Writes, or monitors non-banks' compliance with, business codes of conduct | ✔ | ✔ (d) | ✔ (e) | ✘ |
| Chartering and closure | Provides authority by which a banking entity is created and closed | ✔ | ✔ | ✔ | ✔ |
| **Accounting standards** | Establishes/participates in establishing uniform accounting conventions | ✔ | ✔ | ✘ | ✘ |

(a) For euro-zone countries, in the context of euro-system coordination.
(b) The MAS will assess the situation should it arise. Systemic risk is not an unconditional call on emergency liquidity assistance.
(c) The deposit insurance scheme has been set up by the banking sector. The central bank is responsible for implementation.
(d) De Nederlandsche Bank is also responsible for investment institutions and exchange offices, but not the insurance or securities sectors.
(e) Excluding the insurance sector.
(f) The Reserve Bank is the banking supervisory agency, though in 1996 moved to a system whereby the Reserve Bank does not conduct on site inspections as a matter of course but has the power to require independent reports on a bank. Directors of institutions are primarily responsible for ensuring compliance with regulation and are required to provide regular attestations on compliance.
(g) Most likely to be carried out by the supervisory authority or the deposit insurance agency but the central bank might assist, particularly in systemic circumstances.
(h) The Bank of Korea may require the supervisory agency to examine banking institutions and to accept the participation of central bank staff on joint bank examinations.
(i) In principle, emergency liquidity support is available to any institution supervised by the Finansinpektionen 'APRA' provided the institution is solvent and failure to make its payments poses a threat to the stability of the financial system, and there is a need to act expeditiously.

| New Zealand | Finland | Denmark | Sweden | Canada | South Korea | Australia | Norway | United Kingdom |
|---|---|---|---|---|---|---|---|---|
| ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| ✔ | ✔ (a) | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| ✔ | ✘ | ✔ | ✔ (i) | ✘ | ✔ | ✔ (i) | ✔ | ✘ |
| ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| ✔ | ✔ (g) | ✔ | ✔ (g) | ✔ (g) | ✔ | ✔ (g) | ✔ (g) | ✘ (g) |
| ✔ | ✘ | ✔ | ✘ | ✘ | ✘ | ✘ | ✘ | ? |
| ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| ✔ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| ✘ (f) | ✘ | ✘ | ✘ | ✘ | ✘ (h) | ✘ | ✘ | ✘ |
| ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| ✔ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| ✔ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |

## Table B
## Developing economies: degree of central bank involvement in financial stability 'functions'

| Financial stability function | Malaysia | Malta | India | Sri Lanka | Uganda | Malawi |
|---|---|---|---|---|---|---|
| **Payment systems services** (a) | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| **Safety net provision/crises resolution** | | | | | | |
| Emergency liquidity assistance to the market | ✔ | ✔(b) | ✔ | ✔ | ✔ | ✔ |
| Emergency liquidity assistance to depositories | ✔ | ✔(b) | ✔ | ✔ | ✔ | ✔ |
| Emergency solvency assistance to depositories | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| Emergency liquidity assistance to non-depositories | ✘ | ✔ | ✔(d) | ✘ | ✘ | ✘ |
| Emergency solvency assistance to non-depositories | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| Honest brokering | ✔ | ✘ | ✘ | ✔ | ✔ | ✘ |
| Resolution | ✔ | ✔ | ✘ | ✔ | ✔ | ✔ |
| Legal | ✘ | ✘ | ✘ | ✔ | ✔ | ✔ |
| Deposit insurance | ✘ | ✘ | ✔ | ✔ | ✔ | ✘ |
| **Regulation and supervision** | | | | | | |
| Bank regulation | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Bank supervision | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Bank business code of conduct | ✔ | ✔ | ✔ | ✘ | ✘ | ✘ |
| Non-bank financial regulation | ✔ | ✔(c) | ✔(e) | ✔(e) | ✔ | ✔ |
| Non-bank financial supervision | ✔ | ✔(c) | ✔(e) | ✔(e) | ✔ | ✔ |
| Non-bank business code of conduct | ✔ | ✔(c) | ✔(e) | ✘ | ✘ | ✘ |
| Chartering and closure | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| **Accounting standards** | ✔ | ✘ | ✔ | ✔ | ✔ | ✘ |

(a) For descriptions, refer to Table A.
(b) Subject to the prior approval of the Minister of Finance.
(c) Excluding investment services, insurance companies and offshore banks.
(d) Primary dealers in domestic money markets.
(e) Development finance companies and non-bank financial companies.
(f) Argentina operates a currency board, which prohibits the lender of last resort function except in extreme circumstances and within the terms set out in the convertibility law.
(g) Including non-bank deposit-taking institutions.
(h) Including consortium management companies.
(i) Including certain financial co-operatives.
(j) The Banco de Mexico regulates and supervises financial market activities only. Capital and other prudential regulation and supervision is carried out by other supervisory agencies.
(k) As part of the crises management process set out in the general law on banks, if necessary, to cover the 100% central bank guarantee on demand deposits.
(l) Prudential regulation and supervision is carried out by the SBFI. However, the Banco Central de Chile can determine limits for the asset liabilities risks exposures.
(m) The Banco Central de Chile determines the portfolio limits for the pension fund administrators.
(n) According to the central bank law, credits to commercial banks are only for monetary regulation. The central bank should not be involved in bailout programmes.

| Argentina | Brazil | South Africa | Thailand | Zimbabwe | Cyprus | Indonesia | Mexico | Chile | Peru |
|---|---|---|---|---|---|---|---|---|---|
| ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| | | | | | | | | | |
| ✘ (f) | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✘(n) |
| ✘ (f) | ✔ | ✔ | ✔ | ✔ | ✔ | ? ✘ | ✔ | ✔ | ✘(n) |
| ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✔(k) | ✘ |
| ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
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| ✔(g) | ✔(h) | ✔(i) | ✔ | ✔ | ✔ | ✔ | ✘(j) | ✘ (l) | ✘ |
| ✔(g) | ✔(h) | ✔(i) | ✔ | ✔ | ✔ | ✔ | ✘(j) | ✘ | ✘ |
| ✘ | ✔(h) | ✘ | ✔ | ✔ | ✘ | ✔ | ✘ | ✘ | ✘ |
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## Table C
## Transition economies: degree of central bank involvement in financial stability 'functions'

| Financial stability function | Description | Bulgaria (a) | Estonia (a) | Czech Republic | Poland | Slovenia | Latvia | Russia | Hungary |
|---|---|---|---|---|---|---|---|---|---|
| **Payments system services** | Some or all of: currency distribution and provision of settlement balances, electronic payments, check clearing and general oversight of payments system | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| **Safety net provision/crises resolution** | | | | | | | | | |
| Emergency liquidity assistance to the market | Provision of liquidity to the money markets during a crisis | ✘ | ✘ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Emergency liquidity assistance to depositories | Direct lending to individual illiquid depositories | ✘ | ✘ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Emergency solvency assistance to depositories | Direct lending to individual insolvent depositories | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| Emergency liquidity assistance to non-depositories | Direct lending to individual illiquid non-depository institutions | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| Emergency solvency assistance to non-depositories | Direct lending to individual insolvent non-depository institutions | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| Honest brokering | Facilitating or organising private sector solutions to problem situations | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| Resolution | Conducts, authorises or supervises sales of assets and other transactions in resolving failed institutions | ✘ | ✘ | ✔(b) | ✘ | ✘ | ✘ | ✔ | ✘ |
| Legal | Resolves conflicting legal claims among creditors to failed institutions | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| Deposit insurance | Insures deposits or other household financial assets | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| **Regulation and supervision** | | | | | | | | | |
| Bank regulation | Writes capital and other general prudential regulations that banks (and other deposit-taking institutions) must adhere to | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔(c) | ✘ |
| Bank supervision | Examines banks to ensure compliance with regulation | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔(c) | ✘ (d) |
| Bank business code of conduct | Writes, or monitors banks' compliance with, business codes of conduct | ✔ | ✔ | ✘ | ✘ | ✔ | ✘ | ✔ | ✘ |
| Non-bank financial regulation | Writes capital and other general prudential regulations that non-banks must adhere to | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| Non-bank financial supervision | Examines non-banks (although not necessarily all) to ensure compliance with regulation | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ (d) |
| Non-bank business code of conduct | Writes, or monitors non-banks' compliance with, business codes of conduct | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ | ✘ |
| Chartering and closure | Provides authority by which a banking entity is created and closed | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ (e) |
| **Accounting standards** | Establishes/participates in establishing uniform accounting conventions | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✘ |

(a) Bulgaria and Estonia currently operate currency boards, which prohibits the lender of last resort function except in only the most extreme circumstances.
(b) Limited role, primarily stipulated in the Act on Banks 1992.
(c) Including non-bank credit institutions.
(d) Limited to legal regulations specified in the Central Bank Act and National Bank of Hungary decrees on money circulation, foreign exchange, data supply and minimum reserves (credit institutions).
(e) The NBH issues licences for exercising certain financial services and is involved, with the Hungarian Financial Supervisory Authority, in the issuance and withdrawals of other licences.

There is no emergency solvency assistance to non-depositories by any of the central banks surveyed, nor to depository institutions (except in the case of Chile). Just three central banks in the survey resolve conflicting legal claims of failed institutions' creditors. Only seven provide deposit insurance themselves. Honest brokering is a central bank function in all industrial and most developing (but no transition) economies. In the United Kingdom, and some other countries, this is mainly limited to cases of systemic risk, and will involve co-operation with other supervisory bodies.

The position is less clear-cut for sales of failing institutions' assets. For 4 industrial countries (Denmark, Netherlands, New Zealand and Singapore), 1 transition economy (Russia) and 10 of the 16 respondents from developing countries, this aspect of resolving crises is, at least in part, a central bank function. The Czech National Bank has a restricted role here, while in the United Kingdom,(1) and in some other countries undergoing similar changes, the central bank's role in crisis resolution would be coordinated with other agencies, and will doubtless evolve with experience.

Turning to regulation and supervision, we observe that 5 of the 13 industrial countries sampled currently regulate banks and 8 do not. Before 1998, these numbers would have been reversed, since it was in that year that Australia, South Korea and the United Kingdom saw their central banks lose these responsibilities. Among the 8 transition countries, Hungary is the sole non-regulator. Of the 16 developing countries, all but 3 (Chile, Mexico and Peru) regulate banks, while Chile and Mexico have a limited part in this. Every central bank that *regulates* banks also *supervises* them, although the supervisory regime operated by the Reserve Bank of New Zealand relies upon disclosure and market monitoring. Thailand and Zimbabwe have the only regulating central banks that do not also grant and revoke charters, while Hungary and Mexico have the only non-regulating central banks with some (very limited) licensing and supervision(2) responsibilities.

Among the 25 respondents that regulate banks, only 9 also regulate and supervise some or all non-bank financial institutions. These are Ireland, the Netherlands, Singapore and 6 Commonwealth central banks in the developing countries sub-sample. Usually supervision is accompanied by writing business codes of conduct, or overseeing compliance with them, for the range of financial institutions supervised. No non-regulators exercise an accounting conventions role. Most bank regulators, on the other hand, do this: 7 of the smallest countries are the only exceptions here.

The survey describes the functions of central banks at March 2000. In some cases, such as Brazil, Estonia, Ireland, Latvia, Malta and Slovenia, current arrangements are under review. Traditionally, nearly all central banks supervised banks and banks alone. This is still true of most central banks. But several important changes had previously taken place. The Reserve Bank of South Africa took over bank regulation and supervision from the Ministry of Finance in 1987. Subsequent changes have usually been in the opposite direction. In 1998, Australia, Japan, South Korea and the United Kingdom transferred bank supervision and regulation from the central bank to a single new agency (two in Australia) that would also superintend other financial institutions. Several countries, whose central banks had never regulated or supervised, amalgamated the bodies responsible for this (Norway in 1986, Canada in 1987, Denmark in 1988, and Sweden in 1991). The rationale for having a single regulator has recently been expounded, for the British case, by Briault (1999), and also by Goodhart (2000), while Hawkesby (2000) and Taylor and Fleming (1999) provide other perspectives on this issue. Further discussion on the various institutional models can be found in Juliette Healey's contribution to the Symposium.

What are the main insights to be gleaned from this survey? One is that central banks tend to exercise a larger range of functions in smaller and poorer economies, where financial markets are usually less developed. It is noteworthy that the 5 industrial countries in the sample with regulatory and supervisory responsibilities include the 3 smallest by population (Singapore, Ireland and New Zealand). By contrast, 20 of the transition and developing countries' central banks perform regulatory and supervisory duties. In the 4 that do not, ie Chile, Hungary, Mexico and Peru, GDP per head is somewhat above average for their groups.

These tendencies are also noticeable within continents. India and Indonesia display fewer 'ticks' in the tables than do smaller Malaysia or Sri Lanka. The Reserve Bank of South Africa exhibits a somewhat narrower range of functions than its counterparts in Zimbabwe, Malawi or Uganda, all of which are both smaller and poorer. The same holds true of Cyprus compared with Malta and, in GDP terms at least, of Mexico against Brazil. Among the transition countries, Russia's central bank exhibits the widest responsibilities and by far the lowest GDP per head. There are exceptions to this: two pronounced outliers are the Netherlands, with a wider range of ticks than all but Singapore in the industrial country sample, and Peru, which has the narrowest of all the 37 countries despite its relatively modest wealth and population. Nevertheless there is clear evidence that broader central bank responsibilities go hand in hand, in the main, with lower total GDP and also with lower GDP per head; financial markets are generally less sophisticated in such economies.

The reasons for this are not hard to find. Higher income per head brings disproportionately greater size, diversity and sophistication of financial institutions, and, with it, greater advantages from delegating regulation and supervision to a separate institution (or set of institutions). Greater national

(1) Rodgers (1997) describes the main changes in the Bank of England's functions.
(2) These are specific to certain financial markets.

income allows greater resources to meet the fixed costs of additional agencies (although many richer countries have displayed a recent tendency to aggregate them, in recognition of the blurring of boundaries between different types of financial institution). In less advanced economies, banks tend to be less complex, and financial markets are typically simpler. Both are dominated to a greater degree, given the limited private sector, by the macroeconomic considerations of government finance and foreign exchange, and thus core terrain for the central bank. Governments could and sometimes do undertake several aspects of financial administration themselves. Nonetheless, operating at arm's length, through central banks, may take advantage of greater credibility and more experienced or suitable staff.

A second finding is that, by and large, the extent of central banks' regulatory and supervisory functions is negatively correlated with their degree of independence. Within the group of industrial and transition countries, this relationship actually goes the other way: non-regulatory central banks have an unweighted mean independence score (as calculated in Mahadeva and Sterne (2000)) of 82 against 86 for those that regulate. This difference is modest and too much should not be read into it. Developing countries exhibit much lower independence and more widespread regulation, and this creates the negative association overall.

It is apparent that safeguarding the integrity of the payments system and keeping prices stable are the central functions shared by every central bank. A currency board maintains price stability by proxy, by keeping a fixed exchange rate link to another currency. Argentina does this through its one-to-one link with the US dollar, and Bulgaria and Estonia through their tie to the Deutsche Mark and hence the euro. The other central banks in the survey aim for price stability directly, operating independent monetary policies, or, in the case of Finland, Ireland, and the Netherlands, under the direction of the European Central Bank.

Price stability is the main objective of monetary policy. But, as we shall see in Section 6, both monetary policy, and policies for financial stability, are closely intertwined. The foremost threat to financial stability comes from the failure of banks, to which we turn next.

## 3 Financial crises and the morbidity of banks

The most obvious symptom of a financial crisis is a bank failure. So it is useful to give a broad indication of financial institutions' survival rates. Each year, on average, about 960 financial firms out of 1,000 survive as independent entities. Thirty-four in a thousand join a larger institution as a result of takeover or merger. Finally, the remaining five or six in a thousand perish and vanish, with uninsured depositors standing to lose some of their funds.

These figures are widely drawn averages. They relate to the past century's experience in Western Europe and North America, much of which is described, for example, in Heffernan (1996) and sources cited therein. The annual mortality hazard faced by a financial institution is, on this showing, less than one third of that now confronting a person in those countries; financial institutions are more like Galapagos turtles or oak trees in this regard—they appear to have a half-life of about 115 years. If survival is defined more strictly as neither death nor absorption into a larger company, morbidity worsens to give a half-life of some 24 years.

Averages such as these conceal large disparities. Clearing banks have somewhat better survival prospects than other financial institutions. In finance, just as in the wider economy, large firms are less prone to death or takeover than smaller ones. Probably the highest mortality rates have been recorded recently for new small banks in the Czech Republic: Mantousek and Taci (2000a, 2000b) show that only 2 out of 19 of these institutions, founded after the Velvet Revolution of 1989, had survived a decade by 1999.

Death rates, on broad and narrow definitions, are apt to vary across countries. They also show a very pronounced tendency to cluster in time. The early 1930s witnessed a massive rash of bank closures, especially in the United States, when both nominal bank deposits and the number of banks shrank by more than one third. Severe recessions, and large falls in the prices of equity and real estate, almost invariably accompany increased risks of bank failure. Although cause and effect are hard to identify here, Richard Brealey, in his contribution to the Symposium report, cites important evidence demonstrating that downturns in industrial production and equity prices tend to lead banking failures by about three quarters.

The rate of bank failure also appears to be sensitive to the character of the supervision and regulatory regimes. Tighter supervision and stiffer requirements for reserves and capital should succeed in prolonging a financial institution's expectation of life (but the evidence does not testify to a robust link, as Brealey shows). On the other hand more intense competition between financial institutions—which may result from changes in the regulatory regime—is apt to have the opposite effect. Davis (1999) provides valuable evidence testifying to this, and other concomitants or precipitators of bank failure, in his analysis of macro-prudential indicators of financial turbulence. Demirgüç-Kunt and Detragiache (1998a, 1998b) provide further empirical support.(1)

## 4 Competition and safety

The simplest view of financial markets is that they are perfectly competitive. In perfectly competitive markets, all financial institutions would take the prices of their products

(1) In their contribution to the Symposium, Hoggarth and Soussa also stress the argument that central bank involvement in support of troubled financial institutions is liable to become more necessary as competition intensifies.

as given, outside their control. No retail bank could influence the interest rates on its deposits or advances, for example. Profits would vary as market conditions fluctuated, around a level that gave a 'normal' rate of return on capital. Margins and spreads would be narrow, even wafer-thin. It would not be necessary to have a large number of banks to achieve such an outcome. There could be intense competition between just two banks, or even, in the very special conditions of 'perfect contestability',(1) there might be just one incumbent bank, forced by a hypothetical entrant to price its products at cost. Alternatively, there could be just one bank, or more, owned by its customers, and setting its interest rates to maximise their welfare.(2)

At the opposite extreme, we could have monopoly. A single bank, immune from entry, could set its prices at will, presumably to maximise its profits. If it could price-discriminate perfectly in all its markets and set out to maximise profit, its total volume of activity would resemble that of a perfectly competitive banking industry, although profits would then be very large. Short of perfect price discrimination, both the volume of activity and profits would be somewhat smaller. In comparison with perfect competition, we would see lower activity and larger profit levels. Such an outcome would occur with one firm, but it could arise under other circumstances: there might be two, three or many banks, as long as all of them acted as one and colluded in all their decisions. The risks of insolvency would be smallest in the case of monopoly, and highest under perfect competition.

Between these extremes lies a huge range of intermediate possibilities, best described as oligopoly. One type of banking oligopoly would see banks as independent quantity-setters in their deposit and loan markets, taking the actions of their competitors as given. This is known as Cournot oligopoly. A model of Cournot oligopoly, or strictly speaking oligopsony from the standpoint of deposits, is the most natural starting-place for economists thinking about banks.

In an oligopoly satisfying Cournot's assumptions, total deposits and loans will be smaller than under perfect competition, but higher than under (non price discriminating) monopoly. Profit and spreads will lie between these two extremes. The critical variable in Cournot oligopoly is the number of banks: output is larger and spreads and profits smaller, the greater the number of banks participating in the market. More banks imply more competition, but also, as we shall see, greater risks of financial fragility.

The number of banks is also critical in other circumstances. The more banks there are, the harder it is for them to reach an understanding to limit competition. It is far easier for two banks to collude effectively than three or four. And if banks are characterised by quite intense price competition, but vary in costs, the prices of financial products may tend to gravitate towards the unit costs of the bank with the second-lowest cost. Add another bank, and some incumbents may have to shave their margins further. They could be driven out of business if they fail to reduce their costs to match. Widening access to financial markets (permitting foreign banks to establish themselves in the domestic market, or removing territorial boundaries between financial institutions previously specialised in different markets, for example) will be good for competition but bad for incumbents' profits.

