# **Bank of England Quarterly Bulletin**



## February 2000

Volume 40 Number 1

## **Bank of England Quarterly Bulletin**

## February 2000

Summary	3
Recent economic and financial developments	
Markets and operations	5
Box on interest rate option volatility	8
Box on new estimates of the term structure of real interest rates	15
Box on financial market conditions over the century date change	18
The international environment	23
Box on stock market and housing wealth effects on consumption	
in the United States	30
Sterling wholesale markets: developments in 1999	38
Box on merger of CGO and CMO with CREST	48
Research and analysis	
Recent developments in extracting information	
from options markets	50
Stock prices, stock indexes and index funds	61
Private equity: implications for financial efficiency	60
and stability	69
Box on how leveraging ratchets up the returns on equity	73
Box on the risks from leveraging	74
Speeches	

### **Back to the future of low global inflation** Speech by DeAnne Julius, member of the Bank's Monetary Policy Committee,

delivered as the Maxwell Fry Global Finance Lecture at the University of Birmingham on 20 October 1999

### British unemployment and monetary policy

Speech by Sushil B Wadhwani, member of the Bank's Monetary Policy Committee,<br/>given to the Society of Business Economists on 2 December 199988

### Before the Millennium: from the City of London

Speech by the Governor at the first City of London Biennial Meeting, organised by City University Business School and held at the International Maritime Organisation on 7 December 1999

103

77

Volume 40

Number 1

Printed by Park Communications © Bank of England 2000 ISSN 0005-5166

## **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 November *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 5–22)

*The international environment* (pages 23–37)

Sterling wholesale markets (pages 38–49) This article reviews developments in international and domestic financial markets and describes Bank of England market operations in the period 30 September 1999 to 14 January 2000. The century date change passed with minimal disturbance to markets. Financial market turnover was generally low in December and corporate bond issuance fell, but activity rapidly returned to normal levels in early January. Official interest rates were raised in both the euro area and the United States in November, by 50 and 25 basis points respectively. During the period, yield curves in the euro area and the United States shifted upwards, largely in response to stronger-than-expected economic growth and in anticipation of further monetary policy tightening. Short-term market interest rates also rose in the United Kingdom, partly reflecting the MPC's decisions to raise the Bank's repo rate by 25 basis points in November and January. But long gilt yields fell, further accentuating the inversion of the gilt yield curve. Equity markets in all the major economies rose strongly during the period. The euro depreciated further against the other major currencies, despite higher market interest rates.

This article discusses developments in the global economy since the November 1999 Quarterly Bulletin. World activity continued to expand at a faster-than-expected rate in the second half of 1999. Prospects for 2000 have improved and forecasts for GDP growth have recently been revised upwards. The US economy continued to grow strongly, driven primarily by domestic demand. The Federal funds target rate was increased by  $\frac{1}{4}$ % to  $5\frac{1}{2}$ % in mid-November, and by a further  $\frac{1}{4}$ % to  $5^{3}/4$ % in early February. Activity in the euro area picked up in Q3 and appears to have remained robust in Q4. Conditions in the major euro-area economies improved, partly due to stronger export demand. The ECB raised its main refinancing rate by  $\frac{1}{2}$ % in early November and by a further  $\frac{1}{4}$ % to  $\frac{31}{4}$ % in early February. The Japanese economy has started to improve. That reflects a supportive policy stance as well as an increase in exports. However, the outlook for private consumption and investment remains weak. The recovery in emerging market economies in 1999 was stronger than expected. Growth in Asia is expected to be stronger than in Latin America. Oil prices continued to rise, but growth in non-oil commodities prices was more muted. Although raw materials prices have risen in response to this, inflationary pressures further along the supply chain have been more subdued.

Sterling wholesale markets grew by £800 billion in 1999, though much of this reflected increased market values rather than new issuance. Though the size of markets grew, liquidity in a number of core markets fell, reflecting both the retreat of risk capital following the global financial crisis of 1998 H2 and, in the gilt-edged market, reduced government borrowing and hence lower bond supply. The approach of the millennium date change also affected markets in 1999 H2, though liquidity and turnover in December turned out higher than many had expected. The Bank made two changes to its open market operations in 1999: a major permanent widening in the list of collateral eligible in OMOs; and, from October, the introduction of temporary three-month repos designed to help firms plan their liquidity over the year-end.

## Research and analysis

(pages 50-76)

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

*Recent developments in extracting information from options markets* (by Roger Clews, Nikolaos Panigirtzoglou and James Proudman of the Bank's Monetary Instruments and Markets Division). The Monetary Policy Committee is provided with information from options markets to quantify market uncertainty about the future course of financial asset prices. For short-term interest rates, this is shown in the *Inflation Report's* blue fan chart. Similar information can be obtained from a wide range of other assets. This article compares the performance of alternative techniques for extracting information from options prices. Using a technique for estimating uncertainty about interest rates at a constant horizon a short way into the future, we consider how this uncertainty has evolved since the Bank was granted operational independence in May 1997.

*Stock prices, stock indexes and index funds* (by Richard A Brealey, special adviser to the Governor on financial stability issues). In recent years, many UK investors have given up the quest for superior performance and have instead simply sought to match the returns on some broad market index. This has led to the suggestion that the growth in index funds has depressed the stock prices of those companies that are not represented in the index and has thereby increased their cost of capital. This effect may have been accentuated by the actions of fund managers, whose performance is compared with that of a market index. This paper argues that, in practice, these price effects are likely to be very small. In support of this view, the paper examines the price adjustments that occur when a stock is added to, or removed from, a stock market index.

Private equity: implications for financial efficiency and stability (by Ian Peacock and Stuart Cooper of the Bank's Domestic Finance Division). Private equity has become an important source of finance in recent years for firms wanting to undertake a major restructuring or capital investment. Previously, its increased use was mainly associated with the 'back to basics' policy of many large companies and the consequent sale of non-core subsidiaries. Private equity investment houses have, however, diversified into financing other types of transaction. In doing so, they have achieved some attractive rates of return on amounts invested, which has led to an increase in the funds at their disposal. This article describes the current state of the UK private equity market. It also considers the extent to which private equity promotes efficiency by facilitating the 'shake-up' of businesses, and whether the success of investment houses in attracting substantially increased funds for investment poses any threats to financial stability. Private equity comprises equity investment in all types of unquoted companies, whether provided by individuals, funds or institutions. The article concentrates on larger transactions (particularly management buy-outs and buy-ins of over £10 million), and excludes start-up and early-stage venture capital finance, which in effect forms a distinct market with different characteristics.

The contents page, with links to the articles in PDF format, is available at www.bankofengland.co.uk/qb/f00qbcon.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 and describes Bank of England market operations in the period 30 September 1999 to 14 January 2000.

- The century date change passed with minimal disturbance to markets. Financial market turnover was generally low in December and corporate bond issuance fell, but activity rapidly returned to normal levels in early January.
- Official interest rates were raised in both the euro area and the United States in November, by 50 and 25 basis points respectively. During the period, yield curves in the euro area and the United States shifted upwards, largely in response to stronger-than-expected economic growth and in anticipation of further monetary policy tightening.
- Short-term market interest rates also rose in the United Kingdom, partly reflecting the MPC's decisions to raise the Bank's repo rate by 25 basis points in November and January. But long gilt yields fell, further accentuating the inversion of the gilt yield curve.
- Equity markets in all the major economies rose strongly during the period.
- The euro depreciated further against the other major currencies, despite higher market interest rates.



Interest rates implied by Federal funds

Chart 1

(a) FOMC meeting scheduled for 1–2 February 2000.

#### **International markets**

#### US developments

At its meeting on 5 October, the Federal Open Market Committee (FOMC) left the Federal funds target rate unchanged at 5<sup>1</sup>/<sub>4</sub>%, but adopted a directive 'biased toward a possible firming of policy going forward'. Short-term market rates rose in the days following the announcement. However, data released in late October and early November indicated weaker-than-expected inflationary pressures in the US economy and prompted a significant rally in global money and bond markets.

By 8 November, the interest rate implied by the November Federal funds futures contract had fallen to 5.3% (see Chart 1), suggesting that markets saw a less than one in two chance of a  $^{1/4}$  percentage point increase in official rates at the FOMC meeting on 16 November.<sup>(1)</sup> But the stronger-than-expected October PPI release on 10 November led to renewed inflationary concerns, and by the time of the November FOMC meeting, there was a general expectation of a rate rise. Consequently, when the FOMC did announce a  $^{1/4}$  percentage point increase in its target rate to  $5^{1/2}$ %, there was little change in market interest rate expectations for 1999

<sup>(1)</sup> Each Federal funds futures contract settles on the simple average of the effective overnight Federal funds rate for that month, which tends to equal the FOMC's target rate. The target rate was expected to remain at 5.25% before the FOMC meeting on 16 November, so an implied average effective Federal funds rate of 5.3% for November suggested an expected target rate of 5.35% for the period 16–30 November. Hence, market participants placed roughly a 40% chance on a 25 basis points rise at the November meeting.

#### Chart 2 US interest rates



(a) Interest rates implied by eurodollar futures contracts at the dates specified. From December 1999, the x-axis relates to contract expiry dates.











Q4, and market uncertainty about the near-term interest rate outlook, as measured by implied volatilities in interest rate options, fell (see the box on page 8).

Over the remainder of the period, US short-term interest rate expectations generally increased as economic indicators (such as retail sales and the trade deficit) reflected the continued strength of domestic demand. As had been expected, the FOMC left the stance of monetary policy unchanged at its meeting on 21 December. But in early January market interest rates increased further, on the view that Y2K-related concerns would no longer impede a rise in official interest rates. By 14 January, Federal funds futures fully priced in a <sup>1</sup>/<sub>4</sub> percentage point rate rise at the FOMC meeting on 2 February; and some market participants felt that a larger increase was possible (see Chart 1).

Looking further ahead, interest rates implied by eurodollar futures contracts for end-2000 and end-2001 increased by about 70 basis points over the period as a whole, to 7% and 7.3% respectively (see Chart 2). This increase was larger than that for comparable euro, yen and sterling futures contracts.

During the period, Treasury yields reached their highest levels in more than two years; by 14 January, five and ten-year yields were some 60–70 basis points higher than on 30 September and thirty-year yields were up by around 50 basis points (ten-year yields are shown in Chart 3). The Treasury market responded to domestic news in much the same way as the short-term interest rate markets; yields increased at the beginning of the period, before falling back in late October and early November and rising again from mid-November onwards.

US ten-year swap spreads continued to narrow during Q4, falling from their August peaks towards levels last seen in January 1999 (see Chart 4). This may have reflected the decline in US non-government bond issuance in Q4, which would have allowed underwriters to carry less inventory. Reduced demand to hedge such inventory by paying fixed interest in a swap transaction may have led swap rates to fall relative to Treasury yields. In addition, concerns about market conditions over the century date change eased in November and December (see the box on pages 18–19). The demand to hold Treasury securities for precautionary purposes over the year-end may therefore have fallen, reducing the price premium on Treasury securities over private sector assets.