If there were no fixed costs, introducing another firm would bring more extra benefit to banks' customers, in the form of keener prices, than the cost to banks' owners in the form of lower profits. So in that case, the optimum number of banks would be limitless; and free entry would make for perfect competition by driving profits to zero.

In the presence of fixed costs, which are, say, the same for any firm, the picture changes completely. Free entry would make the number of banks finite. Depositors would have to receive lower interest than the rate the banks could earn on assets, in order to pay for the overhead costs. And the optimum number of banks, the number that maximised the sum of customers' welfare and owners' profit, would be smaller still. Free entry would lead to overcrowding: getting rid of a bank or two at this point would typically save more in total costs than the accompanying sacrifice in consumer welfare. The reason for this is that, at this point, the departure of one bank would raise all banks' profits by more than it would reduce the surplus of banks' customers. The deterioration in depositors' interest would be very small, compared with the gain in the profits earned by the owners of the banks.

This finding about Cournot oligopoly, which can easily be extended to banks, is due to Mankiw and Whinston (1986). The same result is often (but not invariably) encountered under another market form intermediate between perfect competition and monopoly. This is monopolistic competition, which arises when the characteristics of banks' products differ, say by location.(3) The fact that the number of firms is socially excessive under Cournot oligopoly with free entry follows for sure in tranquil conditions, when financial markets are not subject to random shocks. It is displayed even more

(1) These conditions include: (a) the absence of sunk costs, specific to current operations, which cannot be recovered on exit; (b) no incumbent able to change prices until after consumers have had a chance to switch suppliers; and (c) all firms, incumbent and outsiders alike, with access to the same technology and the same price and quality of inputs. The threat of entry then forces an incumbent to price at average cost, which will equal marginal cost if average cost is flat. Consumers' costs of switching banks, freedom to reprice almost instantaneously, the sunk costs of acquiring information and the obstacles to hiring specialised personnel make banking less than perfectly contestable in practice.

(2) Mutual institutions have been long-established in the financial sector, but rarely among market leaders, and current trends are against them.

(3) In Salop (1979), for example, free entry leads to twice as many firms as the social ideal.

forcefully in a stochastic environment, when banks' fixed costs are liable to random movement, for example; furthermore, Bolton and Freixas (2000) show that it will be the riskiest borrowers that opt for bank loans, as opposed to equity or debentures (bonds), for external finance.

In a simple case, the optimum number of firms plus one equals the number of firms under free entry, plus one, raised to the power of two thirds—so if free entry gave room for eight banks, for example, the social ideal would be just three. With random shocks and the risk of socially costly insolvency, the ideal number of banks shrinks still further. These arguments are explored in detail, for the Cournot oligopoly case, by Mullineux and Sinclair (2000).

Further light on the trade-off between competition and safety in banking is thrown by the observation that a troubled bank, desperate to survive if it possibly can, will be tempted to take great risks. Failure is an awful prospect, but it really makes no difference how large the bank's debts are in the event of failure. From the owner's and employee's standpoints, going bankrupt because net liabilities are £1 is as bad as bankruptcy with net debts of £1 billion. The downside risk is effectively truncated. A large gamble, if successful, could pull the bank off the rocks towards which it may be heading. So, in an instance like this, an extra gamble would be cheap or even free. There is no extra cost to the gambler if it fails, and a very large gain, in the form of survival, if it succeeds.

The damaging social consequences of an incentive to take free bets constitute the key argument for making the punishment fit the crime. A death penalty for minor theft might discourage minor theft, but it will induce some malefactors to substitute into more heinous activities. In adverse circumstances, bankers taking free bets—'gambling for resurrection', or gambling to survive—may become a much likelier phenomenon as the number of banks increases. This is because profits will fall, and each bank will edge closer to the region where bets for survival become cheap or free. If emergency lending assistance is given to a bank close to the edge, monitoring by those providing it needs to ensure that the aid is not frittered on gambles that could make the financial system less secure, not more.(1)

Technically, the free (cheaper) bets on (near) a bank's survival boundary represent a convexification of returns. An otherwise risk-neutral individual is encouraged to gamble, and the incentive to gamble is stronger, the greater the likelihood of being at the point of kink for returns. The key point here is not just that more banks and greater competition raise the chance that one or more banks might slip into insolvency, but, still more important, that the risk of this is increased because of the greater incentive to take a gamble in this region.

Free bet incentives also qualify the case for deposit insurance: fully insured depositors need no longer worry about where they lodge their funds, so riskier banks prosper at the expense of the taxpayers or shareholders of safer banks, and each bank is itself encouraged to take on more risk too. As Hoggarth and Soussa argue in their contribution to the Symposium, free bet incentives raise problems for the lender of last resort as well. They can even affect the regulator, who may share a sick bank's inclination to wait for the chance of better news, and be tempted into forbearance or procrastination.

A banking system with fewer banks may well be a safer one. Yet safety is not everything. Competition brings undoubted benefits. Barriers to entry, official or natural, can act as a screen behind which collusion, inefficiency and unhealthy lending practices flourish. The admission of another bank, a foreign one perhaps, may blow away the cobwebs of cronyism.

There are also growth effects. Most models of endogenous growth ultimately reduce to two fundamental equations linking the rates of growth and real interest.(2) One equation is positive: higher real interest for households that save implies a faster long-run growth rate of consumption and income. The other is often negative: higher real interest rates for corporate borrowers deter innovation and invention. Greater competition between banks narrows the gap between interest rates facing lenders and borrowers, and should therefore make for faster long-run growth.(3)

So policy-makers face an intriguing dilemma. Fewer well-padded banks make for a safer, but growth-stifling financial environment. The faster growth that comes from keener competition among banks makes for a bumpier ride. The agency entrusted with regulation and supervision faces conflicting pressures. At one end, there is the risk of capture by the incumbent banking interests. At the other, the constituencies of borrowers and depositors may take over, forcing narrow interest spreads and imperilling financial stability.(4) Fashions change: in the early days of Britain's privatisations in the 1980s, regulators appointed to oversee utility pricing may have been lenient to profit (Vickers and Yarrow (1988)); later, under political pressure, most of them appear to have become much tougher. History might easily repeat itself in the banking arena.

The complex dilemma of safety versus competition confronting financial regulators is modulated, of course, by BIS capital adequacy and risk arrangements, which are

(1) Mitchell (2000) and Aghion, Bolton and Fries (1999) explore some of the implications of these ideas, and the incentives for banks to roll over doubtful loans.
(2) For example, Aghion and Howitt (1992, 1998) and Romer (1990).
(3) King and Levine (1993) were the first to argue this; see also Fry (1995).
(4) Boot and Thakor (2000) show that increased interbank competition must benefit some borrowers, but not necessarily all of them.

currently under review.[1] Many difficult choices remain. Hellman, Murdock and Stiglitz (2000) show that capital adequacy ratios by themselves will establish Pareto-inefficient outcomes, when interest rates on deposits are determined by unfettered competition between banks. The problem arises because competition and capital adequacy ratios together undermine franchise valuations, and this undoes some of the reduction in the incentive to gamble that higher ratios bring. One instrument that could be valuable here, as Hellman *et al* show, is a ceiling on deposit interest rates. Furthermore, as Brealey emphasises in his contribution to the Symposium, neither regulation, nor the imposition of capital standards, succeeds in preventing financial crises.

There are certainly powerful arguments for resolving the safety versus competition dilemma within the confines of a single institution, which might be, but need not be, the central bank itself.

## 5 Financial crises and international capital movements

Sharp price changes in foreign exchange and other asset markets can precipitate a financial crisis. A currency crisis is not the same as a bank crisis, but each can trigger the other. Marion (1999) provides an excellent analysis of the parallels and differences between the two. Under some conditions, McCallum (2000) shows that a currency crisis can be predicted. If, all else equal, one country's monetary aggregates and credit always grow faster than the other's, a fixed exchange rate peg between the two can last for a while, supported by sales of the former's reserves. But at some point, before reserves run out, the exchange rate will start to slide, the home country's interest rate will jump, and a step decline in reserves is needed to accommodate the fall in real money demand.

In foreign exchange and other asset markets, trade volume and price volatility are notoriously unsteady. They are also positively associated. Volume instability points to heterogeneity among market participants. As in Sinclair (1990), they may differ in trading strategies, expectations and information. Some are noise traders who minimise transactions to save commissions. Others back evidence for mean-reversion in asset prices, use economic models or exploit private information. A further group may imitate, thinking 'I don't know why people are selling this, but I assume they have good reasons'. Diverse information sets, as Morris and Shin (1998, 1999) argue, may also create conditions for a critical mass of speculators that converts a vulnerable currency into a crisis victim, if the authorities are believed to view currency defence as too expensive.

The 1997 crises enveloping Thailand, Indonesia and South Korea jumped international boundaries at great speed. One common factor here was the concentration of financial risks in the banking system, risks that would have been dispersed much more widely through capital markets in richer countries. Within a year they had spread to some other countries, including Russia. In every country that succumbed to them, these crises resulted in destruction of previous exchange rate parities after heavy speculative attack. Sharp falls in local equity prices in local currency, deterioration in the perceived quality of local banks' loans, and an adverse revaluation of the solvency prospects of several local financial institutions, were other concomitants. Some of the countries that managed to emerge virtually unscathed, like Hong Kong or Singapore, had a complete absence of restrictions on international capital flows. Others, like Chile, India and Malaysia, had retained or were to impose some measure of control. This last fact prompted some observers to argue that freeing international capital movements was a risky and unwise step.

International capital movements are a form of trade—trade in goods at different dates, or in different contingencies. So restricting them is open to the standard objections to levying tariffs on imports, for example. This is never acceptable under otherwise ideal conditions. In the face of some distortion, such as imperfect competition or market incompleteness, it is always (or almost always) inferior to removing the distortion at (or closer to) its source by other means. Peter Sinclair and Chang Shu, in their contribution to the Symposium report, conclude that capital movements should generally be more blessing than curse, and that policies to restrict them are typically dominated. They also cite evidence that the effectiveness of controls wanes with time and is undermined by evasion. Nonetheless, modest tapering taxes on capital flows may have benefits under emergency conditions, for countries experiencing indigestible inflows, for example, or in the immediate aftermath of a particularly serious crisis.

## 6 The links between financial stability policy and monetary policy

One important argument for preserving a financial stability function in a central bank, even when regulation of financial firms passes to another institution, is that monetary and financial stability policy are intertwined.

Monetary policy can have important implications for financial stability; financial stability decisions will also have implications for monetary policy. Some of these links are investigated below. We consider first the effects of monetary policy on financial stability.

If monetary policy is mishandled, inflation may become rapid and volatile. Positive inflation surprises redistribute real wealth from lenders to borrowers contracting in nominal (unindexed) loan instruments. Negative inflation

(1) Richard Brealey, in his contribution to the Symposium, has numerous pertinent observations upon them. He commends the proposed adoption of explicit market value accounting as a solution to the problem of forbearance towards suspect loans, but queries popular reasons for opposing an expansion of banks' capital on the ground that it is unclear why equity should be much more expensive than debt.

surprises have the opposite effect. The size of this redistribution is greatest when the instruments are at fixed, as opposed to floating, interest. Redistribution in either direction may provoke bankruptcy, with serious implications for the quality and performance of banks' loans. Since inflation surprises, negative and positive, increase with the variance of inflation, and since the variance of inflation appears apt to increase with its speed, these risks are liable to increase with the average rate of inflation.

There is also some risk attached to a very tight, sustained monetary policy that pushes inflation to very low, even negative levels. The lower the rate of inflation, the greater the attraction of holding cash rather than interest-bearing bank deposits. Any switch away from bank deposits is liable to reduce the profits earned by banks, and particularly so in an oligopolistic setting of the Cournot type described above when the number of banks is given. Reducing banks' profits implies a greater chance, in a stochastic environment, however remote, that one or more banks will sooner or later run into insolvency. At sufficiently modest rates, inflation does not just bring seigniorage gains to the government or the monetary authorities. If imperfectly competitive, the banks tend to share some of this seigniorage as well.

A third link running from monetary policy to financial stability policy stems from interest rate setting. Above all, monetary policy aims at stabilising inflation, with short-run nominal interest rates now widely accepted as the instrument of choice. Sharp, temporary alterations in short nominal rates may add to uncertainties in financial markets. Particularly when delayed—so that the magnitude (and duration) of the alterations, when they come, is greater than it otherwise could have been—interest rate swings tend to increase the variance of the rate of business failures. This has adverse effects on the balance sheets of banks at times of credit crunch. These effects are greatest when monetary policy is 'too much, too late'. Timely, modest interest responses to inflation surprises can contribute powerfully to long-run financial stability.

So much for the impact of monetary policy upon financial stability. What of the reverse? More effective supervision, to reduce the risks of bank failures, increases confidence in banks' liabilities. Widely defined, money demand should go up. This has no persistent effect on the rate of inflation, but the transition to a 'safer' regime of financial control will imply lower equilibrium inflation for any given path of nominal monetary aggregates as velocity subsides. Put another way, policy decisions that make the banking system look more hazardous could generate a flight from broad money, and exacerbate the rate of inflation in the short run through a variety of mechanisms (not least via the foreign exchange rate). A lender of last resort function, wisely deployed, may also enhance confidence in the liabilities of banks. So its removal could conceivably trigger a transitory burst of inflation in extreme circumstances.

The intense debate between the Banking and Currency Schools in the era of the 1844 Bank of England Act also throws light upon these issues. The Currency School, widely seen as the antecedent of modern monetarists, was alarmed that a lender of last resort mechanism might ultimately endogenise the supply of money. If liquidity is continually pumped into commercial banks at modest rates of interest, the monetary authorities could ultimately lose control over the price level, Currency School adherents argued. Their opponents stressed the case for the central bank to meet the legitimate needs of commerce: acting as lender of last resort, the monetary authority could stabilise the business cycle, contributing to greater stability in not just the real variables of the macroeconomy, but possibly the nominal variables as well.

On the other hand, financial stability concerns may translate into greater aversion to wobbles in aggregate output relative to wobbles in inflation. Any resulting shift from stabilising the price level to stabilising output is likely to generate greater volatility in inflation, and quite possibly higher average expected and actual rates of inflation as well. Rogoff's (1985) plea for monetary policy to be conducted by a conservative central banker could be compromised if financial stability concerns made the central banker less averse to inflation or inflation swings. Finally, the transmission mechanism for monetary policy may be gravely impaired if credit flows are warped by a defective or unstable financial system.

If the central bank has no responsibility for financial stability *per se*, these numerous linkages between financial and monetary policy are liable to be disregarded. Serious conflicts of interest could arise between the central bank and the agency, or agencies, charged with protecting the stability of the financial system. Organising co-operation between distinct institutions is awkward. It becomes progressively harder, if the central bank has shed these functions, as staff turnover effaces old habits of consultation between erstwhile colleagues. Significant delays could ensue, particularly if channels of information are subject to filtering or blockage. Inefficient outcomes might easily result. Those who argue that the central bank should retain some financial stability responsibilities would stress the advantages of internalising, within a single institution, the discussions that relate to these financial-monetary policy links.

These observations do not, however, imply that all aspects of regulation and supervision belong within the central bank.(1) The 'narrow model', with its separation of supervision and regulation from the central bank's core functions, brings the advantage of a clean, sharp delineation of responsibilities between distinct institutions. The fact that countries' institutional arrangements differ so widely in this respect should not be taken to suggest that some are right and others are mistaken. What is best for one country may well be less than best for another.

(1) The 'broad model' described by Healey in her report to the Symposium.

## 7 Bakers and firefighters

Bread, and those who bake it, are in continuous demand. Firemen are needed only in emergencies. Monetary policy-makers are like bakers. A continuous watch on macroeconomic and monetary conditions must be kept. Interest rates need to be reset, even if only to be confirmed at unchanged levels, at regular and frequent intervals. Financial stability experts, by contrast, are primarily firefighters. Part of this work involves surveillance, and trying to prevent or contain fires by the building of fireproof structures. This relates to the design of the payments system, minimum capital accords, and—since fires do not respect country borders—the international financial architecture as well. A general oversight of financial conditions needs to be maintained at all times, but really close monitoring and intervention is reserved for financial institutions in serious trouble. Checking that fire extinguishers and alarms are in place and in working order, and that fire breaks and walls and regulations are respected, is an important recurrent task, but fighting fires that break out is the prime responsibility. Even in a large economy, it is not as if little fires are happening much of the time. Fires, especially big fires, are occasional events. And just as the externality of fire damage is the central argument for suspecting that individuals will take inadequate precautions if left to themselves, the web of adverse externalities and risks of contagion in financial crises provides the key case against pure *laissez faire*. The externalities that go with systemic risk are the principal reason why a central institution is needed to help ensure the stability of the financial system.

While the need for an institution to formulate and operate monetary policy is beyond doubt, some observers are apt to be sceptical about the usefulness of those responsible for maintaining financial stability. When financial stabilisers, if we may call them this, succeed in preventing fires, their value is invisible to the naked eye. If they succeed in containing a fire, it is hard to establish that the fire would have been worse in their absence. Worse, ill-informed popular opinion seeks scapegoats. Any fire may see them blamed for having, allegedly, allowed it to start in the first place. Like an ailing financial institution, financial stabilisers may be tempted to delay intervention, in the hope that tomorrow brings better news. Rain, or a change in wind direction, might snuff out an incipient fire before any damage is done. The need for timely information-sharing between the supervisor and the financial stabiliser, and for prompt corrective action, is stressed in many contributions to the Symposium—and particularly by Hoggarth and Soussa.

Firefighting is no simple task. Nor is fire-watching. There is a grey area between performing and non-performing loans. Valuing collateral or unquoted assets takes time. The markets for many types of debt are thin. Future debt serviceability is never known. The variances and covariances(1) of returns on all assets are notoriously non-stationary. Brokering an urgent informal auction or rescue of a troubled institution is never straightforward, nor is weighing the benefits and costs of emergency assistance under extreme time pressure, or countering the temptation for lenders to preserve goodwill or stay alive by rolling over suspect debts. All these factors pose real challenge. So, too, does the complex task of promoting robust financial structures, surveillance and macro-prudential analysis, which together form a large part of what financial stabilisers do. The value of experienced staff, and the awkward tendency for financial crises to cluster over time, make it very unwise for those in authority in tranquil periods to dispense with their financial firemen, tempting though that might sometimes seem.

Whatever the institutional arrangements a country has established for safeguarding its financial stability, there are powerful practical reasons for not altering them without due cause. There are costs and risks associated with the transition from one regime to another. If a new institution, with some inexperienced personnel, is entrusted with financial stability issues, it may be tempted to rely heavily on the rule-book. New rules are cheap to write, but they are costly to learn, interpret, obey and enforce.(2) In the absence of compelling reasons to the contrary, a country may do better to refine its existing arrangements than to import an alien model to which its particular circumstances are ill-suited. So wherever the firefighters work, alongside the bakers or elsewhere, rehousing them may well not prove advantageous.

## 8 Conclusions

Safeguarding financial stability is a core function of the modern central bank, no less than market operations and the conduct of monetary policy. This is evident from a detailed survey of 37 central banks, drawn from a wide variety of industrial, transition and developing countries. For those central banks that have never acted as regulator or supervisor of financial institutions, and for those that have recently shed these roles, financial stability responsibilities may be shared with other agencies, but the central bank is still very much in the game. This is particularly true in circumstances where bank failure would pose systemic risk. Threats to financial stability may arise from many sources, including excessive competition or overcrowding in the banking sector, misguided or misapplied regulation or lending to troubled institutions, undue forbearance, and currency crises. Financial stability impinges upon monetary policy and reacts to it. There are therefore powerful arguments for retaining responsibility for both within the central bank.

(1) Omission of covariances across different risky assets is one of the unfortunate features of the Basel Accord rules as they stand at present; this is one of several reasons why those monitoring financial stability need to do much more than merely check whether these rules are obeyed.
(2) As David Llewellyn stresses in his contribution to the Symposium.

## References

**Aghion, P, Bolton, P and Fries, S (1999)**, 'Financial restructuring in transition economies', *Journal of Institutional and Theoretical Economics*, Vol 155, pages 51–79.

**Aghion, P and Howitt, P (1992)**, 'A model of growth through creative destruction', *Econometrica*, Vol 60, pages 323–51.