#### Euro-area developments

The pattern of market interest rate movements in the euro area was similar to that in the United States during the period. In early and mid-October, interest rates implied by euribor futures edged higher, as inflation concerns grew following stronger-than-expected data releases for euro-area PPI, French CPI and German import prices, as well as comments by ECB officials about the upside risks to euro-area inflation.

During late October and early November, however, market interest rates fell, triggered by the fall in US market interest rates. This was despite the release of stronger-than-expected European data (such as euro-area M3 and the French INSEÉ manufacturing survey) and the decision by the European Central Bank (ECB) on 4 November

#### Markets and operations

#### Chart 5 Euro-area interest rates



(a) Interest rates implied by euribor futures contracts at the dates specified. From December 1999, the x-axis relates to contract expiry dates.

#### Chart 6 ECB repo rate expectations



Source: Reuters poll of economists.

(a) Mean expectation of ECB repo rate at dates shown. Economists polled differed across surveys.

#### Chart 7

## Non-government international bond issuance, by currency



Source: Capitaldata Bondware.

(a) Based on issuance in the eleven euro-area legacy currencies before 1 January 1999. to increase its repo rate by a <sup>1</sup>/<sub>2</sub> percentage point to 3%. Markets had increasingly come to expect this repo rate rise; following the announcement, interest rates implied by futures contracts for 2000 and 2001 actually fell. This reaction probably reflected three factors. First, the increases in US interest rates. Second, the November ECB rate rise was seen, on one view, as 'pre-emptive', lessening the need for higher rates in the future. And third, the ECB's move reduced near-term market uncertainty about monetary policy (see the box on page 8). Interest rate expectations fell further following the larger-than-expected falls in German industrial production and retail sales, announced on 8 and 12 November respectively.

By mid-January, however, some in the market had come to expect a further increase in the ECB repo rate as early as 2000 Q1, following signs of stronger-than-expected economic activity in the euro area. In particular, market interest rates increased following the German Ifo survey of business confidence, released on 16 December. There was also concern about possible wage pressures in Germany following the demand from the engineering union IG Metall for a  $5\frac{1}{2}$ % annual pay award.

Over the period as a whole, interest rates implied by euribor futures increased by 20 basis points for the March 2000 contract and by some 35 basis points for contracts expiring at the end of 2000 and 2001 (see Chart 5). Similarly, most private sector economists increased their forecasts of the ECB repo rate in 2000 by about 40 basis points (see Chart 6).

Bund yields also rose over the period, by some 45 basis points at the ten-year horizon (see Chart 3). Yields occasionally increased following lower-than-expected bid-to-cover ratios in Bund auctions. At other times, yields increased when the euro weakened, and fell on its recovery. Both dollar and euro-denominated bond issuance fell in 1999 Q4 (see Chart 7). Nonetheless, the euro's share of total bond issuance increased. This reflected continued expansion of European capital markets following the introduction of the euro.

#### Japanese developments

The Bank of Japan (BoJ) maintained its zero interest rate policy during Q4 and announced, on 13 October, a wider range of money market operations to ensure 'further permeation of the effects of monetary easing'. This included the introduction of outright sales and purchases by the BoJ of short-term government securities, the addition of two-year government securities as eligible collateral for BoJ repo operations, and further temporary operational changes to accommodate any stronger-than-usual demand for liquidity related to Y2K concerns.

Over the period as a whole, interest rates implied by euroyen futures for contracts expiring in 2000 H2 and 2001 H1 increased by 5 to 10 basis points. Changes in Japanese market interest rates were less closely related to those in the United States and the euro area: the correlations between daily changes in interest rates implied by euroyen futures and those implied by eurodollar and euribor futures over the period were 0.3 and 0.4 respectively, compared with a eurodollar-euribor correlation of 0.6. Instead, domestic considerations were more important. Although market interest rates fell following the weaker-than-expected Q3 GDP data

### Interest rate option volatility

Implied volatilities (IVs) of options on short-term interest rate (STIR) futures are a measure of market uncertainty about the interest rate outlook.<sup>(1)</sup> IVs generally fall following policy announcements because the policy decision provides significant new information on the level of interest rates likely to prevail at the maturity date of the option, and because the number of possible changes in official interest rates that remain before the futures contract expires falls by one as each monetary policy meeting passes.

In November 1999, the monetary authorities in the United Kingdom, the euro area and the United States all increased their official interest rates. This monetary tightening was followed by a much larger fall in the IVs of options on STIR futures than is usual in response to monetary policy changes.<sup>(2)</sup> Furthermore, the fall in the December UK IV following the MPC's rate rise on 4 November 1999 was the largest daily percentage fall on the front short sterling futures contract since the MPC raised rates in August 1997, a move which market participants had expected to be the final increase in that interest rate cycle.

The chart shows the average percentage changes in IVs on monetary policy announcement days (in lighter shades), and the percentage changes in IVs in response to the November 1999 interest rate rises (in darker shades) for the front three STIR futures contracts in each economy.<sup>(3)</sup> Part of the fall in IVs of the December 1999 options may have been related to perceived Y2K risks. Some in the markets had been concerned that an increase in interest rates in December could increase the premium on borrowing over the millennium date change, because a rate rise would come at a time when markets were illiquid. The rise in official rates in November was seen as removing, or at least greatly reducing, the chance of a December rate rise, and thus reduced the uncertainty attached to future short-term interest rates by more than usual.

The large falls in IVs in November may also have been related to market perceptions of the monetary policy outcome. For instance, in the euro area, market players were expecting interest rates to rise, but were unsure of the timing of such a move. When the ECB raised its repo rate on 4 November, this uncertainty was removed and, at that time, market participants were confident that euro-area rates would remain at their new 3% level for some time to come. Similarly, in the United Kingdom, markets also saw the November rate rise as being



Reaction to IVs to monetary policy announcements

Note: Light shade: average reaction. Dark shade: November 1999.

pre-emptive, thereby reducing the need for further rate increases in the future. In the United States, the November rate rise was accompanied by a statement from the FOMC noting that increasing labour market tightness 'must eventually be contained if inflationary imbalances are to remain in check and economic expansion continue'. Although this led US market interest rates to rise, the unambiguous nature of the statement helped to reduce uncertainty about the future path of near-term rates.

In addition to the considerations noted above, technical factors may have augmented the decline in UK IVs. There is said to be less liquidity in sterling fixed-income and derivatives markets than in dollar and euro markets, and UK banks are said to have been heavy buyers of caps.<sup>(4)</sup> Both of these factors are thought to have generated a higher implied volatility in short sterling futures prior to November, and may therefore have exaggerated the downward reaction of UK IVs to the developments described above. The volume of options traded on the front three short sterling futures contracts in the week of the November MPC meeting totalled some 110,000 contracts, equivalent to £55 billion-worth of notional principal. While this represented reasonable market liquidity by UK standards, the turnover was low relative to the US and euro-area contracts. The equivalent turnover volume for options on the front three euribor futures contracts in the week of the November ECB meeting and the front three eurodollar futures contracts in the week of the November FOMC meeting were around £100 billion and £240 billion respectively.

- (2) Relevant STIR futures are short sterling (for the United Kingdom), euribor (for the euro area) and eurodollar
- (for the United States). (3) The sample covers May 1997 to October 1999 for the United Kingdom and United States, and January to
- October 1999 for the euro area. Only options on March, June, September and December futures contracts are used.
- $\left(4\right)$  Caps are a strip of options on Libor interest rates traded in the over-the-counter market.

<sup>(1)</sup> Implied volatilities (IVs) are the market's expectation of the standard deviation of the distribution of future daily changes in the interest rates implied by a futures contract. Higher IVs reflect greater market uncertainty.

#### Chart 8 Japanese market interest rates



(a) Derived from Svensson par yield curve

## Table A International equity market performance

Percentage changes from previous period, in local currencies

	1998	1999		
	Year	H1	<u>Q</u> 3	Q4 (a)
United States				
S&P 500	26.7	11.7	-6.6	14.2
Dow Jones 30	16.1	19.5	-5.8	13.4
Nasdaq	39.6	22.5	2.2	48.0
Europe				
CAC 40 (France)	31.5	15.1	1.2	26.1
Dax (Germany)	17.7	7.5	-4.3	39.3
Dow Jones Euro Stoxx 50	32.0	13.4	-3.1	31.6
FTSE 100	14.6	7.4	-4.6	10.4
Japan				
Nikkei 225	-9.3	26.6	0.4	7.7
Source: Bloomberg.				

(a) 30 September 1999–14 January 2000

#### Table B

#### **Revisions to forecasts for GDP growth in 2000**

	October 1999 (per cent)	January 2000 (per cent)	Difference (percentage points)
Euro area	2.8	3.0	0.2
Japan	0.4	0.7	0.3
United Kingdom	2.8	3.1	0.3
United States	2.9	3.6	0.7

Source: Consensus Economics

# Table CInterest rate expectations impliedby futures contracts for December 2000

	Implied yields (per co	Change	
	30 September 1999	14 January 2000	(basis points)
Japan	0.51	0.61	10
United Kingdom	7.05	7.25	20
Euro area	4.23	4.56	33
United States	6.30	7.04	74

Source: Bloomberg.

in early December, there was a general improvement in sentiment about the outlook for the Japanese economy. In addition, statements by BoJ officials were interpreted as suggesting that the zero interest rate policy might end sooner than some market participants expected. Both of these factors at times led Japanese market interest rates to rise. Japanese government bond (JGB) yields also increased, by around 15 basis points (see Chart 8).

#### International equity market developments

Most major international equity markets reached record highs in Q4, despite the increase in market interest rates. Over the period, the Nasdaq composite index, which has a large IT component, increased by 48% (see Table A); IT stocks similarly accounted for a large proportion of the gains made by other major equity market indices. In the euro area, share price increases were also influenced by anticipated merger activity and, in Germany, by the government's announcement in December of the proposed easing of tax disincentives to sales of cross-company shareholdings.

#### **Foreign exchange markets**

The US dollar's effective exchange rate index increased by 1.3% over the period, largely reflecting a 5.2% appreciation against the euro and a small appreciation against sterling. These bilateral movements were partially offset by depreciations of 0.4% and 1.3% against the Japanese yen and the Canadian dollar (these two currencies together account for 55% of the US dollar index).

Changes in growth prospects and interest rate expectations help to explain the dollar's appreciation against the euro and sterling. Although growth forecasts were typically revised upwards for all the major industrialised countries during the period, projections for US growth in 2000 were generally revised up the most (see Table B). These changes in perceptions about growth prospects were accompanied by similar movements in short-term interest rate expectations. As can be seen from Table C, the increase in interest rates implied by futures contracts maturing in December 2000 was greater for the United States than it was for the United Kingdom, the euro area and Japan. However, while these considerations help to explain the dollar's appreciation against the euro and sterling, they fail to explain the dollar's small depreciation against the yen.

Relative growth prospects and interest rate differentials were not the only influences on dollar exchange rates during the period, however. In particular, the correlation between movements in the dollar and US equity prices remained relatively high by recent historical standards. For example, the dollar fell following the stronger-than-expected average hourly earnings and producer price releases in early and mid-October. Although these data were widely interpreted as increasing the probability and likely size of interest rate increases by the FOMC, the dollar was more sensitive over short time horizons to the impact of higher interest rates on the US equity market than it was to changes in the yield curve. Falls in the Dow Jones Industrial Average therefore tended to coincide with falls in the dollar, often notwithstanding an increase in US interest rate expectations.