**Aghion, P and Howitt, P (1998)**, *Endogenous growth theory*, MIT Press.

**Bolton, P and Freixas, X (2000)**, 'Equity, bonds and bank debt: capital structure and financial market equilibrium under asymmetric information', *Journal of Political Economy*, Vol 108, pages 324–51.

**Boot, A and Thakor, A V (2000)**, 'Can relationship banking survive competition?', *Journal of Finance*, Vol 55, pages 679–713.

**Briault, C (1999)**, 'The rationale of a single regulator', *Occasional Paper*, No 2, Financial Services Authority, London.

**Davis, E P (1999)**, 'Financial data needs for macroprudential surveillance—what are the key indicators of risks to domestic financial stability?', *Handbooks in Central Banking Lecture Series*, No 2, Centre for Central Banking Studies, Bank of England.

**Demirgüç-Kunt, A and Detragiache, E (1998a)**, 'Financial liberalization and financial fragility', in Pleskovic, B and Stiglitz, J E (eds), *Annual World Bank Conference on Development Economics*, 1997, World Bank.

**Demirgüç-Kunt, A and Detragiache, E (1998b)**, 'The determinants of bank crisis in developing and developed countries', IMF Staff Papers, March.

'Financial Stability and Central Banks' (2000), a Report by Richard Brealey and others for the Central Bank Governors' Symposium. Centre for Central Banking Studies, Bank of England.

**Fry, M J (1995)**, *Money, interest and banking in financial development*, 2nd edition, Johns Hopkins University Press.

**Goodhart, C A E (2000)**, 'The organisational structure of banking supervision', *Financial Stability Group Working Paper*, Bank for International Settlements, Basel.

**Hawkesby, C (2000)**, 'Central bank and supervisors: the question of institutional structures and responsibilities', Centre for Central Banking Studies, May.

**Heffernan, S A (1996)**, *Modern banking in theory and practice*, J Wiley.

**Hellman, T P, Murdock, K and Stiglitz, J E (2000)**, 'Liberalization, moral hazard in banking, and prudential regulation: are capital requirements enough?', *American Economic Review*, Vol 90, pages 147–65.

**King, R G and Levine, R (1993)**, 'Finance, entrepreneurship and growth: theory and evidence', *Journal of Monetary Economics*, Vol 32, pages 513–42.

**McCallum, B (2000)**, 'Theoretical issues pertaining to monetary unions', in Capie, F and Wood, G E (eds), *Currency unions: theory, history, public choice*, Macmillan, forthcoming.

**Mahadeva, L and Sterne, G (2000)** (eds), *Monetary policy frameworks in a global context*, Routledge.

**Mankiw, N G and Whinston, M D (1986)**, 'Free entry and social inefficiency', *Rand Journal of Economics*, Vol 17, pages 48–58.

**Mantousek, R and Taci, A (2000a)**, 'Banking regulation and supervision in associative countries', in Green, D (ed), *Banking and financial stability in central Europe*, Edward Elgar, forthcoming.

**Mantousek, R and Taci, A (2000b)**, 'The assessment of the costs and benefits of the small and medium-sized commercial banks within the Czech banking sector', in Hoelscher, J (ed), *Financial turbulence and capital markets in transition countries*, Macmillan, forthcoming.

**Marion, N (1999)**, 'Some parallels between currency and banking crises', in Isard, P, Razin, A and Rose, A K (eds), *International finance in turmoil: essays in honor of Robert P Flood*, IMF and Kluwer.

**Mitchell, J (2000)**, 'Theories of soft budget constraints in the analysis of banking crises', *The Economics of Transition*, Vol 8, pages 59–100.

**Morris, S and Shin, H (1998)**, 'Unique equilibrium in a model of self-fulfilling currency attacks', *American Economic Review*, Vol 88, pages 587–97.

**Morris, S and Shin, H (1999)**, 'Risk management with interdependent choice', *Bank of England Financial Stability Review*, Issue 7, November, pages 141–50.

M**ullineux, A and Sinclair, P (2000)**, 'Oligopolistic banks: theory and policy implications', paper presented to Royal Economic Society and Queensland Financial Stability Conferences, June-July 2000.

**Rodgers, P (1997)**, 'Changes at the Bank of England', *Bank of England Quarterly Bulletin*, August, pages 241–46.

**Rogoff, K (1985)**, 'The optimal degree of commitment to an intermediate target', *Quarterly Journal of Economics*, Vol 100, pages 1,169–89.

**Romer, P M (1990)**, 'Endogenous technological change', *Journal of Political Economy*, Vol 98, pages 71–102.

**Salop, S (1979)**, 'Monopolistic competition with outside goods', *Bell Journal of Economics*, Vol 10, pages 141–56.

**Sinclair, P (1990)**, 'The economics of imitation', *Scottish Journal of Political Economy*, Vol 37, pages 113–44.

**Taylor, M and Fleming, A (1999)**, 'Integrated financial supervision: lessons from Northern European experience', International Monetary Fund draft paper, September.

**Vickers, J S and Yarrow, G K (1988)**, *The economics of privatization*, MIT Press.

# Inferring market interest rate expectations from money market rates

By Martin Brooke of the Bank's Gilt-edged and Money Markets Division, and Neil Cooper and Cedric Scholtes of the Bank's Monetary Instruments and Markets Division.

*The Bank's Monetary Policy Committee is interested in market expectations of future interest rates. Short-term interest rate expectations can be inferred from a wide range of money market instruments. But the existence of term premia and differences in the credit quality, maturity, liquidity and contract specifications of alternative instruments means that we have to be careful when interpreting derived forward rates as indicators of the Bank's repo rate. This article discusses the differences between some of the available instruments and relates these to the interest rate expectations that are calculated from them. It also describes the Bank's current approach to inferring rate expectations from these instruments.*

## Introduction

The Bank's Monetary Policy Committee (MPC) is interested in financial market participants' expectations of future interest rates. Knowledge of such expectations helps the MPC to predict whether a particular policy decision is likely to surprise market participants, and what their short-term response is likely to be to a given decision. Expectations of future levels of official rates also play a key role in determining the current stance of monetary policy. The Bank implements the MPC's monetary policy decisions by changing the level of its two-week repo rate which, in turn, influences the levels of other short-term money market interest rates. However, many agents in the economy are also affected by changes in longer-term interest rates. For instance, five-year fixed-rate mortgages are typically priced off the prevailing rates available on five-year swap contracts, and larger firms often raise finance in the capital markets by issuing long-maturity bonds. Changes in these longer-term interest rates depend to a considerable extent on expectations of future official rates. So the Bank needs to have some understanding of expectations of future policy rates, in order to monitor and assess changes in current monetary conditions.

The Bank performs the vast majority of its monetary operations via two-week sale and repurchase (repo) agreements—the Bank lends funds to its counterparties in return for specific types of collateral. Forward rates are the most commonly used measure of interest rate expectations. In principle, we want to derive forward rates that correspond to future two-week Bank repo rates. Unfortunately, however, there is no instrument that allows us to do this exactly. So we have to estimate forward rates from the sterling money market instruments that are actually traded. The Bank of England currently infers market interest rate expectations from: general collateral (GC) repo agreements; conventional gilt yields; interbank loans; short sterling futures contracts; forward-rate agreements (FRAs); and swap contracts settling on both the sterling overnight interest rate average (SONIA) and on six-month Libor rates. The box opposite explains how these instruments operate.

Other money market instruments such as certificates of deposit and commercial paper could also be used to derive forward rates. But the Bank does not use these instruments, as their credit quality can vary significantly from one issuer to the next. In contrast, interbank loans, short sterling futures, FRAs and Libor swaps all settle on Libor rates, determined by the British Bankers' Association (BBA). The credit risk element contained within each of these instruments will be common, and will be related to the financial institutions contained within the BBA's sample pool (see the box opposite). SONIA swap rates are likely to have very little credit risk as they embody expectations of movements in an overnight rate.

A range of maturities is available for each of the instruments outlined in the box, enabling us to calculate implied forward curves. However, the existence of term premia, arising from interest rate uncertainty and investor risk aversion, means that derived forward rates will not in general equal expectations of future short rates. Differences in credit quality, liquidity and contract specifications of the instruments also result in spreads between the forward curves. Consequently, none of these curves provides an unbiased measure of expectations of future official rates. Neither is any one instrument likely to provide consistently the best measure. So an understanding of the differences between the instruments is essential to assess market expectations of future monetary policy. This article explains why biases occur in measuring expectations and how the Bank takes them into account when trying to infer market participants' expectations of future official rates.

## Sterling money market instruments

### *General collateral sale and repurchase agreements*

Gilt sale and repurchase ('gilt repo') transactions involve the temporary exchange of cash and gilts between two parties; they are a means of short-term borrowing using gilts as collateral. The lender of funds holds government bonds as collateral, so is protected in the event of default by the borrower. General collateral (GC) repo rates refer to the rates for repurchase agreements in which any gilt stock may be used as collateral. Hence GC repo rates should, in principle, be close to true risk-free rates. Repo contracts are actively traded for maturities out to one year; the rates prevailing on these contracts are very similar to the yields on comparable-maturity conventional gilts.

### *Interbank loans*

An interbank loan is a cash loan where the borrower receives an agreed amount of money either at call or for a given period of time, at an agreed interest rate. The loan is not tradable. The offer rate is the interest rate at which banks are willing to lend cash to other financial institutions 'in size'. The British Bankers' Association's (BBA) London interbank offer rate (Libor) fixings are calculated by taking the average of the middle eight offer rates collected at 11 am from a pool of 16 financial institutions operating in the London interbank market. The BBA publishes daily fixings for Libor deposits of maturities up to a year. A primary role of interbank deposits is to permit the transfer of funds from 'cash-surplus' institutions (such as clearing banks) to 'cash-deficit' institutions (those who hold financial assets but lack a sufficient retail deposit base).

### *Short sterling futures*

A short sterling contract is a sterling interest rate futures contract that settles on the three-month BBA Libor rate prevailing on the contract's delivery date. Contracts are standardised and traded between members of the London International Financial Futures and Options Exchange (LIFFE). The most liquid and widely used contracts trade on a quarterly cycle with maturities in March, June, September and December. Short sterling contracts are available for settlement in up to six years' time, but the most active trading takes place in contracts with less than two years' maturity. Interest rate futures are predominantly used to speculate on, and to hedge against, future interest rate movements.

### *Forward-rate agreements (FRAs)*

A FRA is a bilateral or 'over the counter' (OTC) interest rate contract in which two counterparties agree to exchange the difference between an agreed interest rate and an as yet unknown Libor rate of specified maturity that will prevail at an agreed date in the future. Payments are calculated against a pre-agreed notional principal. Like short sterling contracts, FRAs allow institutions to lock in future interbank borrowing or lending rates. Unlike futures contracts, which are exchange-traded, FRAs are bilateral agreements with no secondary market. FRAs have the advantage of being more flexible, however, since many more maturities are readily available. Non-marketability means that FRAs are typically not the instrument of first choice for taking speculative positions, but the additional flexibility does make FRAs a good vehicle for hedging, as they can be formulated to match the cash flows on outright positions.

### *Swaps*

An interest rate swap contract is an agreement between two counterparties to exchange fixed interest rate payments for floating interest rate payments, based on a pre-determined notional principal, at the start of each of a number of successive periods. Swap contracts are, therefore, equivalent to a series of FRAs with each FRA beginning when the previous one matures. The floating interest rate chosen to settle against the pre-agreed fixed swap rate is determined by the counterparties in advance. There are two such floating rates used in the sterling swap markets: the sterling overnight interest rate average (SONIA) and six-month Libor rates.

SONIA is the average interest rate, weighted by volume, of unsecured overnight sterling deposit trades transacted prior to 3.30 pm on a given day between seven members of the Wholesale Money Brokers' Association. A SONIA overnight index swap is a contract that exchanges at maturity a fixed interest rate against the geometric average of the floating overnight rates that have prevailed over the life of the contract. SONIA swaps are specialised instruments used to speculate on or to hedge against interest rate movements at the very short end of the yield curve. Maturities traded in the market range from one week to two years.

Libor swaps settle against six-month Libor rates. They are typically used by financial institutions to help reduce their funding costs, to improve the match between their liabilities and their assets, and to hedge long positions in the cash markets. Traded swap contract maturities range from 2 years to 30 years.

## Forward rates, the expectations hypothesis and term premia

Forward rates are the interest rates for future periods that are implicitly incorporated within today's interest rates for loans of different maturities. For example, suppose that the interest rate today for borrowing and lending money for six months is 6% per annum and that the rate for borrowing and lending for twelve months is 7%. Taken together, these two interest rates contain an implicit forward rate for borrowing for a six-month period starting in six months' time. To see this, consider a borrower who wants to lock in to today's rate for borrowing £100 for that period. He can do so by borrowing £97.08(1) for a year at 7% and investing it at the (annualised) six-month rate of 6%. In six months' time he receives back this sum plus six months' of interest at 6% (£2.92), which gives him the £100 of funds in six months' time that he wanted. After a year he has to pay back £97.08 plus a year of interest at 7% (£103.88). In other words, the borrower ensures that his interest cost for the £100 of funds he wants to borrow in six months' time is £3.88. He manages to lock in an interest rate—the forward rate(2) of 7.77% now for borrowing in the future.

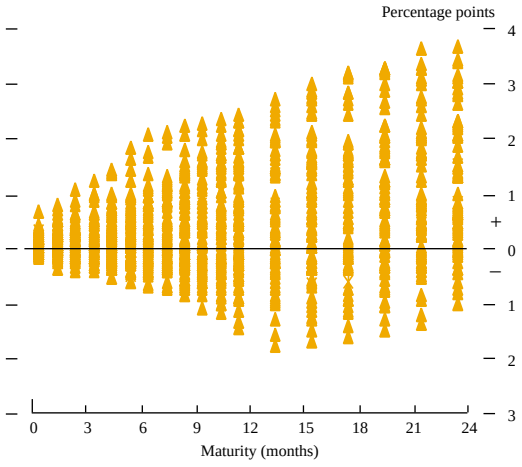
If there were no uncertainty about the path of future interest rates then forward rates would equal expected future interest rates. If this were not the case it would be possible to make unlimited riskless profits. Suppose, for example, that the borrower above knew for certain that six-month rates would be 8% in six months' time. But if today's six-month and twelve-month rates are 6% and 7%, then it is possible to lock in to borrowing now at 7.77%, knowing that one can then lend these funds out at a higher rate in six months' time to make a guaranteed riskless profit. Such an arbitrage opportunity would not persist long in a world of rational investors. As they exploited this situation, the configuration of interest rates would change until the implicit forward rates equalled expectations of future rates.

Future interest rates are, of course, not known with certainty. Nevertheless, if forward rates differ from expected future short rates, an investor will be able to create a position that has positive expected profits. The presence of interest rate uncertainty means that the actual profits from these trades may be positive or negative. Risk-averse investors will then require a risk premium to bear this interest rate risk. In equilibrium this will drive a wedge—the term premium—between the forward rate and expected short rates so that the expected profits incorporate the risk premium. Furthermore, the uncertainty surrounding the likely path of interest rates is greater the further ahead one looks, so this term premium is likely to increase with maturity. Hence the longer the horizon, the larger the difference between forward rates and expected rates.

Recent work at the Bank has tried to estimate the size of such term premia by comparing implied two-week interbank forward rates derived from a combination of Libor-related money market instruments with actual outturns of the Bank's two-week repo rate. If term premia are broadly stable, two-week interbank forwards should produce consistent forecast errors when regressed on the monetary policy rate outturns. However, consistent errors can also occur from repeated mistakes by market participants in forecasting the interest rate cycle. We can attempt to minimise this problem by comparing forward rates with subsequent Bank repo rates over a period spanning at least one complete interest rate cycle. If the sample period is sufficiently long, expectational errors should average out to zero. Any remaining bias should then represent the average term premium, though this technique will also pick up differences between the money market instruments used and the Bank's repo rate that are related to liquidity and credit quality.

Chart 1 plots the differences between our derived two-week interbank forward rates and the actual outturns of the official rate for alternative maturities out to two years, for the period January 1993 to September 2000. Each point represents the difference between the interbank forward rate and the corresponding outturn of the Bank's repo rate. It is clear from the chart that there is often a large degree of 'error' between the forward rate and the actual outturn. Unsurprisingly, the range of these errors increases with maturity, as it is harder to predict official rates further out. This dispersion also makes it hard to infer what the size of term premia are. The chart suggests that, on average, interbank forward rates have been biased above actual outturns of the official rate. The average biases over this period for six-month, one-year and two-year maturities were

**Chart 1**
**Differences between two-week interbank forward rates and official rate outturns**




(1) This is the present value of £100 in six months' time, $£100\left(\frac{1}{1+\frac{0.06}{2}}\right)$.

(2) The implicit forward rate is given by $2\left(\frac{\left(1+r_{0,12}\right)}{\left(1+\frac{r_{0,6}}{2}\right)}-1\right)$ where $r_{0,12}$ is the one-year interest rate and $r_{0,6}$ is the six-month interest rate.

23, 45 and 109 basis points respectively. It should be noted, however, that these are forward rates derived from instruments that contain some element of credit risk. We estimate later in this article that credit risk considerations may account for 20–25 basis points, on average. The remainder of the bias observed in Chart 1 is due to either the existence of term premia or consistent expectational errors over the sample period. Given the volatility in the observed spread, we can draw only very tentative conclusions about the size of the term premia. Nevertheless, it seems reasonable to conclude that term premia create an upward bias in interbank forward rates compared with actual policy rate expectations, and that this bias increases with maturity.

## Credit premia

As noted above, the Bank derives short-term forward interest rates from a variety of fixed-income instruments, which combine varying degrees of credit risk. GC repo is the closest instrument to the Bank's repo agreement. It is used by market participants for a number of purposes: it allows institutions to speculate about future changes in interest rates; retail banks use outright gilt holdings and GC repo to manage their day-to-day liquidity positions; and market-makers and other holders of gilts and gilt futures contracts can use the repo market to fund or close out their positions. Since the lenders of funds in the GC repo market are protected from default by the gilt collateral they hold, GC repo rates ought to be close to true risk-free rates and to the Bank's repo rate. In reality, however, GC repo tends to trade at rates below the Bank's repo rate for two-week maturities because of differences in liquidity and contract specifications between the Bank's and the GC repo agreements.

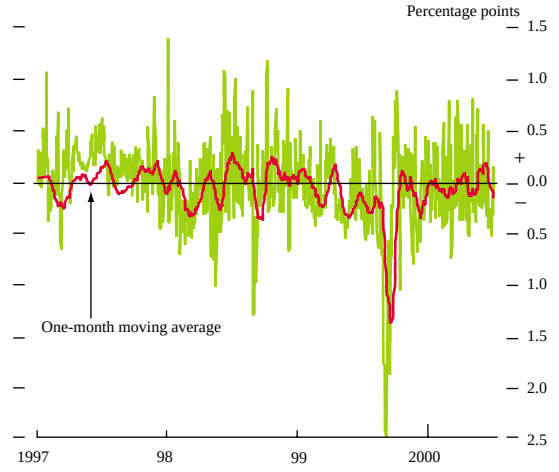
The measure of short-term interest rate expectations most frequently used by market participants is that derived from short sterling futures contracts. These settle at the three-month Libor rate prevailing on the contract's expiry. The implied future level of three-month Libor is simply a three-month forward rate. There are two difficulties in interpreting these forward rates as expectations of the Bank's repo rate. First, they indicate expectations for a three-month rate starting at the maturity of the contract. So they typically encompass three MPC decision dates and hence are an imprecise indicator of future two-week Bank repo rates. And second, Libor rates are based on uncollateralised lending within the interbank market and they consequently contain a credit premium to reflect the possibility of default. So expectations of future interbank rates will be higher than the Bank's repo rate.

Forward rates can also be derived from the term structures of both SONIA swaps and Libor swaps. The forward rates derived from Libor-based swaps will also include a credit risk premium. Just as for term premia, credit risk considerations are likely to increase with maturity. Since Libor swaps settle on six-month Libor, it is likely that the forward rates derived from these swaps will include a slightly larger credit risk bias than the forward rates derived from short sterling futures.

The fixed rate quoted for a SONIA swap represents the average level of SONIA expected by market participants over the life of the swap. SONIA usually follows the Bank's repo rate fairly closely because the credit risk on an overnight deposit is very low. The volatility of the spread between SONIA and the Bank's repo rate is large, however. This is an obvious reason for hedging using swaps. SONIA swaps are also used to take views about future changes in the Bank's repo rate (typically at maturities of between one and three months), and to speculate about market conditions that may drive short-term interest rates away from the official rate.

Chart 2 shows a time series of the spread between SONIA and the Bank's repo rate, and a simple expectation of the spread calculated as a one-month moving average. It shows that although the daily spread is highly volatile, the one-month 'expectation' is stable but often slightly below zero. This suggests that SONIA swaps should be a good indicator of rate expectations but with a small downward bias. Excluding December 1999 and January 2000 (which were affected by liquidity and credit risk considerations relating to the century date change), the spread has averaged -4 basis points since February 1997. This spread is most likely to reflect the trading practices of the principal money market participants, who need an upward-sloping yield curve between the overnight and three-month maturities in order to profitably undertake their market-making functions.

**Chart 2**
**Spread of SONIA over Bank's two-week repo rate**




## Liquidity considerations

As noted above, differences between the forward rates derived from the various money market instruments may also reflect the different liquidity properties of the instruments. In general, market participants are often willing to pay a higher price (receive a lower yield) to hold instruments that are more liquid and that are likely to be easier to trade in distressed market conditions. There is no

unique measure of liquidity, but turnover, market size, and bid-offer spreads may provide some indication of differing liquidity conditions.

Daily turnover in the gilt repo market is currently around £20 billion, with activity largely concentrated at the shortest end of the curve: 90% of the turnover matures between one and eight days, 6% at nine days to one month, and only 4% of turnover is at maturities of more than one month. Bid-offer spreads are typically around 5 basis points for most maturities. At the end of August, the total outstanding stock of gilt repo contracts was £133 billion.

The interbank deposit/loan market is slightly bigger, at around £160 billion. As with GC repo, activity is largely concentrated at maturities of less than one month, but market participants report that liquidity is reasonable out to three months. Bid-offer spreads vary depending on the borrower's creditworthiness but typically average around 3–5 basis points for three-month unsecured loans to high-quality borrowers.

Daily turnover in the short sterling futures market is currently around £45 billion and the total open interest in all contracts is around £385 billion. Contracts are very liquid in the first year and fairly liquid out to two years. Beyond that point, turnover is largely limited to arbitrage with the interest rate swap market and is often connected with hedging activity rather than speculation about future interest rates. Bid-offer spreads are generally 1–2 basis points for the first two years of short sterling contracts, and around 4 basis points after that.

Daily turnover in the SONIA swaps market is much smaller. The most liquid contract maturities are up to three months. Bid-offer spreads at these maturities tend to be around 2 basis points (ie about the same as short sterling).

So, with the exception of Libor-based swaps, all of the instruments are highly liquid in the very near term (ie out to one month). Then the differences become more apparent—gilt repo becomes less liquid after the one-month maturity range, SONIA swaps and interbank borrowing become less liquid after three months, while short sterling is less liquid after one to two years. Libor swaps are generally felt to be liquid in the two-year to ten-year maturity range. However, it is very difficult to quantify the impact of these differences in terms of the biases they are likely to produce in the forward rates derived from these instruments. Furthermore, liquidity conditions can change rapidly and so the biases are unlikely to be constant over time.

## Other instrument-specific considerations

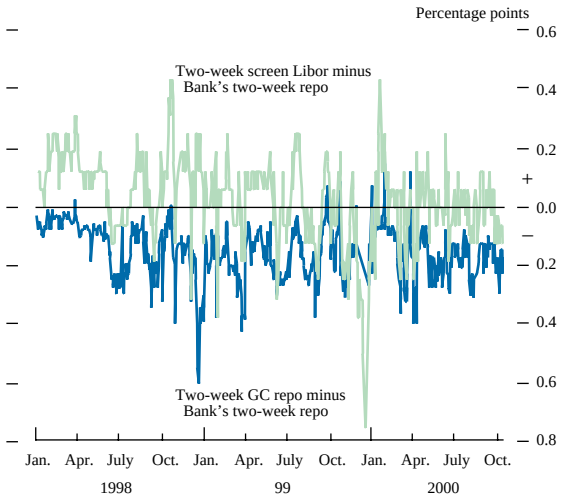
The Bank's two-week repo rate generally acts as a ceiling for the market-determined two-week GC repo rate. The reason for this is that if the market rate were to rise above the Bank's repo rate, counterparties to the Bank's open market operations would choose to borrow solely from the Bank of England, subject to the finite quantities of funding provided by the Bank. Two other specification differences between the Bank's two-week repo rate and the comparable-maturity GC repo rate add to this negative bias. First, the Bank allows its counterparties to replace one form of collateral with another during the life of the repo. This right of substitution, which is less common in market GC repo contracts, is potentially valuable to counterparties. Consequently, they are willing to lend collateral/borrow money from the Bank at a slightly higher interest rate. Around 13% of the collateral offered to the Bank in its open market operations is substituted for other collateral within the typical two-week lifetime of the repo transaction. Market participants believe that the right to substitution is worth around 3 basis points.

Another consideration is the fact that GC repo is used by the major retail banks to meet their liquidity requirements. This creates strong demand for short-dated gilts relative to the available supply. This, in turn, tends to tip the bargaining power in favour of holders of gilt collateral, enabling them to borrow cash at lower repo rates. In contrast, the Bank accepts a wider array of collateral in its repo operations. In particular, the range of eligible collateral for use in the Bank's repo transactions was expanded in August 1999 to include securities issued by other European governments (for which there is a much greater supply). Both of these considerations are likely to act in the same direction, putting downward pressure on two-week GC repo rates relative to the Bank's two-week repo rate.

## How large are the biases?

How large are the biases due to credit, liquidity and the differences between Bank and GC repo? Chart 3 shows the spread between two-week GC repo and the Bank's repo rate. The spread has averaged close to -15 basis points and is highly volatile. The chart also shows the spread between

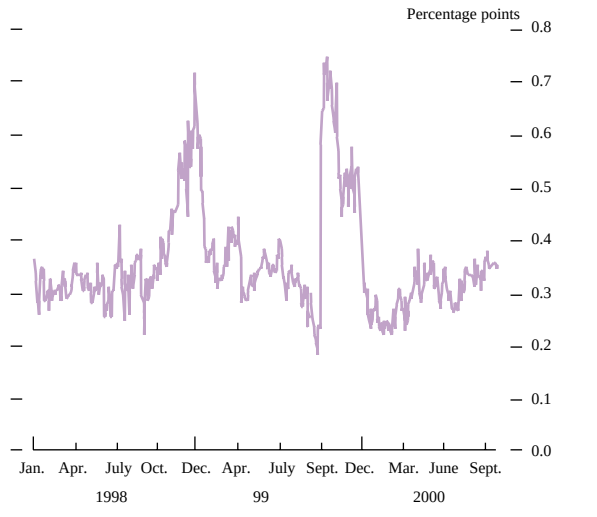
**Chart 3**
**Two-week screen Libor and GC repo spreads against official rates**



two-week Libor[1] and two-week Bank repo. This spread has averaged around 5 basis points, excluding December 1999 and January 2000, when the demand for secured borrowing increased sharply relative to unsecured borrowing because of credit concerns surrounding the century date change. This positive spread is likely primarily to reflect credit risk considerations between the unsecured interbank rate and the collateralised Bank repo rate. As noted previously, the credit risk premium contained within an interbank deposit will increase with its maturity—overnight lending is less risky than a three-month loan. So the credit risk contained within the forward three-month Libor rates derived from interbank loans, short sterling futures and FRAs is likely to be larger than this estimate. Similarly, swaps that settle on six-month Libor are likely to have a slightly larger credit risk element.

Chart 4 plots the spread between three-month Libor and three-month GC repo. Here, we are using the repo rate as an imperfect proxy for the riskless rate. In the run-up to the end of the year the spread widens. This effect is known as the 'year-end turn' and can be observed in a number of other markets. Excluding the three months at the end of the past two years, the average spread between the two rates has been around 35 basis points. Previously we noted that GC repo (at least at two-weeks' maturity) tends to be biased downwards compared with the Bank's repo rate. So around 15 basis points of this spread is likely to be related to the liquidity and contract differences discussed above. This

**Chart 4**
**Three-month Libor minus three-month GC repo**




leaves a credit spread of around 20 basis points between three-month Libor and the Bank's repo rate. Given the volatility of the spreads shown in Chart 2, it is important to recognise that these estimates are averages and that the differences between the forward rates derived from these instruments will vary over time.

## Assessing near-term interest rate expectations

Given the observed level and behaviour of the spreads we can attempt to make a judgment about market expectations of the Bank's repo rate. The Bank's approach follows three stages:

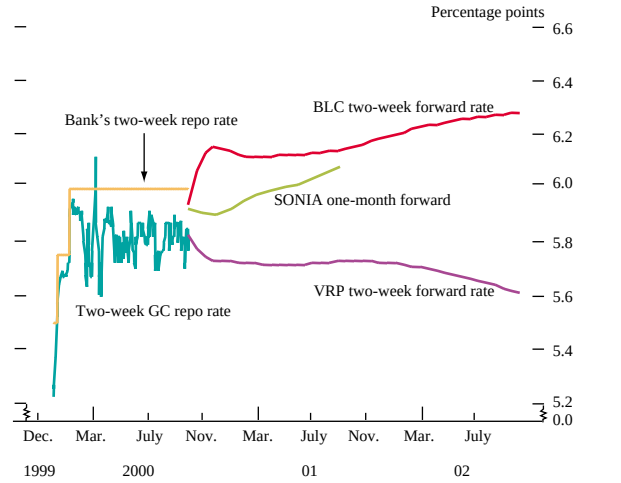
- we estimate two alternative forward curves from two alternative sets of instruments, each with common credit risk characteristics;
- we adjust these forward curves for the biases created by credit, liquidity and contract specification differences; and
- finally, we take a view on the adjustment required to take into account the bias introduced by the existence of term premia.

Both our estimated curves use the Bank's variable roughness penalty (VRP) curve-fitting technique explained in Anderson and Sleath (1999).[2] The first curve is fitted to GC repo rates up to six months and to gilt yields of greater than three months' maturity. The yields on comparable-maturity GC repo contracts and conventional gilts are very similar. Hence this combination of instruments does not introduce any discontinuity into the fitted forward curve. The front three to six months of the forward curve is largely influenced by the GC repo data and after this the forward curve reflects the influence of the conventional gilts. The second forward curve is an estimated two-week 'bank liability curve' (BLC). This is a curve fitted to synthetic bond prices generated from a combination of instruments that all settle on Libor rates. The instruments used are BBA interbank offer rates, short sterling futures, FRAs and, beyond two years, interest rate swaps. (The synthetic bond construction and curve-fitting processes are described in more detail in the appendix on pages 400–02.) The front twelve months of this curve is largely dependent on the interbank offer rates, FRAs and short sterling futures, while the next year is mainly influenced by short sterling futures and FRAs. Beyond two years, Libor swaps are the dominant influence. Chart 5 shows both forward curves, as well as a simple series of one-month forward rates derived from the available quoted rates for different-maturity SONIA swaps.

To interpret the curves in Chart 5 as indications of market expectations of future short rates we next need to adjust for the different types of bias discussed above. It is useful to do this in stages: first consider what a true risk-free forward curve corresponding to the Bank's two-week repo rate would look like, taking into account the credit risk biases in the bank liability curve and the downward bias of GC repo; and second to adjust for the term premia that exist within any forward curve. Because we have limited data on how

(1) This data is collected by the Bank from brokers rather than from the BBA.
(2) See Anderson, N and Sleath, J (1999), 'New estimates of the UK real and nominal yield curves', *Bank of England Quarterly Bulletin*, November, pages 384–96. The appendix on pages 400–02 gives a brief outline of the VRP technique.

**Chart 5**
**Forward rates with historic two-week GC repo**(a)



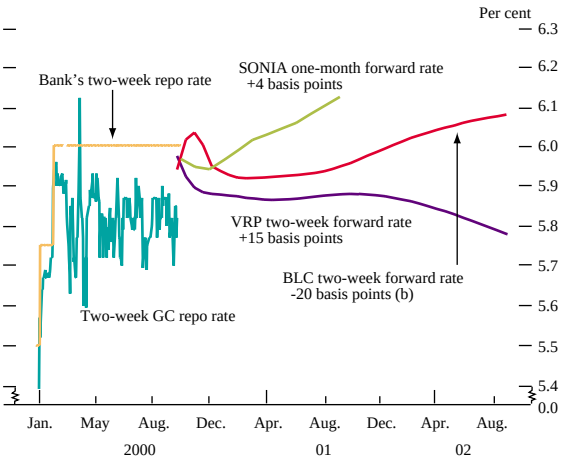

(a) As at 27 October.

these spreads vary at different maturities we can make only simple rough and ready adjustments.

The downward bias in two-week GC repo is approximately 15 basis points, so we can adjust the front end of the VRP gilt curve upwards by this amount to get our estimate of the 'Bank repo' forward curve. Likewise, the bank liability curve needs to be adjusted down by 5 to 10 basis points at the first month or so, rising to 20 basis points from three months to two years. Beyond two years, the bank liability curve is primarily influenced by swaps settling on six-month Libor rates and so the credit risk element is likely to rise to around 25 basis points. The forward rates derived from SONIA swaps need to be adjusted upwards by 4 basis points.

These adjusted curves are shown in Chart 6. Using money market rates prevailing on 27 October, the starting-points for all three of the forward curves were below the Bank's repo rate, even after making our adjustments. This reflects the volatility of the spreads between the market rates and the Bank's repo rate; we have been able to adjust only for the average observed premia. For the first year, the gilt and bank liability curves were telling a consistent story—both were broadly flat and suggested that the market's mean expectation was for no change in rates over the next year. In Section 6 of the *Inflation Report*, the Bank presents projections of inflation and GDP based on market interest rate expectations. The current convention is to use the adjusted GC repo/gilt forward curve as in Chart 6 to estimate these expectations.

**Chart 6**
**Adjusted forward rates with historic two-week GC repo**(a)




(a) As at 27 October.
(b) Adjustment of 5 basis points at two weeks, growing to 20 basis points at two months and beyond.

Beyond a year, however, these two curves diverge. This is puzzling, as we have taken into account (albeit in a simple way) the differences between the forward curves due to credit risk. Term premia effects have not been allowed for in Chart 6, but these are likely to influence all the derived forward rates in the same way and so are unlikely to explain the divergence. One potential explanation is that short sterling futures rates are biased upwards because the demand to hedge against the possibility of higher interest rates exceeds the demand to hedge against the chance of lower rates. Hedging against the possibility of higher interest rates in the future involves the creation of a short position in futures contracts. If interest rates rise in the future, the price of these contracts will fall making the hedge position profitable. This hedging activity (ie selling short sterling contracts) may be pushing up short sterling futures rates to higher levels than they would otherwise be. An alternative explanation is that the low issuance of short-maturity gilts by the UK government has led to their yields, and the forward rates associated with them, being depressed compared with the true risk-free rates.

Finally we need to take into account the effects of term premia. We have only the simple estimates discussed earlier, which suggest that term premia were negligible at less than six months and thereafter suggest a downward revision to the forward curves. Given this information, the forward rates derived from all the sterling money market instruments implied an expectation that the MPC would not raise the Bank's repo rate in the next two years.

## Conclusions

In summary, this article has argued that:

- Forward rates estimated from money market instruments are biased estimates of expectations of future Bank repo rates because of term, credit and liquidity premia, as well as contract specification differences.

- No particular money market instrument is likely to provide a 'best' indication of Bank repo rate expectations at all maturities. The spreads between the Bank's two-week repo rate and the instruments used to estimate our market curves are volatile and so we cannot expect to get a result that is common across all instruments.

- Reflecting these considerations, the Bank estimates two forward curves: one employing GC repo and gilt data and one that uses a combination of sterling money market instruments that settle on Libor rates.

- A number of simple ready-reckoner adjustments can be applied to the two estimated forward curves in an attempt to transform them into an estimate of a forward curve equivalent to two-week Bank repo rates. First, the GC repo/gilt forward curve needs to be adjusted up by around 15 basis points and the bank liability curve adjusted down by around 20 basis points. After these changes we still need to consider the impact of term premia effects. Preliminary estimates suggest that this would require us to make a further downward adjustment to both curves beyond a six-month horizon. However, we currently have limited information on the size of the term premia that create biases in forward curves even after we have taken into account estimates of credit and liquidity premia.

# Appendix
# Estimating a 'bank liability' forward curve using the Bank's VRP curve-fitting technique

The Bank has recently developed a method of estimating a yield curve from interbank liabilities. The new bank liability curve (BLC) uses sterling money market instruments that settle on Libor to construct synthetic 'interbank bonds'. The prices of these synthetic bonds are then used to fit a unified forward curve using the Bank's VRP curve-fitting technique.

### *Constructing synthetic bank liability bonds*

Conceptually, the main issue is how to convert money market and swap market instruments into synthetic bonds. The bank liability instruments used in our curve are:

- interbank loan rates (represented by BBA Libor fixings);
- short sterling futures;
- forward-rate agreements; and
- Libor-based interest rate swaps.

The common thread linking all these instruments—which permits us to estimate a unified forward curve from their rates—is that they are referenced on BBA Libor fixings. This ensures that the instruments are generally comparable in terms of underlying counterparty credit risk, in the sense that they can be treated as if issued by a 'representative' high-quality financial institution.

### *Interbank loans*

An interbank loan is, in effect, a zero-coupon bond. The Libor fixing rate therefore relates to the price of a synthetic zero-coupon bond as follows:

$$B_L(t_0,t_n)=\frac{100}{1+L(t_0,t_n)\alpha(t_0,t_n)} \text{ where } \alpha(t_0,t_n)=\frac{t_n-t_0}{36,500}$$

where $B_L(t_0, t_n)$ is the price at $t_0$ for a synthetic zero-coupon Libor-based bond of maturity $t_n$; $L(t_0, t_n)$ is the annualised Libor deposit rate at $t_0$ for maturity date $t_n$; and $\alpha(t_0, t_n)$ is the day-count basis function for sterling Libor loans and deposits.

### *Forward-rate agreements*

Purchasing a forward-rate agreement (FRA) allows an investor to transform, at time $t_0$, a floating-rate liability commencing at $t_m$ and maturing at $t_n$ into a fixed-rate liability. It achieves this by paying out the difference between a reference floating rate and the pre-specified FRA rate on a notional amount. If the reference rate turns out to be above the FRA rate, the investor would then receive payment on the FRA contract, and this payment would exactly offset the higher costs of a floating-rate loan with the same principal. The end-product would be a fixed-rate loan set at the FRA rate, commencing at $t_m$ and ending at $t_n$ (a forward-start fixed-rate loan). Combining a fixed-rate Libor deposit maturing at $t_m$ with a forward-start fixed-rate loan (constructed as above) commencing at $t_m$ and maturing at $t_n$ thereby gives a synthetic zero-coupon bond with maturity $t_n$.

A useful property of a $(t_m \times t_n)$ FRA is that the contract commences on the same date as the matching $t_m$ Libor deposit expires, and ends on the same date as the $t_n$ Libor deposit expires. Correspondingly, the end of one FRA contract coincides with the beginning of the next. For underlying contract start dates twelve months or less into the future, the price of a synthetic Libor/FRA zero-coupon bond would be given by:

$$B_{FRA}(t_0,t_n)=\frac{B_L(t_0,t_m)}{1+f_{FRA}(t_0,t_m,t_n)\alpha(t_m,t_n)}$$

where $\alpha(t_m,t_n)=\frac{t_n-t_m}{36,500}$

and $f_{FRA}(t_0, t_m, t_n)$ is the FRA rate commencing at $t_m$ and ending at $t_n$. For FRA contracts commencing beyond twelve months (the longest Libor rate) we can construct synthetic bonds by combining FRAs in a similar way. Hence for $t_0 < t_l < t_m < t_n$, where $t_l \leq$ twelve months and $t_m >$ twelve months:

$$B_{FRA}(t_0,t_n)=B_L(t_0,t_l)\left[\frac{1}{1+f_{FRA}(t_0,t_l,t_m)\times\alpha(t_l,t_m)}\right]\times\left[\frac{1}{1+f_{FRA}(t_0,t_m,t_n)\times\alpha(t_m,t_n)}\right]$$

Longer-term bond prices may be calculated in the same way using additional FRAs.