The euro continued to depreciate over the period, by around 5% against the dollar and the yen and by 4.4% against sterling. The

Chart 9 Euro exchange rates



Chart 10 Yen exchange rates



decline in the euro's effective exchange rate was slightly smaller (3.5%), reflecting little change in the level of the euro against other European currencies. During December, the euro fell to new lows against the dollar, sterling, and the yen (see Chart 9).

As noted above, some of the depreciation of the euro against the dollar reflected changes in relative interest rates and growth expectations. It is less easy to explain the euro's depreciation against sterling and the yen. Interest rates implied by euribor futures contracts actually increased by more than those for either short sterling or euroyen futures contracts, and although consensus forecasts of growth in 2000 were revised up by more for the United Kingdom and Japan than for the euro area, the differences between the revisions were small.

This anomaly may be partly explained by the greater weight that market participants have appeared to place on German data than on data from the other euro-area economies. Evidence about the strength of the German economy was mixed during the period, and market participants tended to react more to signs of weakness. For instance, the euro depreciated following the weaker-than-expected German industrial production and retail sales data in November. Furthermore, during the period as a whole, the consensus forecast for German GDP growth in 1999 was revised down and the forecast for 2000 revised up by only 0.1 percentage point, a smaller increase than for the rest of the euro area.

At first glance, the depreciation of the euro also appears odd in the context of rising equity prices and increased euro-denominated bond issuance. However, foreign investor demand for euro-area bonds and, to a lesser extent, equities, appears to have been quite low. The available evidence from flow of funds data suggests that it is euro-area investors (rather than foreign investors) that have been the major buyers of euro-area equities and euro-denominated bonds. Balance of payments data suggest that the euro area had a deficit (ie net outflow) of foreign direct investment for the first eleven months of 1999 of €121 billion, compared with a deficit of €99 billion for the same period in 1998.

Looking ahead, most market participants expect the euro to appreciate in 2000. Private sector analysts responding to a survey conducted in January by Consensus Economics attached a 65% probability to the prospect of the euro appreciating against the US dollar by more than 4% over the coming year.

Following a rise of 12.1% in 1999 Q3, the Japanese yen's effective exchange rate index appreciated by a further 2.2% during the review period. The yen rose sharply against the euro, appreciating by 5.6% (see Chart 10).

As already noted, the yen's appreciation cannot easily be rationalised in terms of changes in relative growth prospects or interest rate expectations. One explanation for the yen's movements relates to the strong rise in Japanese equity prices last year. Measured in common currency terms, the Nikkei rose by more than any of the other major stock market indices in 1999. This performance has attracted, and been aided by, considerable purchases of Japanese equities by foreign investors. Many of these

Chart 11 Sterling exchange rates



Chart 12 Sterling effective exchange rates



transactions are likely to have generated increased demand for yen. The BoJ was reported to have intervened to limit the appreciation of the yen on four occasions over the period: twice in late November (after the yen hit a four-year high against the dollar of  $\$101^{1/2}$ ), on Christmas Eve and on 4 January (again as the dollar reached  $\$101^{1/2}$ ). Following the latter intervention, the yen fell to \$103 against the dollar, and continued to fall over the following week to \$105.

#### Sterling

Sterling's exchange rate index (ERI) rose by 3.0% over the period, to 108.3, its highest level since April 1998. The pound appreciated by 4.4% against the euro to £0.62, equivalent to an exchange rate against the Deutsche Mark of DM3.16. Against the US dollar, sterling depreciated by 0.7% to  $1.63^{1/2}$  (see Chart 11).

Since the beginning of 1999, the dominant influence on sterling's ERI has been the sterling-euro exchange rate, which has a 65% weight in the index; the pound has been broadly unchanged against other currencies on a trade-weighted basis (see Chart 12). During the review period, many of the factors which accounted for the euro's weakness were also responsible for sterling's strength. For example, the appreciation of sterling against the euro to a low of £0.6201 in late December reflected the euro's more general weakness. As noted previously, sterling's movements against the euro are not easy to explain in terms of relative interest rate developments. The depreciation of the euro may have partly reflected the market's particular focus on economic prospects in Germany, which have tended to be weaker than elsewhere in the euro area. During the period, forecasts of GDP growth for the United Kingdom in 2000 were revised up by more than for Germany, and market participants increasingly talked about the possibility that the United Kingdom's long-run potential rate of growth had increased.

Despite these developments, the difference between the price of sterling call and put options against the euro (known as risk reversals) remained small during the period, suggesting that demand for protection against further sterling appreciation was not very strong. This was consistent with market forecasts of the euro-sterling exchange rate throughout Q4, which were for sterling to depreciate against the euro; market participants also expected the dollar to depreciate against the euro.

With supply-side improvements also perceived to have taken place in the US economy, sterling's modest depreciation against the dollar appears to have been more closely related to movements in relative interest rates.

In addition to the above considerations, sterling continued to be supported by actual and anticipated mergers and acquisition activity. During the period, inward takeovers (ie purchases of UK firms by overseas companies) greatly exceeded outward takeovers in total value, perhaps partly because stock market valuations in the UK were lower than in some overseas markets. Many of these deals will have involved orders to buy sterling in the foreign exchange markets.

#### Chart 13 UK interest rates





Chart 14 Correlations between futures contracts<sup>(a)</sup>



#### **Sterling markets**

#### Short-term interest rates

The Monetary Policy Committee (MPC) raised the Bank's repo rate by 25 basis points on two occasions during the period: on 4 November and on 13 January. At each of the MPC meetings during the period there was some market expectation that the Bank's repo rate would be raised and sometimes by a larger amount than the eventual rise. Rates implied by futures contracts fell in the trading sessions following each of the MPC announcements. The largest decline followed the November announcement; this repo rate increase was interpreted by some market participants as indicating that future monetary policy tightening might be smaller than had been previously thought.

Short-dated interest rates implied by futures contracts for dates in 2000 and 2001 rose during the review period, by 30 basis points for the September 2000 contract, but the peak in implied interest rates, at close to 7.40% in 2002, was little changed (see Chart 13). Hence, markets expected monetary policy to be tightened sooner than previously thought: on 14 January the futures market projected that three-month Libor would rise to 7.25% by December 2000, whereas at the end of 1999 Q3 this level was not expected to be reached until June 2001.

Much of this increase in market interest rates can be explained by stronger-than-anticipated economic activity, perhaps giving rise to inflationary pressures sooner than had previously been expected. At various times, the strength of average earnings, house price rises, business sentiment surveys, and retail sales surprised markets. Most forecasters revised up their projections of output growth during this period (see Table B). Money market rates also rose after the publication of the minutes of the November MPC meeting: the discussion of a possible 50 basis point rise and the 8–1 vote in favour of monetary tightening came as a surprise (at least two members had been expected to vote for an unchanged rate).

Movements in UK market interest rates were also strongly influenced by international developments during the period. The evolution of implied futures rates in the United Kingdom, the euro area, and the United States shared a common pattern, rising until late October, falling until mid-November, and then rising again thereafter. For example, on 14 October, implied interest rates in the United States, the euro area and the United Kingdom rose in response to the stronger-than-expected rise in US retail sales. Correlation coefficients between interest rate futures prices for the three areas were relatively high during the period (see Chart 14); the sterling-euribor correlation increased over the period, reaching its highest level for the past two years.

Interest rates implied by short sterling futures contracts are just one measure of expectations for the future path of the Bank's repo rate. Other measures include interest rates derived from the gilt repo market and forecasts made by private sector economists. There are some differences between these measures. Futures contracts settle on three-month Libor (effectively showing this as a forward three-month rate); surveys are based on the Bank's two-week repo rate; and the expectation derived from the gilt repo market is a

## Table DSterling interest rate expectations

Levels; per cent

	30 September 1999	5 January 2000	Change
December 2000			
Reuters survey (a)	5.98	6.32	0.34
Short sterling futures	7.05	7.38	0.33
GC repo market (b)	6.32	6.69	0.37
December 2001			
Reuters survey	5.98	6.10	0.12
Short sterling futures	7.39	7.47	0.08
GC repo market	6.45	6.53	0.08

Sources: Bank of England, Reuters and Bloomberg

 (a) Economists' median forecasts for the Bank's repo rate at the specified dates.
 (b) Two-week forward rate derived using the Bank's 'variable roughness penalty' (VRP) curve fitting technique (see November 1999 Quarterly Bulletin, page 387).

#### Chart 15 UK gilt and swap six-month forward rates<sup>(a)</sup>



(a) The gilt curve is derived using the VRP curve fitting technique

Chart 16 UK gilt par yields curve<sup>(a)</sup>



(a) Derived using the VRP curve fitting technique.

two-week forward rate.<sup>(1)</sup> As can be seen from Table D, all of these measures show an increase in interest rate expectations since September.

Each rise was of a similar magnitude, leaving the spreads between the various measures little changed. About 30 basis points of the spread between the rates derived from futures contracts and those derived from surveys can be explained by technical factors.<sup>(2)</sup> Differences of opinion between traders and economists may also help to explain some of the gap. The remainder could be attributable to factors such as 'overshooting' in markets because of momentum trading, shifts in supply and demand pressures in the futures market, and the diminished supply of risk capital during 1999 (through reduced hedge fund activity). There were also differences between interest rate expectations derived from futures and from surveys in the United States and the euro area in Q4. While they were smaller than in the United Kingdom, their existence suggests that the relatively wide sterling futures-surveys disparity cannot be explained by UK-specific factors alone.

The profile of six-month forward rates derived from the interest rate swap market was similar to that projected by short sterling futures (see Chart 15).

#### Long-term interest rates

The inversion of the gilt yield curve became more pronounced during the review period (see Chart 16). While five-year par yields rose by some 10 basis points, to 6.3%, due to heightened expectations of further monetary policy tightening, ten-year yields were little changed, at 5.75%, and 25-year yields fell by some 20 basis points, to 4.6%, largely as a result of institutional factors.

The par yield on 6% Treasury Stock 2028, the longest-maturity conventional gilt in issue, fell to a record intra-day low of 4.02% on 5 November. US and European developments had a significant impact on the gilt market at around this time. Nevertheless, between late October and mid-November the decline in medium and long-dated gilt yields exceeded the fall in US Treasury and German Bund yields (see Charts 3 and 17). This suggests that some of the reduction in gilt yields was due to UK-specific factors. For example, at around this time the market increasingly came to anticipate that the Pre-Budget Report (PBR) would confirm lower government borrowing needs and lead to the cancellation of gilt auctions; this added to the downward pressure on yields.

Other factors may also have been influential. Pension funds and life assurance companies hold around 55% of the outstanding stock of gilts. For the purposes of the Minimum Funding Requirement (MFR), the liabilities of pension funds with a mature membership and obligations defined in nominal terms are discounted using long gilt yields. This gives funds an incentive to hold gilts to limit the risk of not matching their liabilities. Life assurance companies' demand to hold gilts is related to their past practice of selling

<sup>(1)</sup> For a more detailed discussion of the differences between these measures of interest rate expectations, see page 335 of the November 1999 *Quarterly Bulletin.* 

<sup>(2)</sup> These include the current upward slope at the front end of the yield curve, a difference between BBA fixings and screen-quoted cash rates, credit risk, and a compounding factor (a two-week repo rate is being compared with a three-month Libor rate).