### *Short sterling futures (SSFs)*

A difficulty arises when considering SSFs because futures contract dates will in general not coincide with Libor expiry dates, and some of the futures contracts will commence beyond the longest Libor deposit contract. For SSFs commencing less than twelve months ahead, the same approach as for FRAs can be used to obtain synthetic Libor/SSF zero-coupon prices. But we need a Libor-based bond price that matures at the maturity of the short sterling future. To calculate this we linearly interpolate across Libor rates to get an estimate of the bond price $\hat{B}_L(t_0,t_m)$ that matures at the same time, $t_m$, as the futures contract.

Hence synthetic zero-coupon Libor/SSF 'bond' prices would be given by:

$$\hat{B}_{SSF}(t_0,t_n)=\frac{\hat{B}_L(t_0,t_m)}{1+f_{SSF}(t_0,t_m,t_n)\alpha(t_m,t_n)}$$

where $\alpha(t_m,t_n)=\frac{t_n-t_m}{36,500}$

and $f_{SSF}$ is the short sterling futures rate maturing at $t_m$.

Beyond twelve months, it becomes necessary to bootstrap futures contracts together. This requires us to assume that the SSFs have an underlying interbank loan contract with the same term as the time to the next contract, to ensure strip continuity. Fortunately, day-count errors will matter proportionately less at longer maturities.(1) We can then bootstrap the futures onto the latest available (interpolated) Libor discount factor.

The bootstrapped bond prices can be obtained as follows:

$$\hat{B}_{SSF}(t_0,t_n)=\hat{B}_L(t_0,t_m)\prod_{j\geq m}^{n}\left(\frac{1}{1+f_{SSF}(t_0,t_j,t_{j+1})\alpha\left(t_j,t_{j+1}\right)}\right)$$

where $t_j$ ($j$ = 1, … , J) represents the SSF contract dates and $t_m$ is the start-date for the last SSF contract commencing within twelve months.

### *Interest rate swaps*

A par swap can be thought of as a portfolio of fixed-rate and floating-rate cash flows. For the purchaser of a par swap of maturity $t_N$, the fixed leg of the swap involves a series of outgoing interest payments on a notional principal at a predetermined fixed swap rate, $s(t_0, t_N)$. The floating leg involves incoming interest payments on the same notional principal, but linked to a floating reference rate, reset at given intervals (usually six-month Libor for sterling swaps). A par swap is an interest rate derivative with zero initial premium—ie the swap rate, $s(t_0, t_N)$, is set such that the fixed and floating 'legs' of the swap have equal present value. The present value of the floating leg is £1. Hence equating the fixed and floating legs gives:

$$1=s(t_0,t_N)\sum_{n=1}^{N}\alpha(t_{n-1},t_n)B(t_0,t_n)+B(t_0,t_N)$$

where $\alpha(t_0, t_n)$ is the day count function and $B(t_0, t_n)$ is the price of a zero-coupon bond with face value £1 and maturity $t_n$. The swap rate, $s(t_0, t_N)$, can be interpreted as the coupon rate, payable at the payment dates $t_n$ ($n$ = 1, … , N), giving the coupon bond a market price at $t_0$ equal to its face value.

Typically, swap counterparties exchange the net difference between fixed-rate and floating-rate obligations at the 'coupon' dates. However, we use the formula to calculate the 'fixed-rate coupon' payable on the synthetic fixed-rate bond trading at par.(2) Once refixing and settlement dates are determined, interest payments are calculated using the standard formula:

$$INT = P \times R/100 \times \alpha(t_{n-1}, t_n)$$

where $\alpha(t_{n-1}, t_n) = (t_n - t_{n-1})/365$; $P$ is the nominal principal; $R$ is the fixed/floating rate (annualised but with semi-annual compounding); $t_n$ is the settlement date $n$ = 1, … , N; and $\alpha(t_{n-1}, t_n)$ is the day-count fraction (actual/365(fixed) for sterling swaps).

Transforming bank liability instruments into synthetic zero-coupon and coupon bonds in this fashion allows one to build a bond price vector and a simple cash-flow matrix. Applying the Bank's existing curve-fitting technique then yields a forward curve for bank liabilities.

### *Fitting the forward curve*

The Bank currently fits a forward curve through bond price data using spline-based techniques model forward rates as a piecewise cubic polynomial, with the segments joined at 'knot-points'. The coefficients of the individual polynomials are restricted such that both the curve and its first derivative are continuous at all maturities, including the knot-points. The Bank's approach involves fitting a cubic spline by minimising the sum of squared price residuals plus an additional roughness penalty.

To be more precise, the objective is to fit the instantaneous forward rate, $f(m)$, to minimise the sum of squared bond price residuals weighted by inverse modified duration, plus an additional penalty for 'roughness' or curvature, weighted according to maturity. In the Bank's specification, the roughness penalty, $\lambda_t(m)$—which determines the trade-off between goodness of fit and the smoothness of the curve—is a function of maturity, $m$, but is constant over time, $t$. This allows the curve to have greater flexibility at the short end. Weighting bond price errors by inverse duration gives approximately equal weight to a fractional price error across all maturities.

The objective function to be minimised is:

$$X = X_P + \int_0^N \lambda_t(m)\left[f''(m)\right]^2 dm$$

(1) Typically, SSFs are spaced 91 days apart, though they can be as much as 98 days apart. The term of the underlying three-month Libor contract will usually differ from this.
(2) Note the contrast between coupons on synthetic bank bonds and gilts. Gilts pay out a coupon determined by the formula: $INT = P \times R \times {}^1/_2$, regardless of the precise day on which the coupon falls. Gilts therefore have 'fixed' coupons, whereas synthetic bank bonds have 'fixed-rate' coupons, the size of which depend on the day-count since the previous coupon.

where $X_P = \sum_{i=1}^{I} \left[ \frac{P_i - \prod_i(\beta)}{D_i} \right]^2$

and $f(m)$ is the instantaneous forward rate for maturity $m$, $P_i$ and $\Pi_i(\beta)$ are the observed and fitted bond prices respectively, and $\beta$ is the vector of parameters. The parameters to be optimised are the parameters of the smoothing function, $\lambda(m)$, and the number of knot-points. The smoothing function is specified as follows:

$$\log\lambda(m) = L - (L-S)\exp(-m/\mu)$$

where $L$, $S$ and $\mu$ are parameters to be estimated, as explained in Anderson and Sleath (1999).

# Central bank independence

*In this speech,*[1] *the* ***Governor*** *first identifies the polar positions often taken on the issue of central bank independence: at one extreme a set of elite individuals beyond political influence and with extensive but generally defined powers; at the other the central bank as simply another arm of government. Surveying the history of the Bank of England since 1945, the Governor says that for much of that period it was closer to the second extreme. From the 1970s the intellectual climate changed, with a widespread recognition that monetary policy should play the major role in ensuring macroeconomic stability, culminating in the moves towards greater transparency in the Bank's role in the mid-1990s and the granting of operational independence in 1997. The Governor goes on to describe the monetary policy regime, and the Bank's role in ensuring financial stability, that followed from the Bank of England Act 1998. He concludes by saying that there is no single model to fit all situations and that, whatever the formal arrangements, the political and public confidence on which a central bank depends must be continuously earned through integrity and competence.*

Governor Jayawardena, fellow central bankers, on behalf of the Bank of England, and, I am sure, of all your guests here this morning, I congratulate you, Mr Governor, on the great contribution that the Central Bank of Sri Lanka has made to the development of your beautiful country in your first 50 years, and I wish you continuing success in your task in the years to come.

You invited me to speak about central bank independence, which of course I am happy to do—although I should perhaps make clear at the outset that it is a concept that I find somewhat elusive. Like so many other debates, the debate about central bank independence often seems to become unduly polarised.

At one extreme it seems that some of those who resist central bank independence as undemocratic—or even some central bankers who favour it—assume that it involves an elite body of individuals, who, once appointed are, by virtue of statute, beyond political influence, with extensive but only generally defined powers to affect the financial environment, and hence the lives of individuals and businesses throughout their currency area. At the opposite extreme it sometimes seems that the only alternative is for the central bank to be simply another arm of government, subservient to finance ministers and their officials.

Now I don't know how many of you would recognise yourselves under either of these extreme categorisations. I guess not very many.

I have to confess that—however attractive this definition of independence might appear as a central banking career option—if this really were the choice to be made, then, as a citizen of a democratic society I would have to choose the non-independent alternative. But, of course, the real debate is much more subtle and extends across a much narrower part of the spectrum between these polar extremes.

The real debate is in fact well described by John Exter, the Federal Reserve Board official, who advised on the establishment of the Central Bank of Ceylon, as it then was, and stayed on to become its first Governor.

In his Report—published in November 1949—Exter presented a draft bill accompanied by a commentary. It is still well worth reading. In that commentary Exter first outlines the case for the new central bank being 'non-political' and having 'a considerable amount of independence—essentially on the grounds that central banking 'puts the government into the business life of a country at especially critical points, namely banking and other credit activities, capital markets, foreign exchange markets and the supply of currency', and that it 'embraces problems which are of an unusually technical nature'!

But Exter goes on to recognise that 'there are many important problems of monetary policy, especially those relating to fiscal policy, on which a central bank must necessarily work in close harmony with the government'. Noting that many governments had learned to value the sort of independent and objective, detached, advice that central banks are able to give, Exter nevertheless acknowledges that 'on matters of vital interest to the state it would be impossible for a central bank to adopt a policy contrary to the policy of the government of the day'. His killer argument is that no central banker can help but be 'acutely conscious of the fact that, since no Parliament can bind its successors, their independence is limited by the ultimate power of the government to change the law'.

(1) Given at the SEANZA Governors' Symposium, Colombo, on 26 August 2000. This speech can be found on the Bank of England's web site at www.bankofengland.co.uk/speeches/speech95.htm

He concludes that the exact degree of independence of the central bank is likely to vary from time to time (giving the example of a peacetime and wartime economy), and he describes the ideal as one in which there will be continuous and constructive co-operation between the central bank and the government. The effectiveness of this co-operation—he says—will depend more on the men occupying the key positions at particular times than on any legal formula, no matter how carefully or elaborately it might be worked out.

I have quoted from Exter's Report at some length because of its particular relevance to this anniversary occasion, but also because, although he was writing in the particular context of Sri Lanka at the end of the 1940s, contemplating a move from a currency board to a central bank, much of his comment is timeless. I should like to elaborate upon—or supplement—some of his themes drawing upon our own experience in the United Kingdom.

For just over 50 years—from 1946 to 1998—the Bank of England operated under legislation which, remarkably, did not attempt to define our objectives or functions; they were simply assumed to carry over from our earlier long history. The 1946 Bank of England Act conferred upon us powers, subject to the agreement of the Chancellor of the Exchequer, to issue directions to bankers—though the term 'bankers' was not defined; and it provided for the Treasury to give such directions to the Bank as, after consultation with the Governor, they thought necessary in the public interest. Such directions would necessarily have been made public; none were in fact ever given. In any event the Bank of England was in a formal, statutory, sense throughout this period well along the spectrum towards the subservient polar extreme that I described earlier in relation to policy-making, although we did enjoy elements of independence, for example in relation to security of tenure for the duration of fixed-term appointments for Governors and Directors, and in some degree in relation to our finances.

I am bound to say though that this was not at all how it felt in practice. Even within this statutory framework independence is rather like age—you are as independent as you feel!

The question really came down to how far we were able to influence the government, which in turn depended upon how far they themselves valued our advice and how far they felt a need to take account of it in the light of possible public—including importantly financial market—reactions in the event of disagreement. Clearly this put the ball very much in our own court in the sense that we needed to do all that we could to persuade successive governments, but also financial markets and the public at large, of our integrity and objectivity on the one hand and of our technical and analytical competence on the other. Without that our input to policy would not have been worth very much, and would not have carried conviction. In fact integrity and objectivity together with professional competence are in my view the essential foundations of effective independence whatever the statutory framework. Fundamentally it is up to us!

For much of the period after 1946 two contextual factors served in any event to limit the degree of independence we could realistically expect to achieve.

The first was the post-war context of direct intervention and controls, including initially the physical allocation of scarce materials and consumer rationing but extended to the financial system, for example through credit ceilings and directional guidance as well as exchange controls, which were only finally removed in 1979. Direct resource allocation rather than allocation through market mechanisms involves intrinsically political judgments—choices between the social value of some forms of activity against others—which cannot easily be devolved to appointed officials. It would put the officials dangerously in the political firing line—calling their impartiality and objectivity into question—if they were. While central banks may legitimately advise on the technical implementation of such intervention, and be the agency through which it is carried out, it is far better all round in my view that responsibility for the choices implicit in such policies remains clearly with the government.

Secondly, for a long time after the war in the United Kingdom—until well into the 1970s, majority opinion did not identify a specific role for monetary policy within overall economic policy; nor was there any very clear understanding of the central bank's role in maintaining systemic financial stability.

Economic policy was widely seen as requiring the use of all available policy instruments—monetary policy, overall fiscal policy, direct controls, as I say, even prices and incomes policies—in concert to achieve an appropriate balance at any particular time between what were seen as the conflicting objectives of growth and employment on the one hand, and controlling inflation and maintaining reasonable balance of payments equilibrium on the other. Economic policy overall was in fact directed at managing what was seen as the trade-off between these social objectives. And this again involved intrinsically political rather than technical judgments, though in this context, too, there clearly was a role for the central bank in proffering detached technical and analytical advice. Also during this period, while it was accepted that the Bank of England exercised prudential supervision over the mainstream banking system, there was no effective oversight of the deposit-taking institutions that grew up outside the area of controls. It was only in 1979, after the fringe banking crisis of the early 1970s, that the Bank was given formal supervisory authority, extending to all deposit-taking institutions, but even then with the specific purpose of providing greater protection to depositors.

Our world changed, gradually but very markedly, from the 1970s onwards in all of these respects. Direct methods of monetary control gave way to fully-fledged market-based techniques, encouraging but also encouraged by intensified financial competition, increasingly driven by the IT revolution. Crucially, a consensus gradually developed—

with the Bank's strong encouragement—across a broad political spectrum in the United Kingdom (as it had earlier elsewhere) which recognised that there is in reality no trade-off between growth and stability except possibly in the short term. It recognised in fact the nowadays near-universal central bankers' mantra that stability is a necessary condition for sustainable growth. The consensus recognised, too, that, while overall fiscal policy had significant implications for macroeconomic stability over the medium and longer term it was not sufficiently flexible or adaptable to play the primary stabilising role in the shorter term. That task was specifically allocated to monetary policy. Finally, there was an emerging recognition of the potential for conflict between the central bank's necessary concern with systemic financial stability (you cannot hope to deliver monetary stability if the financial system is crashing about your ears, while monetary stability is itself a primary condition for financial stability) and consumer or depositor protection, which if carried too far can itself undermine the strength of the financial system.

These profound changes in underlying philosophy—which, as I say, spread across much of the political spectrum—were in our case fundamentally important in opening the way to a more clearly defined and distinctive role for the Bank of England and a necessary condition, in my view, for the delegation by the Government to the Bank of greater independent, technical, responsibility.

Even so, although those changes were a necessary condition, they were not in themselves sufficient, and greater independence did not come all at once.

As often happens, sadly, a big step forward came after a major setback. In 1992 after we had been driven unceremoniously out of the European Exchange Rate Mechanism (following the boom and bust of the late 1980s/early 1990s), the Government of the day adopted an explicit inflation target as the nominal anchor for monetary policy. Interest rate decisions in pursuit of that target remained with the Chancellor of the Exchequer after consultation with myself as Governor and my senior monetary policy experts at the Bank. But the really novel feature of the new arrangements was their transparency. The Bank was required by the Government to publish a quarterly *Inflation Report* setting out the background to the monetary policy decisions and the prognosis, and, going further, Chancellor Kenneth Clarke, subsequently decided that minutes of our policymaking meetings should be published six weeks or so after the event.

This degree of transparency was a bold and far-reaching step. Before that—apart from the dozen or so people directly involved in the decision-making process—no one knew with any certainty whether the mistakes that were made were a result of intervention by the Prime Minister, bad decisions by the Chancellor, with or without advice from Treasury officials, or bad advice from the Governor and/or his colleagues at the Bank. We all kept our heads down when things went badly, only putting them above the parapet when things went well. The Bank was, it is true, able within limits to explain its thinking publicly when summoned to appear before the relevant House of Commons Select Committee, or through Governor's speeches, and this possibility may have acted as some kind of a constraint on the Government, but such opportunities needed to be used with discretion or they could have caused a breakdown in the 'continuous and constructive co-operation between the central bank and the Government', which Exter rightly identified as the ideal—I would say even essential—relationship.

I think successive Chancellors came to recognise that the opaqueness of the existing decision-making process was inappropriate in principle in an effective democracy, which requires that we should each be accountable for the decisions that we take or for the advice that we give. They may also have thought that the public generally and Parliament in particular would not put up with it for much longer anyway. Or they may simply have felt that they were no longer prepared to carry the can for the bad advice they received. Whatever the motivation it is to their great credit that they were prepared to put their own reputations—as well as that of the Bank—on the line in this way! It not only allowed the Bank to express its own analysis and judgments about monetary policy publicly, it actually required us to do so. That really concentrated the mind, I can tell you; and it provided us with added stimulus to sharpen up our act. But for it to have this effect it was crucial that the intended integrity of the process was respected. What you saw in the minutes of 'the Ken and Eddie show' was *verbatim* the advice which I gave to the Chancellor and which I had discussed with senior colleagues beforehand.

This new transparency was a big step towards greater independence for the Bank. But it was carried much further by Chancellor Gordon Brown, as literally the new Labour Government's first act of policy—just four days after coming into office in 1997—when he announced that the Bank would henceforth be independently responsible for the operation of monetary policy. This commitment was subsequently embodied in a new Bank of England Act that came into effect in 1998.

The key characteristics of the new legislation were clarity of definition of the Bank's responsibilities, and transparency and elaborate provision for public accountability for the manner in which those responsibilities are carried out.

In relation to monetary policy in particular the new Act defines our responsibility as 'to maintain price stability and, subject to that, to support the economic policy of the Government including its objectives for growth and employment'. It is the Chancellor who defines what, more precisely, is to be understood by 'price stability', which he has done in the form of a symmetrical 2½% target for a particular statistical measure of retail prices. So we have 'instrument' rather than 'goal' independence.

It is sometimes suggested that this is a second-best arrangement. In our national context at least I disagree with that view. The precise objective of policy—even within the confines of the concept of price stability—remains a political decision: there will always be those who argue for a somewhat higher or somewhat lower target, and the fact that the Government endorses a precise target rather than just the vaguer goal of 'stability' certainly strengthens our hand by allowing us to concentrate on our essentially technical task. I am bound to say that in practice it seems to me to be rather a second-order issue anyway given the narrowness of the range of definitions of 'stability' that would carry conviction with the public, including financial markets.

The Act confers the responsibility for meeting the Government's inflation target specifically on a newly created Monetary Policy Committee, comprising myself as Chairman, the two Deputy Governors, two Executive Directors appointed by the Governor after consultation with the Chancellor and four members appointed from outside the Bank by the Chancellor. The Governors are appointed as members of the Committee for their full five-year (renewable) terms; the remaining members are appointed for three-year terms which are also renewable. The Committee's policy meetings are also attended by a senior Treasury official in the capacity of an observer, who may participate in the discussion—essentially to inform the Committee of any relevant aspects of the Government's wider economic policies and explain the Committee's thinking to the Chancellor—but he may not express a view on the monetary policy decision or, of course, vote on that decision.

One can argue endlessly about the precise composition of the Committee, their term of appointment and so on. The key consideration for me is that all nine members need to be genuinely independent, technical experts in the field of monetary policy or a closely related field, not representatives of any particular social or industrial grouping. The objective of policy is appropriately determined by a democratic process; the Committee's job is, as I say, a technical one, which requires relevant technical expertise.

The transparency of the Committee's decision-making process is assured by continuation of the requirements that we should produce our quarterly *Inflation Report* and publish minutes of our monthly meetings, which we have now chosen to do with just a two-week delay. Transparency is further enhanced by a requirement that the minutes should record how each individual member of the Committee voted on the interest rate decision.

As before, it is vital for public confidence in these new arrangements that their intention is not subverted by the evolution of informal conventions—that the integrity of the procedures is respected. In this context we take great pains to ensure that the true nature of the policy debate is reflected in the minutes and that the range of views around our inflation forecast is properly reflected in the *Inflation Report*. In fact I think we probably tend to err on the side of drawing too much, rather than too little, attention to differences of opinion within the Committee, which are often largely a question of nuance. But it is better in my view to err on that side rather than to attempt to submerge the differences. We do not, however, attribute particular views to particular individuals. To do so would invite prepared statements and militate against the interactive debate, which is an outstanding and immensely valuable characteristic of our meetings. It would suppress the kind of 'what if' discussion in which the same individual may explore alternative views. No attempt is made to concert the outcome of the policy decision; in fact I go out of my way to discourage any kind of collusion, whether between the internal or external members of the Committee—we are, and must remain, nine independent members, individually accountable for our decisions as to how we vote.