(a) Derived using the VRP curve fitting technique.

#### Chart 19 Real yields on index-linked government bonds



policies with guaranteed minimum annuity rates (as well as writing other long-term nominal liabilities). These minimum rates are now, in many cases, well above current market annuity rates, and the margin has widened as long gilt yields have fallen. This, in turn, has prompted life assurance companies to make further purchases of gilts to limit the losses to which they are exposed.

These factors can sometimes precipitate more gilt purchases when yields decline, thereby adding further to the downward pressure on yields. For instance, the fall in yields in October and November will have taken some pension funds closer to their MFR-based valuation limits. This may have led them to hedge the risk of further erosion in relation to their MFR limits by buying more long gilts. A second example could arise from the hedging activity undertaken by firms that have sold long-dated receivers' swaptions to life assurance companies.<sup>(1)</sup> These contracts were used by the life assurance companies to hedge their guaranteed annuity exposures. The positions of the options writers would have been hedged when the contracts were written, but the fall in yields would have required them to make further gilt purchases (or to receive fixed in the swaps market) to keep their interest rate exposure constant (known as delta-hedging).

These influences diminished from the middle of November and gilt yields moved higher, broadly in parallel with increases in short-term interest rates and yields on US Treasuries and German Bunds. Two other factors also put upward pressure on gilt yields around this time. First, there was further discussion in the markets about the potential for reform of the MFR, focusing on the possibility of using corporate bonds (in addition to long gilts) to discount nominal liabilities. If realised, this could reduce the demand for long gilts. Second, the financial markets' smooth transition over the century date change led to a further general rise in global interest rate expectations early in the new year.

#### Index-linked gilts

The real interest rate curve generated from index-linked gilts using the Bank's new variable roughness penalty (VRP) fitting technique (see the box on page 15) inverted further during the review period (see Chart 18), similar to the change in the shape of the conventional yield curve. Long-dated real yields followed conventionals, with a sharp fall in late October to early November. An additional influence on long-dated index-linked yields was the auction of the 21/2% Index-linked Treasury Stock 2016 on 27 October which met with stronger-than-expected demand, largely from pension funds and life assurance companies. The change in the shape of the curve also reflected institutional switching from shorter-dated to longer-dated IGs, as portfolio durations were adjusted when the 43/8% 2004 stock was removed from the benchmark. Long-dated real yields in the United Kingdom remained considerably lower than those overseas during Q4 (see Chart 19).

#### Gilt auctions

During the course of Q4, the Debt Management Office (DMO) held one index-linked and one conventional gilt auction, and completed

<sup>(1)</sup> A receivers' swaption gives the buyer the option to receive fixed interest in a swap contract.

## New estimates of the term structure of real interest rates

**Chart B** 

New estimates of the UK nominal yield curve derived from gilt prices and general collateral (GC) repo rates were presented in the November 1999 *Quarterly Bulletin*.<sup>(1)</sup> This box briefly outlines how a similar approach can be used to estimate the real yield curve from index-linked gilts (IGs).

The new approach has two main features. First, it uses a smoothing spline approach (rather than the parametric approach used before). And second, it adopts the framework developed by Evans<sup>(2)</sup> to deal with the fact that IGs are not true 'real' bonds payments on IGs are indexed to the level of the RPI prevailing eight months previously. This technique has two main advantages over the Bank's previous method of estimating the real and inflation term structures. First, it allows the curve to fit the data more accurately. And, second, the derived yield curves are more stable; small changes in the underlying IG prices do not produce disproportionate changes in the derived curves.

As an illustration of the first point, Chart A shows the new and old estimates of the real zero-coupon yield curve on 10 January 2000. The new method is able to capture more accurately the structure of the underlying curve.



Nevertheless, a number of caveats must be placed on the interpretation of the new curve. First, the sparsity of IG issues means that we are unable to estimate the very short end of the curve. Second, the relatively large spacing between IG redemption dates means that the local slope of the yield curve is not particularly well defined; care must therefore be taken when examining forward-rate curves. For example, Chart B shows instantaneous forward rates corresponding to the zero-coupon yield curves of Chart A. First note the upward slope in the five to ten-year maturity range. This reflects the slight increase in the corresponding redemption yields-it is exaggerated simply because of the mathematical relationship between zero-coupon yields and forwards. So though it is difficult to rationalise the shape of the forward curve in economic terms, the new model fits the available data more accurately than the old one. The issue arises because the underlying data themselves are difficult to interpret. Although one of the benefits of the spline methodology is that it attaches relatively low weight to movements in the prices of individual bonds, the sparsity of IGs means that the 'neighbourhood' in which it does so is much larger than for the nominal curve.



In summary, the new technique is better able to reflect information in the index-linked gilts market than that used in the past, but the relative scarcity of IGs means that estimates of the real curve, particularly in terms of forward rates, will always be less reliable than those of the nominal curve, irrespective of the method used.

(1) See 'New estimates of the UK real and nominal yield curves', Anderson and Sleath, *Bank of England Quarterly Bulletin*, Vol 39(4), pages 384–92

(2) Evans, M D D (1998), 'Real rates, expected inflation, and inflation risk premia', *Journal of Finance*, Vol 53.





#### Chart 21 Sterling non-government issuance, by type of issuer



a gilt switch auction (see Table E). The auctions were well-covered, and differences between the highest and lowest accepted yields were relatively small; yields on the sale stocks either fell or held steady after the auctions. There were two auctions in Q1:  $2^{1}/_{2}$ % Index-linked Treasury Stock 2024 on 26 January 2000 and a switch of 8% Treasury Stock 2015 into 6% Treasury Stock 2028 on 9 February.

The conventional gilt auction scheduled for 29 March was cancelled following the publication of the PBR on 9 November. The gilt sales requirement was reduced by £3.1 billion compared with the April 1999 Budget estimate, reflecting a downward revision to the Central Government Net Cash Requirement. Total gilt sales for the financial year are now planned to be in the range £13.8 billion to £14.6 billion (in cash terms).

#### Other sterling bond issues

Total fixed-rate sterling bond issuance (other than gilts) was  $\pounds$ 7.7 billion in Q4, bringing issuance for the year to a record  $\pounds$ 43.6 billion. The largest part of this Q4 total was of longer-dated maturities ( $\pounds$ 5.7 billion), with just  $\pounds$ 1.1 billion in mediums and  $\pounds$ 0.9 billion in shorts (see Chart 20).

Earlier in the year there had been some concern that market liquidity might deteriorate in Q4 as investors' and traders' risk appetite diminished ahead of the century date change. The heavy issuance in Q2 and Q3 (compared with previous years) may have reflected some borrowers bringing forward their funding plans to avoid uncertain market conditions at the end of the year. Total fixed-rate issuance in Q4 was indeed lower than in the previous four quarters, but it was greater than had been expected, and a fairly steady stream of issuance was maintained until mid-December. Nevertheless, the number of UK corporate issuers did decline in the second half of the year (see Chart 21). In Q4, just eight non-financial firms tapped the bond market for financing, down from 19 in Q2. Furthermore, 80% of the £1 billion of UK corporate issuance in Q4 was raised by only four companies, each with credit ratings of AA or A (see Table F). Issuance by companies rated BBB or below fell to just £0.4 billion, down from £1.1 billion in Q3.

There were large dividend payments on gilt and eurosterling bonds in early December. Consequently, a number of issues were brought in November with settlement dates on or around the dividend

Conventio	nal and index-linked				
Date	Stock	Amount issued (£ millions)	Cover	Yield at lowest accepted price	Lowest accepted price
27.10.99 24.11.99 26.01.00	2 <sup>1</sup> / <sub>2</sub> % Index-linked Treasury Stock 2016 6% Treasury Stock 2028 2 <sup>1</sup> / <sub>2</sub> % Index-linked Treasury Stock 2024	350 2,000 350	2.65 1.79 2.54	2.34% (a) 4.27% 1.93% (a)	£204.61 £129.60 £187.01
Switch					
Date	Source stock	Nominal amount purchased (£ millions)	Cover	Destination stock	Total nominal amount created (£ millions)
21.10.99	8% Treasury Stock 2003	1,000	5.129	5% Treasury Stock 2004	1,120

(a) Real yield, assuming 3% inflation.

**DMO** gilt auctions results

#### 16

**Table E** 

## Table FSterling bond issuance in 1999 Q4

		Amount (	(£ billions)		
	Number		By crea	lit rating	g:
	of		AAA	AA/A	BBB and
	companies	Total			below
Fixed-rate issues					
UK corporates	13	1.6	0.2	1.0	0.4
UK financials	5	0.9	0.0	0.9	0.0
Supranationals	6	2.4	2.4	0.0	0.0
Overseas public sector (	(a) 9	2.0	1.9	0.1	0.0
Overseas corporates	1	0.3	0.3	0.0	0.0
Overseas financials	2	0.5	0.2	0.3	0.0
Total (a)	36	7.7	5.0	2.3	0.4
FRNs					
UK corporates	1	0.1	0.1	0.0	0.0
UK financials	7	1.5	1.2	0.2	0.1
Supranationals	0.0	0.0	0.0	0.0	0.0
Overseas public sector (	(a) 1	0.1	0.1	0.0	0.0
Overseas corporates	1	0.1	0.1	0.0	0.0
Overseas financial	6	1.3	0.6	0.6	0.1
Total (a)	16	3.1	2.1	0.8	0.2

Sources: Bank of England, Moody's and Standard and Poor's (a) Includes sovereign and government-backed borrowers.





payment dates, to take advantage of the likely re-investment of these dividends by institutional investors.

Securitisation continued to play a part in corporate financing in Q4, although UK banks were mostly restricted to a few small opportunistic issues. The Halifax became the first UK bank to bring a preferred security issue since the Financial Services Authority allowed such bonds to qualify as Tier 1 capital and the Inland Revenue confirmed that interest payments on such issues are to be tax-deductible.<sup>(1)</sup> Previously, banks have issued debt as Tier 2 capital. Market participants reported that the Halifax bonds were heavily oversubscribed and tightly priced.

The continued inversion of the UK yield curve, combined with the relatively wide spread between AAA-rated bond yields and swap yields (see Chart 22), maintained the incentive for AAA-rated borrowers to issue fixed at long maturities and then use swaps to raise relatively cheap floating-rate sterling, US dollar or euro-denominated finance. With market liquidity reduced, most of these issues were small re-openings by regular borrowers that had been pre-placed and with pre-arranged swap counterparties. Issuance by regular AAA-rated borrowers (supranationals, government-backed agencies and overseas corporates) amounted to £4.8 billion over the quarter, of which £3.4 billion was long-dated.