This, of course, means that the Committee is divided as often as not; but although this initially led to public comment to the effect that the Committee did not know what it was doing and could not make up its mind, it is now generally accepted as the natural order of things and helps to underline to the public at large that monetary policy making cannot be a precise science—however much it needs to be informed by all the science available to us. That, in our context, is I think now much easier to understand than a more consensual approach would be, but there was certainly a learning period.

It has been suggested to me that the arrangements I have described somehow diminish the position of the Governor. Well if that's true this Governor at least welcomes it! I am sure that all of you are well aware of how finely balanced monetary policy decisions are at the margin, and that all of you have agonised, just as I have, over the right thing to do and the right time to do it. I find the cross-bearings on those decisions provided by the other Committee members—and they are, I remind you, all highly qualified experts in their own right—immensely reassuring. If a majority of them argued for a particular decision, that would certainly weigh heavily with me, although—as a matter of personal integrity—I always reserve the right to take a different point of view from that of the majority on those occasions when I am particularly confident of my own judgment. That has not so far happened but it almost certainly will; people should not be unduly surprised.

Finally, in relation to monetary policy, let me say a few words about accountability. In the terms of the new Act the Monetary Policy Committee—apart from its public accountability through the *Inflation Report* and the minutes of its meetings—is accountable for the adequacy of its procedure to the non-executive members on the Bank of England's Board of Directors, who in turn report to Parliament through the medium of the Bank's *Annual Report*. We are all accountable to Parliament in the sense that we may be—and regularly are—summoned to appear before the relevant Select Committees of both Upper and

Lower Houses. And we are accountable to the Chancellor in that the Chairman of the MPC is required to write him an open letter if the rate of inflation diverges by more than 1% either side of the 2½% target explaining why and what steps we propose to take to bring inflation back within that range and over what time period. Finally, the Treasury has the power to give the Bank directions in respect of monetary policy if they are satisfied that the directions are required in the public interest and by extreme economic circumstances.

Again, some observers have suggested that these elaborate accountability provisions are onerous and constrain the Bank's independence. I take the contrary view, that they are essential to the legitimacy of the arrangements as a whole and so actually reinforce our independence—provided of course that we are able to provide convincing explanations of our conduct! And the likely public and financial market reaction is, in my view, the most effective protection against abuse of the Treasury's emergency powers.

What I have described up to this point relates solely to monetary policy. But the new legislation similarly deals with the Bank's other key responsibility—maintaining financial stability. And at the risk of trying your patience let me say a few words about that. Less than a fortnight after announcing the Bank's new independent responsibility for the operation of monetary policy, Chancellor Gordon Brown announced that the Bank's responsibility for banking supervision would pass to a new institution—the Financial Services Authority, or FSA—which would assume responsibility for the regulation and supervision of all financial institutions in the United Kingdom. This was widely seen as the price we had to pay for our enhanced monetary policy role. But at the same time the Chancellor confirmed the Bank's continuing responsibility for the stability of the financial system as a whole, so that in fact what this has done—as in relation to monetary policy—is to distinguish and clarify the respective roles: of the Bank, which now focuses upon systemic risk and retains its lender of last resort role within parameters that are broadly defined by the legislation; of the FSA, which oversees both the prudential and business conduct of all individual financial institutions, including the banks, with the emphasis on consumer protection; and the Treasury, which has ultimate responsibility for both these dimensions. The new arrangements make a good deal of sense in the UK context where traditional distinctions between banks and other types of financial institution have progressively eroded and where there has been a general movement towards greater consumer protection across a much broader front. But at the same time as clarifying our respective responsibilities, and providing in each case for transparency and separate accountability for the way in which they are carried out, the new legislation recognises the vital importance of close coordination between them and establishes a framework for that. It is early days to assess the effectiveness of these arrangements, but my impression is that so far they are working well.

Governor Jayawardena, there are many aspects of our new regime that I have not touched upon—including questions relating to our capital, revenues, expenditure and allocation of profits, and how they are reported and accounted for—which can also affect the degree of independence we enjoy. Perhaps we might explore these together with the other issues in our discussion. But I hope I have said enough to draw a few conclusions.

My starting-point has been that central bank independence in the extreme sense of exemption from democratic control is unrealistic and inappropriate. Yet wise governments in many countries around the world have recognised that they can gain advantage—in terms of public and market credibility— from detached and unbiased advice in its field of competence from the central bank. The value that they put on the central bank's role depends very much on the quality of that advice—the central bank's objectivity and its technical expertise and professional competence. That is largely down to us. But the benefit a government derives from it depends too upon the advice being seen to be detached and unbiased, as well as technically expert and professionally competent. And that depends also upon the government. It can discourage the central bank from expressing views in public but gain little in terms of credibility from doing so; it can to varying degrees encourage greater independence on the basis that this would strengthen public confidence but accepting that it could involve a greater degree of constraint on its policies; or, where there exists a sufficient consensus on the particular role of monetary and financial policy, it can devolve operational responsibilities to the central bank, holding it publicly accountable for the way in which it exercises those responsibilities but accepting the limitation that such arrangements place on the government's own operational discretion.

There is no single model to fit all situations. The appropriate arrangements for a particular country at any particular time depend upon the economic and financial environment and upon political perceptions relating to the approach to monetary and financial policy. I believe that we are now well served in the case of the United Kingdom by the present arrangements involving operational independence, based upon the principles of clearly defined responsibilities, transparency and accountability, which I have described. But I am very conscious that, whatever the formal arrangements applying to the central bank, the political and public confidence on which our position depends is something that we, all of us, need continuously to earn through personal and professional integrity, objectivity and competence. It is in the end, as I say, up to us.

# Britain and the euro

*In this speech,*[1] *the* ***Governor*** *notes that monetary union is fundamentally a political rather than an economic issue, and that the politics of monetary union is for elected politicians. But it is also an economic issue: he goes on to survey the pros and cons of the single currency in the context of the United Kingdom; on the plus side, nominal exchange rate certainty and the potential for broader and deeper financial markets; and on the minus side the 'one-size-fits-all' monetary policy, noting that the UK Government will decide whether to recommend membership on pragmatic grounds, based on five economic tests. Finally the Governor notes the economic progress of the United Kingdom since the early 1990s and concludes that this provides a firm foundation for a continuing constructive relationship between the United Kingdom and other EU countries, whether or not they are inside the eurozone.*

I agreed to talk briefly about Britain and Europe: I will in fact talk more specifically about Britain and the euro from my perspective at the Bank of England. But let me make clear, from the outset, that monetary union is fundamentally a political rather than an economic issue. It necessarily involves the deliberate pooling of national sovereignty over important aspects of public policy, in the interest not just of collective economic advantage, but of a perceived wider political harmony within Europe.

As a central banker, I have nothing to say about the politics of monetary union. That's for elected politicians, and clearly political opinion is divided—not just in the United Kingdom—about how far and certainly how fast to go in the sensitive matter of pooling national sovereignty. But monetary union is also an economic issue and that is my concern.

So what are the economic pros and cons?

The arguments on either side are in fact now reasonably well defined in the United Kingdom, where there has already been an intense and protracted debate—though different opinions inevitably attach different weights to them.

On the plus side, the crucial and unique economic advantage of monetary union is nominal exchange rate certainty within the eurozone—which takes more than half of UK exports. I'm not talking just about reasonable exchange rate stability, which might result over time from each country pursuing disciplined macroeconomic policies in parallel. I'm talking about nominal exchange rate certainty for the indefinite future.

That very real economic advantage is well understood in the United Kingdom. It is particularly well understood by those businesses in the United Kingdom that export to, or compete with, businesses in the eurozone, especially given the euro's unexpected—and puzzlingly persistent—weakness since its inception at the beginning of last year. On that ground alone many of them, who are under intense competitive pressure as a result of sterling's excessive strength against the euro, though not against other major currencies, would see our joining the single currency as an advantage. Provided, of course, that the exchange rate at which we joined was fixed at an appropriate level, which most of them—and indeed most analysts looking at the economic fundamentals—think should be substantially lower than it is at present.

At a broader macroeconomic level the potential benefit of joining, as a result of greater transparency of costs and prices and lower transaction costs, leading to greater competition and more efficient economic resource allocation, is well understood.

Exchange rate certainty within Europe—even though only within Europe, and even though it is nominal exchange rate certainty rather than real exchange rate certainty, which is what matters in terms of competitiveness—would potentially enhance the benefits to be derived from the European Single Market.

The euro's second very powerful advantage is the possibility that it opens up for much broader and more liquid financial markets. It will mean a progressive narrowing of spreads between borrowers and lenders, which is good news for the users of those markets—and that will be good news too for financial intermediaries as a group, because it will lead to greater volumes of financial activity. Not every individual intermediary will benefit, of course, in the more competitive environment, but those who survive will thrive!

The City of London is already making an important contribution to this process of euro financial market integration. It is in fact the greatest contribution that the

(1) Given at the British-Swiss Chamber of Commerce lunch on 'Britain and Europe' in Basel on 12 September 2000. This speech can be found on the Bank of England's web site at www.bankofengland.co.uk/speeches/speech99.htm

United Kingdom can make to the success of the euro while we remain outside. (It runs alongside the conceptually distinct, but closely related, pressure for broader international integration of financial markets, currently reflected in a spate of initiatives to unify trading platforms, and clearing mechanisms and settlement systems, in which London, of course, is also very much involved.)

These then—nominal exchange rate certainty throughout the eurozone and integrated euro financial markets—are potentially powerful economic arguments in favour of UK membership. What then are the risks—the possible arguments against our joining the euro?

Essentially the potential downside can be summed up as the risk that the single monetary policy—the 'one-size-fits-all' short-term interest rate within the eurozone, which is the inevitable consequence of a single currency—will not in the event prove to be appropriate to the domestic monetary policy needs of all the participating countries.

Countries may have divergent cyclical positions. They may face divergent fiscal positions, which would affect their appropriate fiscal/monetary policy mix in different directions—though this should be contained by the Growth and Stability Pact. Or their domestic policy needs may diverge as a result of economic shocks of some sort—a classic, but unique, example was German reunification, but the more recent global economic disturbance was perhaps another example.

The risks of divergent monetary policy needs within a monetary union are certainly real. They were recognised in the Maastricht Treaty, which established the famous 'convergence criteria' precisely in order to try to limit the risks before the euro project went ahead.

They are essentially similar to the risks of sectoral or regional divergence within a national currency area, which we in the United Kingdom certainly know something about—it is in fact a major monetary policy headache for us at the present time. But in the case of the eurozone the risks of divergent monetary policy apply between the different member countries. And if they materialised to any very significant extent, the resulting tensions could be serious, because alternative mechanisms—such as labour migration or fiscal redistribution through a central budget, which help to mitigate sectoral or regional disparities in the national context—are less developed at the eurozone level. Some commentators point to the present inflationary pressures in Ireland as an example of the problems that could arise where the single monetary policy is easier then the national situation might require—though I am not sure how far one can sensibly generalise from the Irish experience. It is equally possible to envisage circumstances in which the single monetary policy is too restrictive for some countries.

The fact that the United Kingdom did not join in the first wave of EMU was a disappointment to some people, including to some of our European partners—but it was also a considerable relief to them; we would certainly have complicated the task of the ECB in setting its single monetary policy. And from our own perspective, if we had joined EMU from the start—and had eurozone interest rates over the past 18 months or so, it is very difficult to envisage how we would have avoided an inflationary boom in the United Kingdom. It is true that, to the extent that the present imbalance within our economy reflects sterling's appreciation against the euro, we would have been protected against that. But, with accelerating inflation in the economy as a whole, the effect would have been tantamount to real exchange rate appreciation, which would in any event have damaged their competitive position and so provided at best only short-term relief even to them. And it would not in that case be possible to reverse that effect through exchange rate adjustment. The fact is that there are no easy answers or ideal solutions to the one-size-fits-all problem at the eurozone level, without substantial—and sustainable—convergence between our economies. Although coping with such tensions as may emerge within the eurozone—with or without the United Kingdom—is likely to be easier in the context of structural, supply-side, flexibility and adaptability in labour and product markets.

Now, many people in the eurozone acknowledge these concerns. But they are inclined to argue that if a country participating in the monetary union were to find itself in an unsustainable situation, and given that it would have no macroeconomic way out—through exchange rate adjustment, independent monetary policy action or fiscal stimulus beyond the limits of the Growth and Stability Pact—and given limited labour migration or fiscal redistribution at the pan-European level, then it would have an overwhelming incentive to undertake the supply-side reforms that have proved so difficult to introduce up until now. One of my ECB colleagues in fact once put it to me that 'when we have closed off every other policy option, we will finally be forced to do the things we know that we should have been doing all along!'

There are those, I know, who find our hesitation about the euro—in an economic context—hard to understand. That's true particularly of those who have been in effective *de facto* monetary union with the Deutsche Mark for a long time already. But it is not just stubbornness or obstinacy on our part—though we British can of course be pretty stubborn at times. In the macroeconomic context it reflects a real debate about the risks and potential costs of divergence between our own monetary policy needs and those of the members of the eurozone. Which in turn depend upon the extent to which our economies really have achieved sustainable convergence, and the extent to which we are able to respond flexibly on the supply side to economic shocks or tensions between our domestic monetary policy needs and those of our European partners.

As you know, the Chancellor of the Exchequer announced some three years ago that we would not join the euro in the first wave. He made it clear that the present British

Government is not opposed to euro membership as a matter of principle. It will make a decision on pragmatic grounds, based on five economic tests. These are: whether the UK economy has achieved sustainable convergence with the economies of the single currency; whether there is sufficient flexibility in the UK economy to adapt to change and other unexpected economic events; whether joining the single currency would create better conditions for businesses to make long-term decisions to invest in the United Kingdom; the impact that membership would have on the UK financial services industry; and ultimately whether joining the single currency would be good for employment. It would then submit a favourable decision to Parliament, and the British people in a referendum.

The Chancellor recognised that it was unrealistic to think that a decision could be reached during the lifetime of the present Parliament, which runs to May 2002 at the latest. But he stressed that in the meantime the United Kingdom should nevertheless prepare—not only for introduction of the euro on the Continent on 1 January 1999—which we of course did very effectively—but also for our own eventual participation.

The Chancellor's statement was the first by a British Government to accept the principle of monetary union. It recognised that the single currency will affect us whether we are in fact in or out—and that it is clearly in our own national interest to do all that we can to ensure that the euro is successful.

This policy of 'prepare and decide' has subsequently been confirmed by the publication of a National Changeover Plan, which sets out the key steps that would be involved in the transition following a positive decision on UK entry. This remains the Government's policy.

In the meantime, we continue to pursue macroeconomic—both fiscal and monetary—stability and supply-side flexibility alongside our European partners, in our own national economic interest, which will also help to bring about closer convergence between our economies.

Over the past seven years or so we have in the United Kingdom achieved the longest period of sustained low inflation that we've known for a generation. Retail price inflation—on the Government's target measure—has averaged 2.6% since the beginning of 1993, and is currently running at 2.2%, or at only 1% on the European harmonised index of consumer prices.

But alongside low inflation we've had the lowest nominal interest rates that most of us can remember. Short-term rates have averaged some 6¼% since the MPC's first decision in June 1997, compared with some 9¼% over the preceding decade. And ten-year government bond yields have fallen, with inflationary expectations, to around 5¼%, which apart from a brief period last year is the lowest that they've been for nearly 40 years.

Much more fundamentally we've enjoyed the longest period of uninterrupted, quarter by quarter, economic growth since records began some 45 years ago—with annual growth since 1992 Q3 averaging 2.8%; between ¼% and ½% above most estimates of our underlying trend rate. The number of people in employment is the highest on record. And unemployment has fallen from its most recent peak of 10½% on a claimant count basis at the turn of 1992/93 to the present rate of 3.7%. That is the lowest for 25 years in the United Kingdom as a whole, and just about the lowest in nearly every region.

This is not just past history. Having come through the global economic slowdown a year or two ago, the economy as a whole is now again growing at well above trend, with inflation a bit below target; and the broad prospect for the next couple of years—on most forecasts—is for continuing relatively strong growth with relatively high employment and relatively low inflation.

Our economic progress—and the common approach to economic management that underlies it and that we share with our European partners—provides, in my view, a firm foundation for a continuing positive and constructive relationship between the United Kingdom and other members of the European Union, whether or not they are members of the eurozone. That of course is in the economic interest of all sides. Just as we benefit from a stable and prosperous Europe, so too the continental European interest lies in a stable and prosperous United Kingdom. And that mutual self-interest above all is the thing that we all need to hold on to.

# Monetary challenges in a 'New Economy'

*In this speech,[1] Sushil Wadhwani, member of the Bank's Monetary Policy Committee argues that the tendency for economic forecasters to underestimate growth and overestimate inflation suggests that the UK economy is behaving differently from the past. Possible explanations include an intensification of product market competition, labour market reform and a tendency to underestimate productivity growth because of measurement error.[2]*

## Introduction

There has, in recent years, been much discussion of the 'New Economy' (NE), though there is no generally accepted definition of what is meant by the NE.[3] 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, since 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, greater labour market flexibility, and several other factors.

A more appropriate characterisation of how a central banker might define the NE is, perhaps, that provided by Federal Reserve Chairman Greenspan:[4]

'*... 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 stability and growth than we had in the past*'.

I shall therefore turn to a discussion of what might be different about how the UK economy operates now, compared with how it behaved in, say, the 1970s or 1980s.

## Is the UK economy different now?

### *The recent forecasting record*

One reason for thinking that the UK economy *might* be behaving differently is based on the evidence suggesting that economic forecasters have been persistently too gloomy about the UK economy since its departure from the ERM.

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

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

| | Average error [b] | Significant [c] at 10% level |
|---|---|---|
| GDP growth forecast [d] | +0.48% | Yes |
| Inflation (RPIX) forecast [d] | –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.
(d) Source: Consensus Economics.

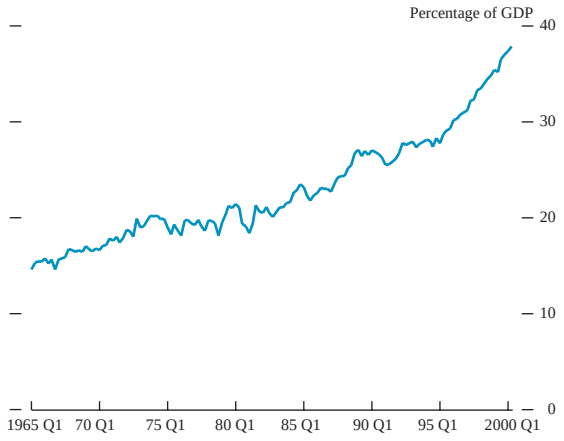
A conventional view (found both in textbooks and in minutes of central bank meetings) holds that if GDP growth were faster than expected over a sustained period of time, then,[6] on average, actual inflation must also be *higher* than expected. However, the actual inflation outturn over this period was, 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 the improvement in the growth-inflation trade-off during the 1990s. There are a variety of possible explanations for this. One class of hypotheses would envisage a significant change in the structural relationships that underlie the forecasting processes. I discuss some of these hypotheses next, as policy-makers must always be alive to the possibility that historical relationships might be breaking down.

(1) Delivered to the HSBC Global Investment Seminar on 12 October 2000. This speech can be found on the Bank of England's web site at www.bankofengland.co.uk/speeches/speech103.pdf
(2) I am greatly indebted to Nick Davey, Jennifer Greenslade, John Henderson and Nick Oulton for their considerable help and advice on this speech. I am also grateful to Bill Allen, Charlie Bean, Roger Clews, Joanne Cutler, Neal Hatch, Chris Kelly (HMT), John Kidgell (ONS), Robin Lynch (ONS), Nigel Jenkinson, DeAnne Julius, Ian Plenderleith, Clifford Smout and John Whitley for their helpful comments on an earlier draft. Of course, all the views expressed here are entirely personal and do not necessarily reflect the views of either the Monetary Policy Committee or the Bank of England.
(3) See Browne (2000) for an extensive discussion of this issue.
(4) Testimony before the Senate Banking Committee, February 23, 2000.
(5) These numbers are based on preliminary work by Nick Davey and Jennifer Greenslade of the External MPC Unit at the Bank of England.
(6) Conditional on potential output growth remaining unchanged.

*An intensification of product market competition?*

A commonly cited reason for the economy behaving differently is that the degree of product market competition has intensified over the past few years. A contributory factor may be globalisation, ie the increasing integration of global product markets. (Chart 1 suggests a striking increase in the degree of import penetration in the United Kingdom, with the rate of increase having accelerated in recent years.)

**Chart 1**
**Import penetration**




Evidence of increased product market competition has been confined not just to globalisation; government action has also played a role. Privatisation and/or regulatory changes in a whole host of industries, including gas, water, telecom, electricity, airports, rail, the docks and broadcasting, have led to rather more competitive product market conditions.

Of course, the intensification of competition does not appear to have been confined just to the internationally traded or deregulated sectors—in a conjunctural context we continue to hear much about the 'price wars' in retailing as well.

Chart 2 shows that, within the retailing sector, the CBI Distributive Trades Survey suggests that the perceived ability to increase prices, at a given level of demand, is less than it used to be. Note that while reported volumes recovered after slowing in autumn 1998, pressure on pricing has continued to intensify. Currently, the response to the price question is at a record low, even though the survey balance for volumes is above average. It appears that, in a low and stable inflation environment, consumers have become more discriminating buyers, as they are better able to distinguish between relative and absolute changes. More recently, foreign entrants into the UK retail market, Internet price comparisons and investigations into allegedly uncompetitive practices may also have played a role.

Survey evidence provides a crude proxy for the extent of perceived competitive pressure. The Euler Trade Industry Indemnity survey (which spans all the broad industry sectors) has asked questions relating to the extent to which price discounting and the competitive environment have been perceived as affecting profitability since 1994. Chart 3 displays the responses. Note that a response below 50 suggests that the factor is having a negative impact on profitability. The responses appear to point to an intensification of perceived competitive pressure and the extent of discounting over this period (dating back to around mid-1997), as they have fallen further below 50, suggesting a greater negative impact on profitability.

**Chart 2**
**CBI prices and volumes**

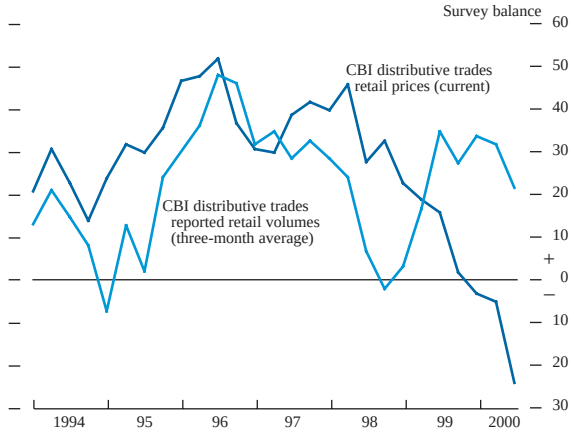
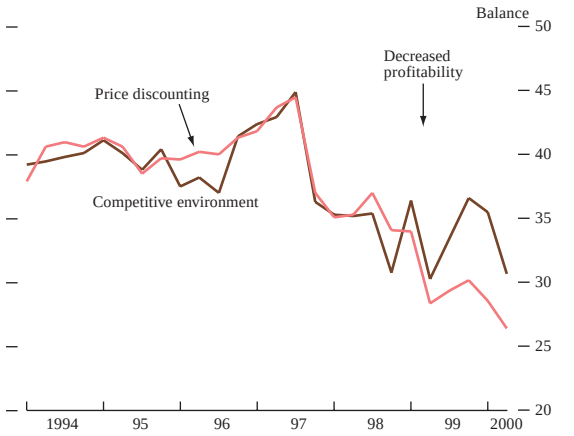



**Chart 3**
**Euler survey measures of pricing pressures**




It is sometimes asserted that an intensification of competition is a one-off event and must, therefore, have only a transient effect on inflation. Consequently, the argument goes, it should not affect one's perception of the medium-term outlook for inflation.

As my ex-colleague, Willem Buiter (2000) has recently re-emphasised, inflation is, ultimately, a monetary phenomenon. So a fall in the NAIRU that was associated with intensified product market competition would not reduce inflation in the long run, though there would be important short-run effects.

Specifically, suppose that we start in a position where inflation is 2½% and would, on unchanged interest rates, remain constant thereafter. Assuming that the NAIRU falls because of intensified product market competition, then,

other things being equal, inflation outturns will start coming in below target. A central bank that, like the Bank of England, has a *symmetric* inflation target will respond to the expected below-target inflation by lowering interest rates. However, over time, the actual unemployment rate should drift down to the new, lower level of the NAIRU. When that happens, one would expect interest rates and inflation to rise back to their original level.

Hence, in the *short run*, the benign structural factors should enable inflation to be lower than before. I should say that the 'short run' in this example could, in practice, last several years, as structural factors that lower the NAIRU can sometimes improve gradually over a number of years. Indeed, Chart 3 suggests that, until now, the perceived intensification of competitive pressure has been a relatively long-lasting phenomenon (which has already gone on for more than three years) and could, therefore, have legitimately been taken into account by policy-makers.

Importantly, preliminary work by Nick Davey and Jennifer Greenslade of the External MPC Unit at the Bank of England suggests that during the 1990s, a regression of actual RPIX outturns on RPIX forecasts (four quarters earlier) and the Euler survey responses (also four quarters earlier) results in a statistically significant coefficient on the survey measure of competitive pressure (see Table B). The evidence suggests that the Euler survey responses contain incremental predictive power relative to the Consensus RPIX forecasts (or, indeed, the National Institute or Bank of England forecasts—see Table B). In other words, it is possible that the tendency to overpredict inflation is related to not paying enough attention to the possibility that the intensification of product market pressure has been altering some of the relationships built into existing macroeconometric models.(1)

**Table B**
**Incremental predictive power of Euler survey responses for RPIX outturns (one year ahead)**(a)(b)

| Forecast included | Euler survey response coefficient | t-ratio (c) |
|---|---|---|
| Consensus Economics | 0.05 | 2.1 |
| NIESR (d) | 0.06 | 3.3 |

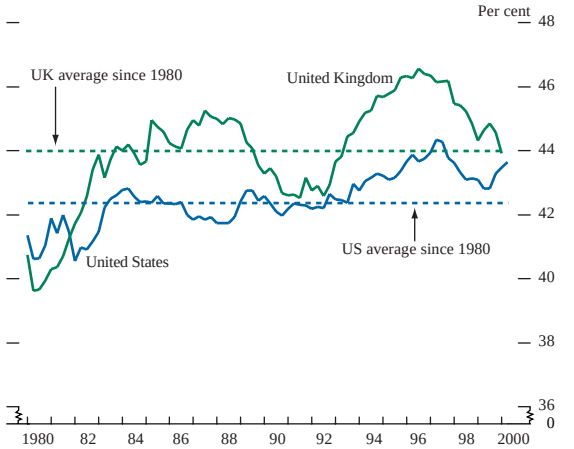
(a) Sample period is 1995 Q1–2000 Q2.
(b) Regression run is actual RPIX outturns on a constant term, the relevant forecast (four quarters earlier), and the Euler survey response (four quarters earlier).
(c) t-ratios are based on Newey-West standard errors.
(d) National Institute of Economic and Social Research.

There is also some direct support for the notion of a change in the underlying structural relationship linking retail goods prices to their underlying determinants. Some preliminary econometric work at the External MPC Unit has found that a conventional equation,(2) which could explain the behaviour of retail goods prices reasonably well until early 1998, has since broken down, with actual outturns significantly lower than fitted values. Of course, as with any econometric exercise, alternative explanations might be offered, but the hypothesis of a structural change in margins is quite compelling as it accords with anecdotal and survey evidence.

Since the November 1999 *Inflation Report*, the MPC has, in fact, incorporated a 'structural' compression of price-cost margins within the central projection, which, of course, is consistent with some of the evidence discussed above. The assumption that we made was a judgment, which was necessarily based on a host of different considerations, mainly of a forward-looking nature. It, is notable, however, that our behaviour can perhaps also be justified by the observed correlation between actual forecast errors and survey-based measures of the intensity of product market competition that emerges from the Davey-Greenslade work (see Table B).

If one were, however, sceptical of the view that an intensification of product market competition has been an important factor, one might point to the fact that the profit share of nominal GDP for the United Kingdom is around its post-1980 average (see Chart 4), which does not, at first sight, suggest a significant squeeze in margins. Although the profit share has fallen back in recent years (which would be consistent with a compression of margins), the level of the profit share is broadly unchanged since 1992, which is around the time when the trade-off between inflation and GDP growth appears to have altered. Moreover, the profit share of GDP in the United States is also, if anything, slightly above its post-1980 average (see Chart 4).

**Chart 4**
**Measure of profit share of GDP**(a)




(a) Measured as the share of income not taken by labour.

However, it is important to recognise that an intensification of competitive pressure would be associated with an actual

(1) It is plausible that some of the overprediction of inflation might be explained by exchange rate forecasting errors over the post-1997 period. Davey-Greenslade included actual exchange rate forecasting errors or the Euler survey question on exchange rates within their regression. However, the basic result that the survey measures of price discounting and a competitive environment help to explain the inflation forecast errors was intact.
(2) A regression of retail goods prices on the exchange rate, oil and commodity prices, unit labour costs, foreign export prices, a time trend and retail sales, carried out by Nick Davey.

fall of observed profit margins only if everything else remained unchanged.[1] Specifically, if, for example, there was a technology-driven rise in productivity growth and the real wages of workers did not initially rise in line with the increase in productivity (which is an historical regularity), then we might nevertheless observe a rise in the profit share. This may help to explain why the profit share in the United States has not fallen in the 1990s.

Alternatively, if the power of labour were diminishing (say, because of a fall in union power), then this would, of itself, be associated with a *rise* in the profit share. Of course, a simultaneous intensification of product market competition would put *downward* pressure on the profit share. As to what happens to the actual observed profit margin depends on which of these two factors predominates.

As I shall remind you below, much has happened in the UK labour market to strengthen the relative bargaining position of firms *vis-à-vis* workers. Consequently, I am content to believe that an intensification of competitive pressure has occurred, even though the profit share has been broadly stable.

### *Changes in the labour market*

I have previously discussed the far-reaching changes that have occurred in the UK labour market over the past two decades (see Wadhwani (2000a)), so I will not say much now on that topic. However, Table C reminds us that, on a variety of dimensions, a great deal is different today. 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.

**Table C**
**Key features of the labour market**

| | 1998 | 1992 | 1980 |
|---|---|---|---|
| **Factors** | | | |
| 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) | 4.9 | 8.0 | 8.0 |
| 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 notable that if one takes the wage equation in the Bank of England's core macroeconometric model (see Bank of England (1999)), then there is evidence that it has overpredicted wage growth in recent years (ie since around 1992).

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 explain the changes 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. There is case study evidence in favour of both these factors having played some role (see, for example, Brown *et al* (1999)). Other possible catalytic events include the adoption of an explicit inflation target after 1992. Personally, I have no problem with the notion that it can take time before structural changes manifest themselves in improved macroeconomic performance. Any changes to the way that labour is used (eg reforming pay systems, improving selection, etc) require managerial effort, and take time to be 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 is attributable to 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 improvements in other countries. Note 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.

Looking over the past decade, it is reasonable to believe that the NAIRU has fallen because of both labour market improvements *and* the intensification of product market competition, some of which may have been associated with changes in regulation. Moreover, it is possible that recent outcomes (1998–99) have been somewhat flattered by lower real import prices during 1997–98. Looking ahead, the higher real import prices over the past year (mainly due to higher oil prices) should worsen the apparent short-run trade-off, but the likely intensification of product market competition (through the Internet etc) should continue to help reduce the NAIRU over the next few years. Obviously this is a complex affair, and I am not surprised that Chairman Greenspan was recently quoted[2] as saying:

'*My forecast is that the NAIRU which served as a very useful statistical procedure to evaluate how the economy was behaving over a number of years, like so many types of*

(1) I am grateful to my colleague, Stephen Nickell, for helpful discussions on these issues.
(2) Reuters, July 20, 2000.

*temporary models which worked, is probably going to fail in the years ahead as a useful indicator ...'.*

It will, therefore, remain especially important to monitor actual developments closely as we attempt to form the difficult judgments in this area. Recall that the intensification of product market competition has already gone on for several years. At some point, this process will come to an end. It will be important for us to be vigilant to signs that this might be happening.

I have, so far, discussed how structural changes in the economy make an assessment of the conjuncture and the preparation of our inflation forecast a rather tricky matter. However, our problems are compounded by the existence of measurement error, an issue to which I turn next.

## Some problems caused by measurement error

It is inevitable that the economic aggregates that we are interested in will be measured with error. If the size of the bias caused by measurement error varies significantly over time, this can make it especially difficult to set policy appropriately. I shall discuss a couple of illustrative examples below.

### *Measuring the supply potential of the economy*

We discussed above the use of the NAIRU in policy-setting. A closely related concept is that of the 'output gap', which is the difference between actual and potential output. Of course, the level of potential output is rather difficult to measure.

#### Some US evidence

Researchers at the US Federal Reserve System (see Orphanides and van Norden (1999)) have shown that:

'*... the ex post revisions of the output gap are of the same order of magnitude as the output gap itself ... and the real-time estimates tend to be severely biased around business cycle turning points, when the cost of policy induced errors due to incorrect measurement is at its greatest*'.

In related research, Orphanides (1999) argues that:

'*The evidence points to misperceptions of the economy's productive capacity as the primary underlying cause of the 1970s inflation.*'

As discussed above, estimating the level of equilibrium unemployment (or, relatedly, the level of potential output) at a time of significant structural change is extremely difficult. Just as it is possible that a supply shock in the form of cheaper information costs is plausibly boosting the level of potential output today, a supply shock in the form of much higher oil prices (in real terms) hurt productive capacity in the 1970s, and the work of Orphanides suggests that policy-makers and the economics profession in general may have been a little slow to realise that.

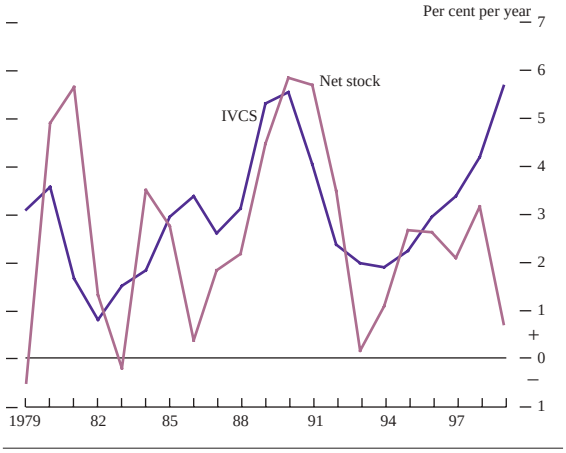
#### Alternative conceptual measures of the capital stock

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 important to use a measure of the capital stock that reflects its productive potential when performing this calculation. The 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 instead 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 of assets, 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 5).

**Chart 5**
**Comparison of measures of capital input growth**




Notice that while, on the wealth-based measure, the growth rate over the past two decades is broadly constant, the IVCS grew faster over 1989–99 (by 3.38% per year) than in 1979–89 (2.62% per year). Concentrating on the post-1996 period, the wealth-based measure has grown at around 2% per year, while the IVCS measure has grown at around twice that rate (approximately 4% per year). Of course, this can make a significant difference to any estimate of the growth rate of potential output. For example, if one makes the extreme assumption that one's estimate of total factor

productivity (TPF) growth is unaffected, then the alternative estimate of the growth rate of the capital stock would imply an increase in the growth rate of potential output of as much as 0.6% per year; in relation to conventional estimates of a growth rate of potential output in the range of 2%–2½% per year this is a rather large difference. Note, however, that as a matter of arithmetic, if the productive capital stock has indeed grown faster in recent years, then *measured* TFP growth must have been slower, which might lead one to lower the assumption about the trend growth rate of TFP. This would correspondingly lower the degree to which current estimates of the growth rate of potential output might be understated. Alternatively, the lowering of the measured growth rate of TFP might lead one to question the plausibility of the GDP estimates. Hence, the precise impact that the understatement of the growth rate of the productive capital stock has on the growth rate of potential output is necessarily uncertain, though the direction of the bias is clear. Fortunately, the Bank and the ONS are currently co-operating on a project on the IVCS, and we await the results with great interest.

### Alternative measures of ICT investment

With the growing consensus that the growth of investment in information and communications technology (ICT) has contributed to an upsurge in productivity growth in the United States, there is obvious interest in investigating the role of ICT and productivity growth in the United Kingdom. I have initiated some work on this issue at the Bank, though, as yet, I can only share with you some rather preliminary results.

Nicholas Oulton has started the project by applying US methods for measuring ICT. 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 that the measurement of price 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.

Table D compares the price indices used by both countries in their national accounts. In computers and software, the UK price index was growing much faster than its US counterpart in 1979–89. In computers, this gap narrowed in the early 1990s, but then widened substantially in the latest period, 1994–98. In software, the gap narrowed in 1994–98 while still remaining substantial. In telecommunications, by contrast, the gap was in the other direction in 1979–89. Since then, it has been small by comparison with other components.

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*, there are some calculations that 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 established in the post-1997 period. There are those who believe that the hedonic price indices used by 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.

**Table D**
**Differences between the growth rates of UK and US(a) price indices: average growth of UK index minus average growth of US index**

Per cent per annum

| | Computers (b) | Software (c) | Telecommunications equipment (b) |
|---|---|---|---|
| 1979–89 | 7.32 | 13.20 | -10.02 |
| 1989–98 | 6.61 | 10.09 | 0.34 |
| 1989–94 | 1.39 | 12.56 | -2.05 |
| 1994–98 | 13.14 | 7.00 | 3.32 |

(a) US price indices adjusted for exchange rate changes.
(b) Using the official UK producer price indices for computers and telecommunications.
(c) Using adjusted version of official US software price indices. For the United Kingdom, software investment is deflated by the overall implicit deflator for machinery and equipment.

Note that there are other important differences between ICT measurement practices in the United States and the United Kingdom, which might also have led to overstatement of the amount of ICT investment in the United States relative to the United Kingdom.

For example, although the growth rate of 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 two countries. 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.

So Oulton suggests that, for illustrative purposes, 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 that he considers. Of course this is an extremely difficult area and, because of the paucity of reliable information, what 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.

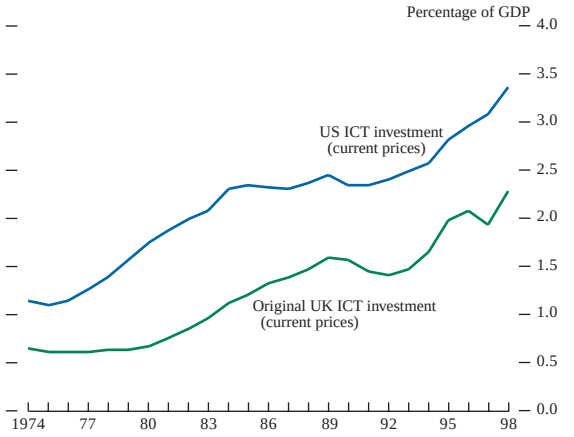
In particular, on the official numbers, the United Kingdom lags the United States considerably in terms of ICT investment as a percentage of GDP (see Chart 6a). By contrast, on Oulton's estimates, the United Kingdom stacks up rather well *vis-à-vis* the United States (see Chart 6b).(1)

Table E shows the impact of adjusting estimates of GDP growth on Oulton's assumptions for the biases mentioned above. Note that the potential bias is substantial (up to 0.38 percentage points per year by 1994–98) and, moreover, has been rising over time (only 0.07 to 0.1 percentage points per year during 1979–89). If GDP growth has truly been 0.4% per year faster than we currently believe, then this would affect estimates of productivity growth, which, in turn, might affect our assessment of domestically generated inflationary pressure. Note that if the growth rate of actual and potential output were higher than we thought by the same amount, but this amount remained constant over time, then our estimates of the output gap would be unaffected by this measurement error.