Both swap and corporate bond spreads declined in late December and early January (see Chart 22). This probably reflected changing perceptions about liquidity conditions around the year-end. In October, investors' increased risk-aversion led to greater demand for liquidity and a preference for government bonds. However, as central banks took action to ensure an ample supply of liquidity over the year-end, concerns about disruptions to financial markets eased. This led both swap spreads and corporate bond spreads to narrow (in the United Kingdom, the United States and elsewhere) before and after the year-end. UK spreads were also affected by market speculation about the likely recommendations of the forthcoming MFR review, with a growing expectation that the result of the review will facilitate hedging in corporate bonds as well as in gilts.

#### Gilt repo

Developments in the gilt repo market were dominated by considerations relating to the century date change in Q4. Uncertainty about liquidity conditions over the year-end increased the value attached to high-quality collateral (see box on pages 18–19), causing the spot spread between GC repo and Libor rates at the one-month maturity to increase to more than 50 basis points in December. However, once the millennium date change was successfully negotiated, this spread fell back to around 10–20 basis points, slightly below its long-run average level.

The appetite for collateral at the year-end was also seen in the Bank's repo survey figures. While reported repo outstandings increased by £6 billion in the three months to end-November, the stock of reverse repo transactions outstanding rose by £11 billion to £103 billion. This suggests that the core money market

The Basel Committee on Banking Supervision's October 1998 recommendation was implemented by the FSA in March 1999 and the Inland Revenue decided on tax-deductibility in August 1999.

## Financial market conditions over the century date change

### **Money markets**

By the second half of 1999, a premium had emerged on unsecured money market lending rates spanning the year-end. This reflected widespread concerns about the potential for computer systems to fail to recognise correctly the date change from 1999 to 2000—the so-called 'millennium bug'—and for market rumours which, even if unfounded, could undermine confidence. This, in turn, generated greater demand for term borrowing and secured lending and a widespread expectation that financial markets would be less liquid than usual around the year-end.

Chart A illustrates one way of examining the premium attached to unsecured money market rates spanning the year-end. The 'one-month spike' measures the cost of year-end liquidity implied by cash rates. This was derived by subtracting the average of the implied one-month forward rates for November and January from the implied one-month forward rate for December (which spanned the year-end). As can be seen, the December premium for borrowing in sterling jumped up at the end of June when six-month cash lending began to mature in early January 2000 for the first time. The one-month spike then continued to increase until early October (rising above 100 basis points) before falling steadily over the rest of the year. These movements were very similar in profile to those observed in other currencies.





In parallel with these developments, a 'negative spike' appeared in some secured lending markets. For instance, by mid-October, the demand for collateral over the year-end had pushed the UK one-month forward general collateral (GC) repo rate implied for December below the one-month forward GC repo rates implied for both November and January. This configuration of forward rates was particularly unusual given the upward-sloping yield curve at that time.

The gradual decline in size of these spikes from October onwards reflected a growing belief that any Y2K disruptions would be relatively minor. This improvement in confidence in the financial markets was partly related to steps taken by central banks in the euro area, Japan, the United Kingdom and the United States to reassure market participants that adequate liquidity levels would be maintained in the money markets in December and January.<sup>(1)</sup>

In the event, the century date change passed without significant disturbance in financial markets. Y2K-related risk premia in money markets rapidly fell in the last week of December, and although the liquidity of most markets decreased (see the table), turnover volumes were generally higher than had been expected and recovered to close to normal levels within the first two weeks of January. Equity market turnover was in fact relatively high in December.

#### **UK market turnover**

December turnover as a percentage of monthly average in rest of year<sup>(a)</sup>

	1997-98	1999
Short sterling futures (b)	65	32
Long gilt futures (c)	50	29
Broked overnight interbank trades	110	92
FTSE indices: value	79	98
number of bargains	87	127
Sterling bond issuance	81	71

Sources: Bloomberg, Wholesale Markets Brokers Association, London Stock Exchange and Bank of England.

(a) Figures based on value of transactions unless stated otherwise.

(b) Front four contracts.(c) Front two contracts.

The Bank's long-term repo transactions contributed to market confidence that adverse year-end liquidity conditions would not arise, leading the premium attached to interbank rates spanning the century date change to fall. By reducing the size of the daily money market shortages, the long-term repo transactions were also a factor behind relatively low overnight interest rates in December; the sterling overnight index average (SONIA) typically traded some 70 basis points below the Bank's repo rate during the month (see Chart B). The position of the large retail banks could also have been influential. If these institutions had received sizeable unadvised interbank deposits at the end of the year, such inflows would have necessitated increased holdings of

(1) Details of central banks' Y2K liquidity measures can be found in issues of the Bank of England's *Financial Sector Preparations for the Year 2000* (available on www.bankofengland.co.uk/millennium/y2kintro.htm).

Chart B Monthly average of SONIA minus the Bank's repo rate



collateral under the Financial Services Authority's stock liquidity requirements at a time when markets were less liquid. The banks therefore successfully agreed limits with their customers before the year-end and discouraged unadvised wholesale deposits by offering low interest rates. Demand pressures in collateral markets also eased at this time, partly because end-investors in gilts did not recall stock out on loan over the year end, as some had feared, and also following the Bank's permanent

#### Chart 23 Sectoral contributions to changes in the FTSE All-Share index



extension of collateral eligible in its open market operations (announced earlier in the year).

In the United States, the effective Federal funds rate averaged 5.3% for the month of December, and 4.7% for the last week of December, below the official target rate of 5.5%. In contrast, in the euro area, overnight interest rates, were quoted close to 3% during most of December (in line with the ECB's official repo rate). It seems likely, however, that the rate would have been higher had the ECB not decided to increase its supply of liquidity to the market—in October, November, and December, the ECB raised the amount of funds allotted in the monthly longer-term refinancing operations by  $\notin$  10 billion, to  $\notin$  25 billion.

#### **Foreign exchange markets**

Although trading in the foreign exchange market was comparatively quiet in the final weeks of the year, markets were more active than many had expected. Market participants generally avoided trading for settlement dates between the end of the year and 10 January 2000. In early January, trading in the interbank market was initially quieter than average, but, in the absence of computer problems, it picked up more quickly than had been expected, as inhibitions about trading for value dates early in the new year diminished.

counterparties covered in the survey strengthened their preference to receive high-quality collateral in cash lending operations over the year-end. The amount of stock borrowing fell by more than £6 billion in the same period. There may have been a substitution effect, away from stock borrowing and towards reverse repo transactions, since a large proportion of stock loans are on call and borrowers may have preferred to lock in reverse repo trades for a fixed period. The rise in the use of both conventional repo and reverse repo was most marked for one to three-month maturities. However, the introduction of the Bank's three-month repo facility in October is thought to have had little impact on gilt repo outstandings.

#### Equities

In line with movements in the other major equity markets, UK share prices rebounded strongly in the fourth quarter, following declines in Q3. Average daily turnover increased in Q4 and, at the end of December, the FTSE 100 index stood at 6930, almost 15% higher than at the end of September. Furthermore, price increases were not restricted to the biggest UK companies; the FTSE 250 and SmallCap indices rose by 13.3% and 15.6% respectively in Q4, leaving the All-Share index 14.7% higher.

As can be seen from Chart 23, positive contributions towards the increase in the All-Share index in Q4 were fairly evenly spread across six of the ten sectors. Taken together, these sectors make up about three quarters of the total index. The strong positive

#### Chart 24 Influence of real yields on the FTSE All-Share index



(a) FTSE All-Share implied by current dividend and real yield curve, and risk premium/dividend growth rate as at January 1999.

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

£ billions; not seasonally adjusted Increase in settlement banks' operational balances (+)

	1999	1999		
	AprSept.	Oct.	Nov.	Dec.
CGNCR (+)	3.2	-8.9	2.3	9.1
Net official sales of gilts (-) (a)	-2.4	-0.3	-1.1	0.1
National Savings (-)	0.7	0.1	0.0	0.0
Currency circulation (-)	-0.8	-1.7	0.6	-5.9
Other	-1.3	-0.4	1.4	-1.6
Total	-0.7	-11.3	3.2	1.7
Outright purchases of Treasury bills and Bank bills	-0.1	0.0	0.2	-0.5
Repos of Treasury bills, Bank bills, EEA bonds, and British Government stock and non-sterling debt	1.9	9.9	-0.5	-2.4
Late facilities	-0.2	0.1	-0.2	0.0
Total refinancing	1.6	9.9	-0.5	-2.9
Foreign exchange swaps	0.9	-1.4	-0.5	-0.3
Treasury bills: Market issues and redemptions (b)	1.9	-2.8	2.1	-1.8
Total offsetting operations	0.6	11.3	-3.1	-1.4
Settlement banks' operational balances at the Bank	-0.1	0.0	0.1	0.4

(a) Excluding repurchase transactions with the Bank
 (b) Issues at weekly tenders plus redemptions in mar

(b) Issues at weekly tenders plus redemptions in market hands. Excludes repurchase transactions with the Bank (market holdings include Treasury bills sold to the Bank in repurchase transactions). contributions from the IT and general industrials sectors stand out in particular, since they account for only around 5% and 3% of the index respectively; the IT component of the share price index more than doubled in value in Q4.<sup>(1)</sup>

While the recent strength of IT stocks largely reflects sector-specific considerations (in particular, the rapid expansion of Internet-related business activities), equity prices are also likely to have been influenced by the decline in bond yields in Q4. Between 25 October and 16 November, real yields on index-linked gilts fell by around 40–50 basis points. Using the dividend discount model, and assuming that the expected real dividend growth rate and the equity risk premium remained constant at 21/2% and 3% respectively, one can estimate the impact that the decline in real bond yields is likely to have had on the All-Share index (see Chart 24).<sup>(2)</sup> However, given that actual movements in the All-Share index did not follow the path suggested by the dividend discount model, other considerations must also have influenced equity prices. For instance, market participants may have revised their expectations about the equity risk premium or the real growth rate of dividends. Alternatively, other factors specific to index-linked gilts or to equities may have been influential.

In early January, equity prices fell back, as expectations of near-term increases in official interest rates became more widespread. These price declines were concentrated largely in the Financials and Resources sectors (see Chart 23). By 14 January, the FTSE 100 index had fallen by 3.9% from its 30 December peak, leaving it 10.4% above the 30 September level.

#### **Market operations**

#### Open market operations and sterling Treasury bill issuance

The stock of money market refinancing held by the Bank is usually high in the fourth quarter of the year, reflecting the seasonality of the government's tax receipts and the rise in the note issue in the run-up to the Christmas holiday (see Table G). Daily money market shortages consequently tend to be larger in the middle of the year (see Chart 25). In Q4, however, the Bank provided almost £8 billion of the stock of money market refinancing at a maturity of three months (see Table H), rather than the usual two weeks. This temporary longer-term repo facility was announced on 20 September and implemented in mid-October in order to help market participants plan their liquidity management over the year-end period and to reinforce market confidence that liquidity provision would be sufficient at that time.<sup>(3)</sup>

The stock of money market refinancing held by the Bank averaged £14 billion in October; daily money market shortages averaged £1.3 billion, compared with £0.7 billion in September (see Table I). In anticipation of this period of larger shortages, the Bank reduced the size of the one-month Treasury bill tender to £300 million a week from 1 October, and withdrew it as from 15 October (see

<sup>(1)</sup> It should be noted, however, that this rise includes the effects of the re-classification of Marconi, which was part of GEC in the General Industrials sector until the end of November. See also the box on this subject in the February 2000 *Inflation Report*.

<sup>(2)</sup> Further details of the dividend discount model can be found on page 330 of the November 1999 *Quarterly Bulletin*.

<sup>(3)</sup> See 'Sterling market liquidity over the Y2K period', November 1999 *Quarterly Bulletin*, pages 325–26.

#### Chart 25 Stock of money market refinancing and daily shortages



## Table HRefinancing provided by three-month repos

Date of facility	Amount, (£ millions)	
13 October 20 October	3,000	
27 October 3 November	1,315	
1 December	50	
Total	7,965	

#### **Table I**

#### Average daily money market shortages

#### £ millions

1996	Year	900	
1997	Year	1,200	
1998	Year	1,400	
1999	Q1 Q2 Q3 October November December	1,700 1,200 1,000 1,300 1,000 700	

#### Table J

### Size of weekly Treasury bill tenders

	Amount (£ millions)	
Period beginning	One-month tender	Three-month tender
1 October	300 (28 days)	100
15 October	0	100
5 November	300 (28 days)	100
12 November	600 (28 days)	100
19 November	900 (28 days)	100
26 November	1,200 (31 days)	100
3 December	1,200 (24 days)	100
10 December	1,200 (17 days)	100
17 December	1.200 (28 days)	100
24 December	600 (28 days)	100
30 December	0	100

Table J). In November, the stock of money market refinancing was slightly higher at £15 billion. However, the take-up of the Bank's new longer-term repo facility was more rapid than had been expected and half of this refinancing was provided at a three-month maturity. Consequently, daily shortages in November were actually lower than in October. To sustain the daily money market shortages at an appropriate level for the conduct of the Bank's open market operations, the one-month Treasury bill tender was re-introduced from 5 November and gradually increased in size in succeeding weeks; this supported the money market shortages at a daily average of £1.0 billion in November and £0.7 billion in December.

For three weeks from 26 November, the Bank adapted the weekly one-month Treasury bill tender in order to assist its management of the money market's liquidity position on Thursday 30 December, the last trading day of the year, when a large net flow of funds from the market to the Bank was expected. In place of the regular tender for one-month bills, the Bank held three tenders for bills maturing on 30 December, so that the maturing bills would moderate the size of the shortage on that day. The normal tender for one-month bills resumed on 17 December, but was discontinued after Christmas in anticipation of rising shortages in January and February. Demand for Treasury bills continued to be strong over the quarter: cover at the tenders averaged around five times the amount of bills on offer. The average yields were around 17 and 47 basis points below Libid for the one-month and three-month bills respectively.

On four days in the quarter, there were money market surpluses twice in November and twice in December. The Bank's operations on these days involved the sale of short-dated ('mop') Treasury bills to the market. On each occasion, the maturity date of the Treasury bills (which ranged from one to eleven days) was chosen to coincide with a day when a relatively large shortage was otherwise expected (thereby partially offsetting it); on one occasion Treasury bills with different maturity dates were sold in the morning and afternoon rounds. The short-dated Treasury bills were sold at an average of 44 basis points below the Bank's repo rate.

Foreign exchange swaps are also used by the Bank to supply liquidity to the sterling money market (mostly when the money market shortages are large). Only limited use was made of foreign exchange swaps in November and December; a daily average of £0.2 billion was outstanding during the quarter.

Over the past year the Bank has progressively extended the range of collateral eligible to be used in repo operations with the Bank. In the latest step in this process (implemented on 31 August), the pool of eligible securities was enlarged by some £2 trillion—a sixfold increase—to include government securities issued in euro by the European Economic Area countries.<sup>(1)</sup> The Bank's counterparties made significant use of the new eligible securities during the quarter, principally as collateral for the longer-term repos. For most of Q4 the Bank held around £7 billion in euro-denominated collateral, representing around one half of the

<sup>(1)</sup> See the open market operations section of 'Sterling wholesale markets: developments in 1999' on pages 38–49. A list of the eligible securities is available on the Bank's web site: www.bankofengland.co.uk/eligsec.htm

### Chart 26 OMOs—instrument overview<sup>(a)</sup>



(a) This chart shows the share of the various instruments in the Bank's daily open market operations in 1999 Q4 (including the longer-term repo facility). Figures in brackets relate to 1999 Q3. Figures may not sum to 100% because of rounding.

Results of UK gold auctions					
Auction	Amount on offer (approx.)	Cover ratio	Allotment price per ounce		
29 November 1999	803,600 oz (a)	2.1	\$293.50		
25 January 2000	803,600 oz (a)	4.3	\$289.50		

(a) Approximately 25 tonnes

**Table K** 

total value of collateral on the Bank's books. This helped to ease the demand for gilts to be used as collateral. The share of different instruments in the Bank's refinancing during Q4 is shown in Chart 26.

#### Exchequer cash management

On 6 January 2000, the Debt Management Office (DMO) issued a press notice about the intended timing of the transfer of responsibility of Exchequer cash management from the Bank to the DMO. The DMO assumed responsibility from the Bank for the processing of the weekly sterling Treasury bill tender from 14 January, although the Bank will advise the DMO on the size of the tender and maturity of bills on offer until the final transfer of cash management has taken place. From 14 February, the DMO expects to undertake a limited range of bilateral transactions (potentially including repo, reverse repo and outright purchases and sales) to help smooth part of the Exchequer component of the Bank's money market forecast. The Bank will retain final responsibility for managing the balance of the Exchequer's cash flow until full responsibility for cash management is transferred to the DMO, which is expected to be around the end of March.

### HM Treasury and Bank of England euro issues

In Q4, the Bank of England's monthly auctions of euro bills comprised  $\notin 200$  million,  $\notin 500$  million, and  $\notin 300$  million of one, three, and six-month bills. The auctions continued to be oversubscribed, with issues being covered an average of 4 times the amount on offer. During the quarter, bids were accepted at average yields in a range of 8 basis points above to 29 basis points below the euribid rate for the relevant maturity. At the end of December, the amount of Bank of England euro bills outstanding with the public was unchanged from end-September, at  $\notin 3.5$  billion.

On 19 October, the Bank reopened the UK Government euro Treasury note maturing on 28 January 2002 with a further auction for  $\notin$  500 million, raising the amount of this note outstanding with the public to  $\notin$  2 billion. Cover at the auction was 2.5 times the amount on offer and the average yield was 4.3%. Consequently, total UK euro notes outstanding with the public rose from  $\notin$  5.5 billion at the end of Q3 to  $\notin$  6 billion by the end of Q4.

#### **UK gold auctions**

The Bank has conducted two further gold auctions on behalf of HM Treasury (see Table K). The remaining auction in the current financial year will take place on 21 March 2000.

## The international environment

- *This article discusses developments*<sup>(1)</sup> *in the global economy since the November 1999* Quarterly Bulletin.
- World activity continued to expand at a faster-than-expected rate in the second half of 1999. Prospects for 2000 have improved and forecasts for GDP growth have recently been revised upwards.
- The US economy continued to grow strongly, driven primarily by domestic demand. The Federal funds target rate was increased by 1/4% to 51/2% in mid-November, and by a further 1/4% to 53/4% in early February.
- Activity in the euro area picked up in Q3 and appears to have remained robust in Q4. Conditions in the major euro-area economies improved, partly due to stronger export demand. The ECB raised its main refinancing rate by 1/2% in early November and by a further 1/4% to 31/4% in early February.
- The Japanese economy has started to improve. That reflects a supportive policy stance as well as an increase in exports. However, the outlook for private consumption and investment remains weak.
- The recovery in emerging market economies in 1999 was stronger than expected. Growth in Asia is expected to be stronger than in Latin America.
- Oil prices continued to rise, but growth in non-oil commodities prices was more muted. Although raw materials prices have risen in response to this, inflationary pressures further along the supply chain have been more subdued.



<sup>(</sup>a) Hong Kong SAR, India, Indonesia, Malaysia, Peoples' Republic of China, the Philippines, Singapore, South Korea, Taiwan and Thailand.

### Overview

World activity expanded at a faster-than-expected pace in the second half of 1999. The outlook for growth in 2000 and beyond has also improved, as reflected in upward revisions to GDP forecasts. The strengthening in activity is now fairly broadly based (see Chart 1), with growth in the United States remaining strong, albeit moderating over 1999 as a whole, a continued recovery in the euro area, and the Asian economies recovering rapidly from the financial crises in 1998.

Stronger global demand and a reduction in oil production by OPEC members have led to a pick-up in oil prices and, to a lesser extent, some other commodities prices, but there has been little evidence so far of a substantial increase in consumer prices. Monetary policy was tightened in both the United States and the euro area in November and February. Market expectations, as reflected in futures rates, are for further tightening in response to strengthening activity.

<sup>(1)</sup> Based on data up to 3 February 2000.

#### **Table A OECD** projections for growth in GDP and world trade

Per cent

	1999		2000		2001
	New	Revision (a)	New	Revision (a)	New
GDP:					
World	3.0	0.6	3.5	0.6	3.4
United States	3.8	0.2	3.1	1.1	2.3
Japan	1.4	2.3	1.4	1.4	1.2
Germany	1.3	-0.4	2.3	0.0	2.5
France	2.4	0.1	3.0	0.4	2.9
Italy	1.0	-0.4	2.4	0.2	2.7
United					
Kingdom	1.7	1.0	2.7	1.1	2.3
Canada	3.7	0.8	3.0	0.2	2.7
Euro area	2.1	0.2	2.8	0.4	2.8
World trade	4.9	1.0	7.1	1.5	6.3
Source: OECD Economic Outlook, December 1999.					

(a) Difference from May 1999 Economic Outlook

#### **Table B Other forecasts for GDP growth**

Per cent

	IMF (a)		Consensus Economics (b)		The Economist poll of forecasters (c)	
	1999	2000	1999	2000	1999	2000
United States	3.7	2.6	4.0	3.6	4.0	3.7
Japan	1.0	1.5	0.7	0.7	0.8	1.2
Germany	1.4	2.5	1.4	2.7	1.3	2.7
France	2.5	3.0	2.7	3.4	2.8	3.3
Italy	1.2	2.4	1.2	2.4	1.2	2.4
Euro area	2.1	2.8	2.2	3.0	2.1	3.1

IMF World Economic Outlook, October 1999. Consensus Forecasts, January 2000. The Economist, 29 January-4 February 2000.

### Chart 2 World trade and GDP growth



Forecasts of world activity have been revised up over the past six months. The IMF's October World Economic Outlook and the OECD's December Economic Outlook were more optimistic about prospects than their previous publications in the first half of 1999. Private sector projections are also stronger, and reflect output data published since November. The Monetary Policy Committee's most recent central forecast for world output in 2000 and 2001 is consistent with this view of stronger prospects.

The December OECD Economic Outlook substantially revised up GDP and world trade projections for 1999 and 2000 (see Table A). The OECD expected world GDP to grow by 3% in 1999 and by 3.5% in 2000. The OECD cited 'unexpected near-term momentum of the US economy, a stronger and more rapid resumption of growth in Japan and, particularly, Korea, as well as a slightly better outlook for the European Union' as the main reasons for the upward revision. Euro-area output was projected to continue growing at 2.8% into 2001, leaving world GDP growth unchanged, at around 3.4%, despite a forecast slowdown in the United States.