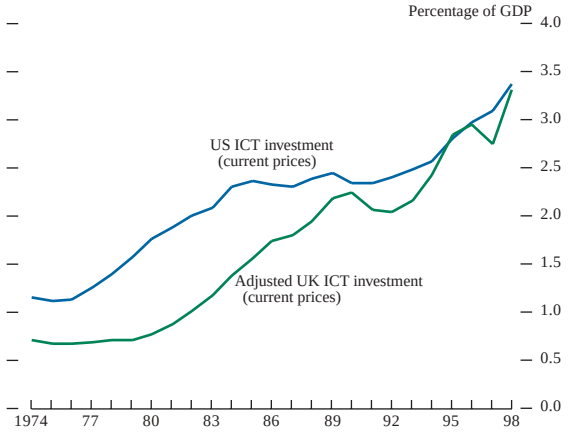
However, if the size of the understatement of actual output growth is rising over time (on these numbers, it accelerated in 1994–98 by 0.25% compared with 1989–94), but estimates of the potential growth rate are, in part, backward-looking, then contemporaneous measures of the output gap are likely to end up underestimating the degree of slack in the economy.

Also, there are, of course, other indicators of inflationary pressure that we monitor that would be affected by an understatement of productivity growth. For example, measures of unit labour cost growth would obviously be overstated if productivity growth were understated.

**Chart 6**
**ICT investment: United States and United Kingdom compared**
**(a)**




**(b)**




Source: Estimates from Bank of England work.

Of course, Oulton's preliminary estimates are predicated on his 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.

**Table E**
**GDP growth with and without adjustment for ICT effects, 1979–98: period averages**

| | Increase in GDP growth (a) due to adjusting for: | | | | | | |
|---|---|---|---|---|---|---|---|
| | GDP growth (not corrected for ICT) (b) | Computers | Software (low) | Software (high) | Telecommunications equipment | All three together (software low) | All three together (software high) |
| 1979–89 | 2.37 | 0.02 | 0.06 | 0.10 | -0.02 | 0.07 | 0.10 |
| 1989–98 | 1.91 | 0.07 | 0.10 | 0.18 | 0.01 | 0.17 | 0.25 |
| 1989–94 | 1.17 | 0.00 | 0.07 | 0.15 | -0.01 | 0.07 | 0.15 |
| 1994–98 | 2.83 | 0.15 | 0.14 | 0.21 | 0.02 | 0.31 | 0.38 |

(a) Percentage points per year, unless otherwise stated.
(b) Per cent per year.

(1) Some authors (eg Kneller and Young (2000)) suggest that computers contributed very little to productivity growth in the United Kingdom in the 1990s. However, they exclude the contribution of software and telecommunications. On the measure of ICT discussed here, the contribution of ICT to productivity growth would rise significantly.

Having discussed some examples of the problems we face caused by measurement difficulties, I now consider the issue of attempting to forecast likely productivity growth, a rather important component of any inflation forecast.

## Forecasting productivity growth

Currently, our best collective projection builds in the assumption that labour productivity growth will not materially differ from its 40-year average of around 2% per year. Of course, this is in sharp contrast to the United States, where, in recent years, forecasts of productivity growth have been increased significantly (by, at least, 1 percentage point per year). Given that it is accepted that ICT advances have played a significant role in recent US productivity experience (see, for example, Oliner and Sichel (2000) or Jorgensen and Stiroh (2000)), and given the significant amount of ICT investment that has been undertaken in the United Kingdom (the numbers discussed above suggested that, as a fraction of GDP, the United Kingdom might even have invested as much as the United States), it is rather puzzling that the United Kingdom does not appear to have experienced any significant upsurge in terms of measured productivity growth. I discussed above the ICT-related biases in the measurement of GDP growth, with the preliminary illustrative calculations suggesting a recent understatement of labour productivity growth of perhaps around 0.4 percentage points per year.

However, if this were the only source of bias in the measurement of productivity growth, this would, by itself, not change the fact that labour productivity growth in 1994–98 was below its average level. 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 shall be brief here, but I would point to the following.

(i) Official data suggests that manufacturing productivity growth was zero during 1995–97, while survey responses from the CBI Pay Databank sample suggest that 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, as a policy-maker, it is important to be alive to the possibility that measured productivity growth numbers significantly understate actual growth.

Even if there were no reasons for believing that historical, measured productivity growth has been understated, one might believe that productivity growth might be set to rise in coming years.

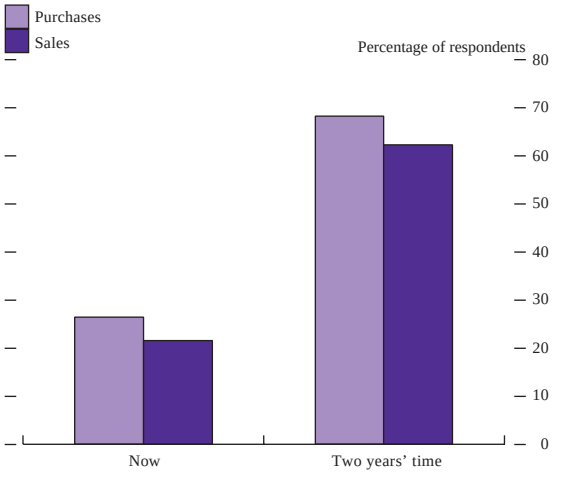
Another possible explanation for the fact that UK productivity growth has not risen despite significant ICT investment is that there are time lags associated with learning how to use the technology appropriately. Note that US productivity growth did not rise until after 1995 despite many years of significant ICT-related investment. Hence, it is possible that productivity growth in the United Kingdom may be about to rise.

I draw some encouragement from some empirical work reported in Bean (2000), where he reports a significant link between average TFP growth and the share of ICT investment in GDP for a cross-section of OECD economies. The economic impact of ICT investment is estimated to be large, implying roughly a point-for-point response of TFP growth to an increase in the share of GDP spent on ICT investment.

Yet another possibility is that the likely growth in the ICT sector in the United Kingdom (note that productivity growth in the ICT sector itself has been a significant contributor to US productivity growth) and the effects of the Internet-related B2B commerce could lead to a significant rise in productivity growth.(1)

In a special survey conducted for the Monetary Policy Committee during May 2000, the Bank’s Agents found that UK companies expect a significant increase in B2B e-commerce over the next two years. Chart 7 shows that while the vast majority of businesses do not engage in B2B e-commerce now, more than two thirds expect to purchase over the Internet within two years.

**Chart 7**
**B2B e-commerce**




Of course, there are those who are sceptical about the significance of the Internet for productivity growth—for example Gordon (2000) points out that the period 1860–1900 saw five ‘clusters’ of inventions including

(1) See Wadhwani (2000b) for a discussion of this issue.

electricity, the internal combustion engine, chemicals, the telephone, and indoor plumbing. He argues that in terms of the effect on living conditions, the computer revolution cannot possibly measure up to these earlier great inventions.

However, in terms of assessing the likely effects of the Internet on productivity growth over the next few years (which is primarily what central bankers care about), it is important to assess the likely speed of diffusion of an invention alongside its intrinsic merit. On this criterion, the Internet scores rather well relative to previous inventions. As *The Economist* (2000) points out, electricity achieved a 50% share of the power used by America's manufacturing industry 90 years after the discovery of electromagnetic induction, and 40 years after the first power station was built. By contrast, the Internet is approaching 50% penetration in America 30 years after it was invented and only 7 years since it was launched commercially in 1993. Of course, the Agents' survey that I discussed earlier also pointed to a quick take-up of B2B e-commerce. In the United Kingdom, 45% of adults had used the Internet by July 2000. Among these people, as many as 28% had already used it for buying or ordering tickets/goods/services, while 70% did so for finding information about goods or services. Kneller and Young (2000) point out that the 1990s have seen strong productivity growth in the business services sector, an area which is ICT-intensive. Perhaps this is indicative of what might occur as ICT diffuses more widely through the economy.

An additional reason for believing that productivity growth might rise is the intensification of product market competition that was discussed above. In standard bargaining models, one would expect this to lead to a reduction in the degree of X-inefficiency. I must say that there is much anecdotal evidence that this might be happening.(1)

In the light of the above, some members of the MPC (including myself) have been prepared to assume that, at least over the next two years, labour productivity growth is likely to be above average.

It is possible to argue that we should 'wait and see' until there is a statistically significant increase in observed productivity growth. However, when I was a student, some of my teachers often emphasised the distinction between an 'economically significant difference' and a 'statistically significant difference'. Actual productivity growth is notoriously volatile—waiting for a statistically significant increase in productivity growth could lead to inappropriate policy.

For example, Table F shows some estimates of TFP growth in the United Kingdom for the post-war period. Note that estimated TFP growth slowed by 0.64 percentage points per year over a 26-year period after the so-called 'Golden Age' of 1950–73. A difference of 0.6 percentage points is economically significant for any assessment of underlying inflationary pressure (eg measuring unit labour costs). Yet a formal statistical test (a t-statistic) would not reject the hypothesis that the means of TFP growth are equal. A monetary policy maker who waited for a statistically significant change in TFP growth would almost certainly have left interest rates too low in this case. Of course, it would remain important to be vigilant to the possibility that what seemed like an economically significant difference in productivity growth was not an entirely transient phenomenon, but that is why monitoring a host of indicators is so important.

**Table F**
**TFP growth in the United Kingdom**

| | Mean | Standard deviation | t-test for difference of means |
|---|---|---|---|
| 1950–73 'Golden Age' | 1.52 | 1.47 | |
| 1973–99 'After' | 0.88 | 1.74 | 1.41 |

In discussing the challenges posed for monetary policy by the 'New Economy', I have, so far, concentrated exclusively on the supply-side effects. I now turn to a brief consideration of the demand-side effects.

## Aggregate demand effects of a 'New Economy'

As Chairman Greenspan and others have argued, it is possible that an expected rise in productivity growth leads to a rise in aggregate demand before one gets a corresponding rise in aggregate supply. This is because, say, share prices rise in line with the higher *expected* productivity growth *before* there is any necessary improvement in supply-side performance. Higher share prices, in turn, are assumed to boost consumption expenditure now. The existence of such a wealth effect on consumption is relatively uncontroversial, and the MPC has indeed allowed higher share prices to boost its most likely forecast for consumption.

Note that it is difficult to make sense of the current level of global equity prices, unless productivity growth is expected to be rather higher than in the past.(2) In this situation, it seems to me that a forecaster should choose between two logically consistent possibilities. The forecaster might assume that productivity growth is going to be higher and then build this assumption into both the demand side (through higher share prices) *and* the supply side. Alternatively, if the forecaster is a 'New Economy' sceptic, he/she should assume that share prices will actually fall when the markets realise that productivity growth is not going to rise, and should therefore build in lower aggregate demand. Personally, I am, therefore, a little uncomfortable with the MPC's best collective 'most likely' projection, which builds in the demand-side effects of a rise in

(1) One must, however, recognise the possibility that the fact that intensified product market competition depresses profits might, of itself, hurt investment, and thereby labour productivity.
(2) See, for example, Cecchetti *et al* (2000) for a discussion of how to understand the current valuation of equity markets.

productivity through higher share prices, but makes no corresponding adjustment to the supply side for productivity effects.

## Keeping a sense of perspective

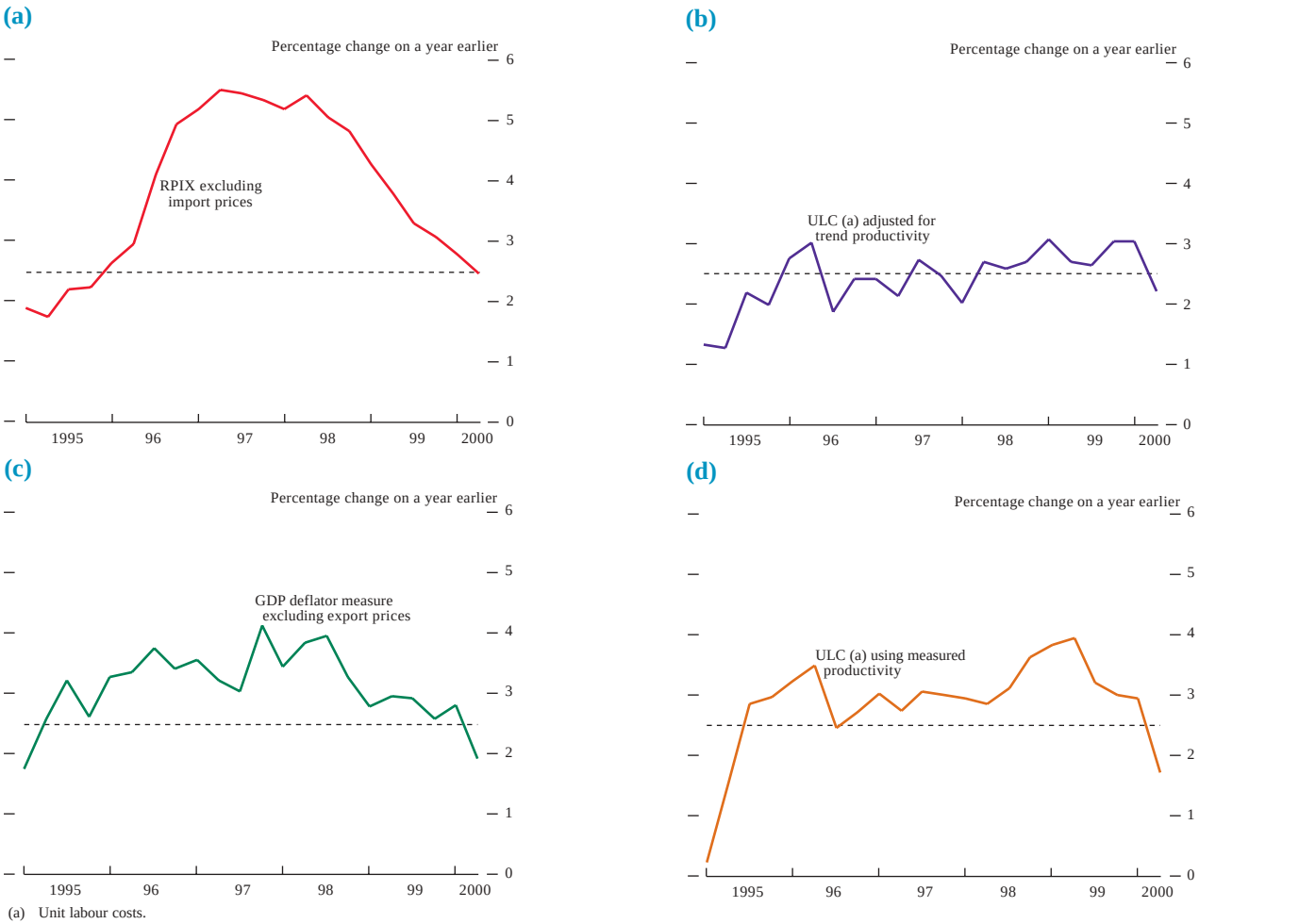
There is much that is exciting about the Internet and it is sometimes difficult to resist being swept along by some of the hype that surrounds it. Although I have argued above that the 'New Economy' (defined in the broad sense of changes in underlying structural relationships) has already had a significant impact, it remains important to keep one's feet planted firmly on the ground.

As we have already discussed above, the past 200 years have been characterised by significant technological change, and few would argue that the Internet approaches the major innovations in terms of their effect on lifestyles. Also from a central banker's perspective, one always has to guard against the possibility that underlying economic relationships might be changing—recall that the policy mistakes of the 1970s were at least partly attributable to a failure to realise that productivity growth had slowed and/or the NAIRU had risen, so there is a sense in which we always inhabit a 'new' economy.

Turning to the current UK conjuncture, it is obviously gratifying that we appear to be able to continue to combine relatively steady growth with low and stable inflation. A concern that some of us have is that the exchange rate remains overvalued (*vis-à-vis* the euro). It is possible that a sharp downward adjustment of the exchange rate could have a large impact on measured inflation in the first instance.

Over the past few years the MPC has therefore been concerned about the fact that so-called domestically generated inflation (DGI) has been above our target of 2½%, with RPIX being restrained only by a high exchange rate. An encouraging feature of the current conjuncture is that all four alternative measures of DGI that we monitor are either at or below the 2½% target (see Charts 8a–8d) for the first time since 1996. So-called New Economy factors like intensified product market competition and higher (unmeasured) productivity growth have undoubtedly played an important role in keeping DGI subdued. However, it remains important for DGI to be relatively well controlled. It has recently become fashionable to assert that wage settlements should rise because headline inflation (RPI) is currently rather higher than RPIX (3% compared with

**Chart 8**
**Measures of domestically generated inflation**




(a) Unit labour costs.

1.9%).[1] It strikes me that a tendency for wages to follow past headline inflation was perhaps true of a world where firms had considerable product market power and inflation itself was not mean-reverting. Currently we have a central bank that is mandated to maintain inflation at 2½% at all times and intense product market competition. It is therefore less likely that wage settlements will rise significantly with headline inflation, but we must remain vigilant to this risk.

Another short-term risk to the benign inflation picture is the significant rise in the oil price. While the MPC has accommodated the first-round impact effect on inflation, we shall continue to look out for any evidence of second-round effects on wages, which must clearly be resisted. Once again, intense product market competition is likely to stiffen the resolve of employers, who can be expected to resist oil-related wage increases, but it remains important for us to be vigilant to this risk. Inflation expectations must not be allowed to rise. As discussed earlier, one is necessarily uncertain about the relative contribution of low import prices and structural changes to the improvement in the growth-inflation trade-off. As import prices have now risen, we shall 'learn' more about this in forthcoming months. So monitoring indicators of building wage or price pressures will be particularly important. It is important to remind ourselves that, historically, misplaced hopes of a supply-side improvement have led to poor policy decisions.[2]

More generally, it is important to emphasise that although the 'New Economy' considerations discussed above have important disinflationary effects, they do not imply the death of inflation. It therefore remains important to continue to monitor a variety of wholly conventional influences on inflation when setting policy.

(1) The current RPI-RPIX differential is attributable to the abolition of tax relief on mortgage interest payments in the last budget, and the four interest rate rises since September 1999. On the MPC's usual forecasting convention of unchanged interest rates, the RPI-RPIX differential should shrink to close to zero by next April.
(2) See, for example, the discussion in Orphanides (1999).

## References

**Bank of England (1999)**, *Economic models at the Bank of England*.

**Bean, C (2000)**, 'The Australian economic miracle: a view from the North', paper presented at the Reserve Bank of Australia (rba-gov-au).

**Brown, W, Dickens, R, Gregg, P, Manning, A and McIntosh, S (1999)**, 'Everything under a fiver: recruitment and staff turnover in low-pay firms', Joseph Rowntree Foundation, forthcoming.

**Browne, F (2000)**, 'Is there a New Economy?', paper presented at Oesterreichische Nationalbank Conference, June.

**Buiter, W (2000)**, 'The new economy and the old monetary economics', *Bank of England Quarterly Bulletin*, May, pages 173–83.

**Cecchetti, S, Genberg, H, Lipsky, J and Wadhwani, S (2000)**, 'Asset prices and central bank policy', ICMB/CEPR.

***The Economist* (2000)**, 'Untangling e-conomics', 23–29 September.

**Gordon, R J (2000)**, 'Does the 'New Economy' measure up to the great inventions of the past?', forthcoming, *Journal of Economic Perspectives*.

**Jorgensen, D W and Stiroh, K J (2000)**, 'Raising the speed limit: US economic growth in the information age', *mimeo*.

**Kneller, R and Young, G (2000)**, 'The new British economy', NIESR, *mimeo*.

**Oliner, S D and Sichel, D E (2000)**, 'The resurgence of growth in the 1990s: is information technology the story?', *Journal of Economic Perspectives*, forthcoming.

**Orphanides, A (1999)**, 'The quest for prosperity without inflation', Board of Governors of the Federal Reserve System, *mimeo*.

**Orphanides, A and van Norden, S (1999)**, 'The reliability of output gap estimates in real time', Board of Governors of the Federal Reserve System, *mimeo*.

**Wadhwani, S B (2000a)**, 'British unemployment and monetary policy', *Bank of England Quarterly Bulletin*, February, pages 88–102.

**Wadhwani, S B (2000b)**, 'The impact of the Internet on UK inflation', *Bank of England Quarterly Bulletin*, May, pages 184–98.

# 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

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Executive summary of the single monetary policy in Stage 3
The financing of technology-based small firms: an update
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Bond yields and macroeconomic behaviour (S)
Monetary policy and the exchange rate (S)
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| Developments in international banking statistics in 1999 | Sarah Wharmby | August | 1–4 |
| Commercial property statistics: a report of a half-day meeting of the Financial Statistics Users' Group | Richard Windram | July | 1–4 |

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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.

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