Other more recent forecasts are somewhat stronger than the IMF and OECD forecasts (see Table B). That principally reflects more recent releases of stronger euro-area activity data and stronger-than-expected US private consumption data.

World trade is also expected to be stronger, principally reflecting a pick-up in non-Japan Asia (see the emerging markets section). But recent emerging markets crises proved more serious than the Mexican crisis of 1995. Their combined effects led to a sharper slowdown in world trade growth, perhaps reflecting the greater financial disruption in Asia, which hindered trade finance and so had a larger impact on world GDP.

The Monetary Policy Committee's central projection for world GDP and trade growth, consistent with the February 2000 Inflation *Report* projections, reflects this view of stronger prospects. Annual world GDP growth is expected to rise to 3% or so in 1999 and then to around 4% in 2000 and 2001; this would be above the average growth rates of the 1990s but below growth rates seen immediately before the Asian crisis (see Chart 2). World imports are projected to grow by between 6% and 7% over the same period, close to the average growth rates seen in the 1990s.

The balance of risks around that projection is judged to remain on the downside, primarily for reasons linked to the possibility of asset markets falling.

The global inflation picture is mixed. Oil prices continued to rise strongly, but non-oil commodities prices have been more subdued. Despite the rise in oil prices, producer price inflation further along the supply chain remained more subdued in the major economies.

Commodity prices, particularly oil prices, continued to rise, partly in response to the improvement in global output (see Chart 3). The price of Brent crude oil rose from US\$21.82 on 29 October to US\$26.73 on 3 February. There are signs that, having fallen between late 1997 and early 1999, some non-oil commodity prices are responding to the improvement in global prospects. The Economist non-oil commodity index rose by 2.2% between 29 October and 31 December, and by a further 1.8% to 3 February.



#### Chart 3 **Commodity prices**



#### Chart 4 **Producer prices**





Source: Primark Datastream

#### Nominal ten-year government bond yields

96



But there are few signs that producer prices further along the supply chain are rising substantially in response to these price movements. Chart 4 decomposes producer prices in the United States and Japan into raw materials, intermediate and final goods prices. In the year to December, raw materials prices rose by 15.8% in the United States and by 4.9% in Japan, reflecting higher oil prices, with the increase in Japan being smaller due to yen appreciation. But final and intermediate producer prices rose by much less. In the United States, intermediate prices rose by 3.9% in the twelve months to December, while in Japan they fell by 0.6%. Final producer prices followed a similar pattern.

#### After declining since mid-October 1999, nominal ten-year government bond yields in both the United States and Germany rose from November onwards. Japanese nominal ten-year government bond yields remained broadly unchanged over the same period.

Nominal ten-year government bond yields in the United States and Germany rose by 46 and 30 basis points, to 6.47% and 5.49% respectively, between 29 October and 3 February (see Chart 5). US ten-year yields peaked at 6.78% on 21 January before falling back. The increase in nominal yields in both countries may reflect the improvement in prospects for activity discussed above. Japanese nominal government bond yields remained broadly unchanged, rising by only 9 basis points, to 1.79%, in the same period.(1)

US thirty-year nominal bond yields followed a similar pattern to those of ten-year yields, until they fell sharply from late January. Thirty-year yields rose by 58 basis points from 29 October, to peak at 6.75% on 20 January, but then fell back sharply, to 6.13%, by 3 February, just below their level on 29 October and below the ten-year yield. Market commentators have offered several explanations for this movement, typically focusing on reaction to the government bond buyback programme recently announced by the US Treasury.

The US economy continued to grow at rates that on most estimates are above trend. GDP grew by 1.4% in the fourth quarter, and by 4.0% in 1999 as a whole, largely reflecting domestic demand. *The Federal funds target rate was increased by 1/4% in November* and by a further  $\frac{1}{4}$  in February. Market expectations, as reflected in yield curves, are for further rate rises in 2000. Labour market pressures had only a muted impact on earnings.

The Federal Open Market Committee (FOMC) increased the Federal funds target rate by 25 basis points to 5.5% on 16 November. Combined with earlier rises, that rise fully reversed the 75 basis point reduction in the Federal funds target rate made during the financial crisis of autumn 1998. The Federal funds target rate was raised by a further 25 basis points on 2 February 2000, when the FOMC was concerned 'that over time, increases in demand will continue to exceed the growth in potential supply, even after taking account of the pronounced rise in productivity growth'. Further, the FOMC cautioned that 'the risks are weighted mainly towards conditions that might generate heightened inflation pressures in the foreseeable future'.

<sup>(1)</sup> Movements in foreign exchange, equity and bond markets are discussed in more detail in the 'Markets and operations' article on pages 5-22.

### Chart 6 Eurodollar futures rates



Chart 7



#### Chart 8

## US non-residential investment and private consumption



Note: Dotted lines show 1988–99 average annual growth rates. Source: Primark Datastream.

As Chart 6 shows, three-month forward interest rates, as predicted by the futures market, moved little following the November interest rate increase, suggesting that the rate rise had been widely expected by the market and did not imply substantial additional tightening in the future. But futures rates had increased sharply by early January, and the slope of the curve steepened; and after the rate rise on 2 February, futures rates indicated a market expectation of further tightening. Bond yields also rose, with the ten-year bond yield rising to more than 6.6% on 5 January, the first time it had breached that level since May 1997.

Although they declined for a short period in early January, equity prices appeared to be largely unaffected by the tighter monetary conditions. The Dow Jones Industrial Average index rose by 7.2% between 29 October and 31 December 1999, but fell by 4.2% to 3 February. The Nasdaq composite price index which has a higher proportion of IT-related companies rose by 37.2% to 31 December 1999 and by a further 3.4% to 3 February.

By the end of January the US economy had experienced 106 consecutive months of expansion, as long as that experienced in the 1960s. If, as expected by many commentators, the expansion continues in February, it will have been the longest in US history.<sup>(1)</sup> GDP growth in 1999 Q3 was revised upwards to 1.4% and growth in Q4 on the advance estimate was 1.4%, a rise of 4.2% relative to a year earlier. GDP rose by 4.0% in 1999 as a whole, a slight slowdown from the 4.3% growth rate in 1998. The overall profile of growth in Q4 was somewhat similar to Q3 (see Chart 7), driven by private consumption, which rose by 1.3%, a slight pick-up from Q3. A slowdown in private investment growth was offset by a rise in government spending. Net trade continued to detract from growth, contributing -0.2 percentage points. Y2K effects might explain some of the slowdown in investment, as some preparations were completed in Q3, and some of the further positive contribution to growth from stockbuilding.

As in 1998, GDP growth in 1999 was largely driven by private consumption and investment. For the past five years, business investment has been continuously above its average growth rate since 1988, as shown in Chart 8. But private consumption only picked up above its average growth rate from 1997. Whereas the strength of investment was largely due to IT-related expenditure, the underlying factors behind the rise in private consumption are more complex. The box on pages 30–31 considers the evidence that wealth effects from sustained equity and house price rises have played an important role in boosting consumption. In a recent speech, Chairman Greenspan cited a central estimate that the rise in US equity prices had 'added around 1 percentage point of the somewhat more than 4 percentage point annual growth rate of GDP since late 1996'.<sup>(2)</sup>

The increase in measured GDP growth following the comprehensive revisions to national income and product accounts by the Bureau of Economic Analysis was discussed in the November 1999 *Quarterly Bulletin.*<sup>(3)</sup> One consequence of those revisions has been an increase in estimates of US trend labour

<sup>(1)</sup> Greenspan, A, 'Technology and the economy', 13 January 2000. Remarks made before the Economic Club of New York.

<sup>(2)</sup> *op cit.* 

<sup>(3)</sup> November 1999 Quarterly Bulletin, page 346.

#### Chart 9 US productivity growth



#### Chart 10 US labour market



#### Chart 11 US labour costs



productivity growth. As Chart 9 shows, US labour productivity growth has been revised up over the course of the 1990s. Those revisions have raised and somewhat flattened the profile of productivity growth in recent years. Stronger productivity growth could partly explain why inflationary pressures have remained muted in the United States, as it would tend to increase the economy's productive capacity. Other things being equal, that would allow output growth to be higher for longer before inflationary pressures emerge.

The labour market continued to tighten during Q4 (see Chart 10). The unemployment rate fell to 4.1% in October—its lowest level in 30 years—reflecting employment growth outstripping the expansion of the labour force. Non-farm payrolls grew by 315,000 in December, after a rise of 222,000 in November, and civilian employment rose by 0.5% in the three months to December compared with the previous three months, outstripping labour force growth of 0.4% in the same period.

But recent trends in compensation and wages continue to suggest that stronger employment growth has yet to feed into wage inflation. Average hourly earnings rose by 0.4% in December, following a 0.1% rise in November, and the annual growth rate increased to 3.7%, from 3.6% in November (see Chart 11). Alternative measures of compensation also suggest that wage pressures remained subdued. The Employment Cost Index (ECI), which includes benefits, rose by 1.1% in Q4 and by 3.4% relative to a year earlier, reflecting a sharp rise in benefits, which increased by 1.3% in Q4, their largest increase since 1993 Q1.

Compensation per hour, which attempts to adjust wages for the realisation of stock options, has grown faster than the ECI, but its annual growth rate slowed in 1999, from a peak of 5.7% in 1998 Q3. Compensation per hour grew by 4.6% relative to a year earlier in Q3. However, this growth rate might be understated, as the speed at which stock options are incorporated into the latest quarterly estimates is somewhat unclear.

Chart 12 plots the relationship between the inflation rate and unemployment for the United States from 1982 to 1999. As the chart shows, inflation remained relatively muted in 1999, despite the unemployment rate falling to 4.1%. By contrast, in 1992, the unemployment rate was 7.5% and annual inflation was 3.0%. Inflation in the United States since 1992 has generally been lower than expected, given the unemployment rate. Between 1995 and 1998, the unemployment rate fell by 1.1 percentage points to 4.5%; the annual inflation rate fell, from 2.8% to 1.6%, over the same period.

There may be two broad explanations for this. The first suggests that a decline in the 'non-accelerating inflation rate of unemployment' (NAIRU) for the United States explains why unemployment has fallen without an increase in inflation. The NAIRU is commonly estimated to have been around 6% in the 1980s, but there are a number of reasons to believe that it might subsequently have fallen. For example, Katz and Krueger<sup>(1)</sup> estimate that the decline in the share of the labour force accounted

Katz, L and Krueger, A, 'The high-pressure labour market of the 1990s', Brookings Papers on Economic Activity, 1999:1, pages 1–87.

### Chart 12 US inflation and unemployment rate





for by 16–19 year olds would explain a decline in the NAIRU of up to 0.4 percentage points since the mid-1980s. Increased incarceration could have reduced the NAIRU by as much as a further 0.17 percentage points, as the incarcerated typically come from a part of the labour force only marginally attached to jobs. Katz and Krueger also estimate that structural changes in the labour market, such as the increased use of employment agencies as well as deunionisation, may have reduced the NAIRU by another 0.1–0.5 percentage points.

The second explanation rests on whether the underlying rate of inflation has decreased. Gordon suggests that a number of other effects, such as the declining cost of computers, falls in medicare cost inflation and changes in the methodology of price measurement may have temporarily reduced inflation, despite unemployment being below the NAIRU.<sup>(1)</sup>

Headline US consumer price inflation fell between 1997 and early 1999. That largely reflected declines in the prices of oil and other commodities. However, both the headline measure and the core measure of inflation (which excludes food and energy prices) could also have been affected by US dollar appreciation over the same period, which led to falling import prices more generally.

Overall, there seems to be evidence that the NAIRU in the United States has fallen. But, to the extent that temporary factors explain why inflation has been so muted despite the declining unemployment rate, the prospects for inflationary pressures will depend on the degree to which these temporary shocks persist.

Euro-area GDP increased by 1.0% in the third quarter of 1999, and available evidence suggests that activity continued to be robust in the fourth quarter. Euro-area inflation was 1.7% in December. The ECB raised its main refinancing rate on 4 November, and again on 3 February.

Euro-area GDP increased by 1.0% in 1999 Q3. Both domestic demand and net trade made significant positive contributions to growth in Q3; domestic demand contributed 0.5 percentage points while net trade contributed 0.4 percentage points. After the slowdown in euro-area activity in the second half of 1998 and the first half of 1999, most forecasters now expect stronger euro-area growth in 2000 and 2001. Much of that strengthening is expected to come from domestic demand, though net trade should continue to make a positive contribution, in view of the recovery in world trade and the depreciation of the euro.

As Chart 13 shows, growth in the smaller euro-area countries continued to outstrip that of the three largest economies. These growth differentials partly reflect the more advanced cyclical positions of some smaller euro-area countries, which have experienced robust domestic demand. They also partly reflect the monetary easing experienced by the smaller countries in the run-up to monetary union. However, growth differentials could also result from longer-term factors as lower-income countries 'catch up'.

<sup>(1)</sup> Gordon, R, 'Foundations of the Goldilocks economy: supply shocks and the time-varying NAIRU' and associated discussion, *Brookings Papers on Economic Activity*, 1998:2, pages 297–346.

#### Chart 14 EU3 exports



#### Chart 15 Euro-area consumer confidence and consumption



Chart 16 Euro-area unemployment



Euro-area exports grew by 3.0% in 1999 Q3, their fastest quarterly growth since 1997. Although import growth was also strong, increasing by 1.9%, net trade made a significant positive contribution to growth. European Commission survey data show that manufacturers became considerably more optimistic in Q4 about export prospects. Although these survey data do not distinguish between intra and extra euro-area trade, it seems likely that the prospects for external demand have improved, reflecting the recovery in world demand and the lower euro real effective exchange rate.

As Chart 14 shows, export growth in the main euro-area economies rose in Q4 relative to a year earlier. Italian exports were more affected by the Asian crisis, so their recovery is consistent with the rebound in emerging market growth. Although France has had a stronger net trade position than Germany, this seems to reflect lower French import growth, as export growth has been similar in each country.

Private investment in the euro area increased by 1.5% in 1999 Q3 following an increase of 0.4% in Q2. Survey data on orders continued to strengthen in Q4 and euro-area business confidence also increased, reaching levels last seen in July 1998. The divergence between strong consumer confidence and weaker industrial confidence that existed at the start of 1999 has been eroded by a rise in industrial confidence; consumer confidence has remained near to its historical high.

Alongside stronger export growth, euro-area private consumption also increased, rising in Q3 by 2.4% relative to a year earlier. Growth in euro-area consumption remained relatively robust in 1999, as stronger growth in consumer spending in France and the smaller euro-area countries compensated for slower growth in Germany and Italy. Chart 15 shows the relationship between consumer confidence and private consumption, and suggests that the outlook for consumption is likely to remain strong.

The continued strength of consumption partly reflected developments in the euro-area labour market. Euro-area unemployment fell to 9.6% in December, from 10.1% at the start of Q3 (see Chart 16). The unemployment rates in France and Italy also declined though remained higher than overall euro-area unemployment. Unemployment in the euro area fell fastest among those aged under 25: by 0.8 percentage points between September and December 1999, compared with a fall of 0.2 percentage points for the over 25s, perhaps reflecting schemes aimed at reducing youth unemployment. Nonetheless, youth unemployment is still high, at 18.0% in December 1999.

Euro-area annual inflation, measured on a harmonised basis, has risen from a low of 0.8% in January 1999 to 1.7% in December (see Chart 17). The rise was driven by retail energy prices, which increased by 10.2% on a year earlier in December. Annual 'core' inflation, ie excluding energy, food, alcohol and tobacco, has fallen since January 1999, to 1.1% in December on the harmonised measure.

Concerns over monetary developments and upward pressures on inflation led the ECB to tighten monetary policy. The main

## Stock market and housing wealth effects on consumption in the United States

Buoyant consumer spending contributed to the sustained period of robust growth experienced by the US economy in the 1990s. One issue is the extent to which consumption was boosted by rising equity and housing wealth. Although there is less empirical evidence outside the United States,<sup>(1)</sup> the issue has nonetheless become increasingly relevant to other economies recently, in the wake of rising global stock markets and other asset price rises.

Between January 1994 and January 2000 the Dow Jones industrial average index rose by 191%. At the same time, the proportion of the population owning shares, either directly or through mutual funds or retirement accounts, increased significantly, so a large number of households benefited to some degree from increased stock market wealth. Chart A shows that both consumption and net financial wealth (which includes equities) rose as a share of personal disposable income in the 1990s. House prices rose more moderately, by an average of 3.9% per annum over the same period. But housing remained the largest component of total household wealth. And there was a steady rise in housing-related borrowing, which underpinned spending.

#### Chart A





Source: Primark Datastream

#### Links between wealth and consumption

Wealth effects are usually viewed as affecting spending over the lifetime of the consumer. In life-cycle models, household consumption depends on permanent income, which is the present value of current and future labour and capital income. Households are assumed to smooth their spending over their life-cycle, typically borrowing

in the early part of their career, saving during their peak earning years, and using their savings to finance spending in retirement. An unexpected increase in wealth, from a rise in house prices for example, will not be spent all at once, but spread over the remaining lifetime. But such an increase in house prices also raises the costs facing first-time buyers or those trading up to larger properties, which may curb overall non-housing expenditure.(2)

The relationship between stock market wealth and consumption is also complex. An increase in stock market wealth may affect consumption in a similar way to a rise in housing wealth. But the dynamics of the relationship between an increase in stock market wealth and consumption may be different.

#### Housing wealth and consumption

Estimates by economists at the Federal Reserve<sup>(3)</sup> suggest that over the past five years, 40% of the growth in mortgage debt originated as financing home equity withdrawal. About half of that reflects sellers realising capital gains, while the new buyers take out larger mortgages (than the seller had at the point of the sale). The average capital gain on house sales over the past five years is about \$25,000. The other half of equity withdrawal reflects unrealised capital gains taken out through, for example, cash-out refinancing.

A more detailed report on home equity lending is contained in an article by Canner, Durkin and Luckett.<sup>(4)</sup> The authors estimate that at end-1997, US homeowners' outstanding equity debt, at \$420 billion, amounted to 25% of total non-mortgage consumer debt.

Although house prices have not risen as strongly as stock markets, economists at the Federal Reserve<sup>(5)</sup> see a different pattern of consumption out of housing wealth than out of stock market wealth. Housing wealth is spent more quickly, and on larger-ticket items. Permanent consumption is boosted by about 5% of the value of the increase in housing wealth, but by only 3%–4% of the increase in stock market wealth, which also tends to be spent more slowly. One explanation may be that house prices are much less volatile, so an increase in housing wealth will be more likely to be viewed as permanent. Brayton *et al*<sup>(6)</sup> find that the elasticity impact on consumption of changes in property wealth is about four times larger than for changes in stock market wealth.

(1) See 'Stock market fluctuations and consumption behaviour: some recent evidence', OECD Working Paper, No 208, December 1998.

(2) Bank of England Inflation Report, August 1999, pages 15-16.

Speech by Chairman Alan Greenspan (November 1999), 'Mortgage markets and economic activity', before a conference on Mortgage Markets and Economic Activity, sponsored by America's Community Bankers, Washington DC. (3)

- 'Recent developments in home equity lending', Federal Reserve Bulletin, April 1998.

<sup>(5)</sup> Speech by Chairman Alan Greenspan, *op cit.*(6) 'The role of expectations in the FRB/US macroeconomic model' published in the *Federal Reserve Bulletin*, April 1997.

#### Stock market wealth and consumption

How much wealth has been accumulated in the United States, and what is the effect on spending? The empirical evidence is mixed, and there is no clear consensus on this issue. A further problem is that the pattern of stock ownership has changed markedly over the 1990s and older studies may not reflect current behaviour.

As noted above, the relationship between the stock market and spending is complex. Chart B plots three-month on three-month moving averages of retail sales and the S&P 500 index. It suggests that retail sales have moved in tandem with the stock market. But the econometric evidence is mixed. For example Ludvigson and Steindel<sup>(1)</sup> use an array of econometric techniques to investigate the relationship between consumption and the stock market. They find no evidence of a stable relationship between aggregate consumer spending and changes in aggregate household wealth. They accept that recent equity gains 'have surely provided some support for consumer spending', but conclude that the unstable econometric relationship cautions against including stock market effects in macroeconomic forecasts.

## Chart B



Specifically the authors find that the dynamic response of consumption growth to an unexpected change in wealth is very short-lived, so forecasts for consumption growth one or more quarters ahead are not typically improved by including changes in wealth.

Starr-McCluer<sup>(2)</sup> used survey evidence to investigate the apparently weak links between stock market wealth and

consumer spending. Her paper presents evidence from the Michigan SRC Survey of Consumers (conducted between July and September 1997), which interviewed households owning stocks. The results are 'broadly consistent with life-cycle saving and a modest wealth effect: the vast majority of stockholders reported no appreciable effect of stock prices on their spending or saving, but many mentioned 'retirement saving' in explaining their behaviour'. Respondents seemed to view stock gains as part of long-term savings, with few immediate implications for spending. Fears of a reversal in gains did not seem to inhibit spending.

#### Conclusions

The IMF (May 1999 *World Economic Outlook*) calculated that most of the rise in net wealth in the US household sector between 1994 and 1998 was accounted for by the rise in the stock market. IMF estimates show that aggregate real estate wealth remained fairly stable at around 150% of disposable income over this period, while equity wealth rose from about 200% of disposable income in 1994 to nearly 300% in 1998. Nonetheless the housing market is linked to the substantial growth in household debt seen over recent years, which may have fuelled consumption.

The distribution of housing and stock market wealth may be an important influence on the pattern of consumption. Tracy, Schnieder and Chan<sup>(3)</sup> found that in the United States 'most corporate equity is held by the wealthiest 10% of the population while more than half of all households hold no corporate equity through any channel. In contrast, a large majority of households own real estate, which represents roughly two thirds of their overall assets'.

However, the authors found that equities were an increasingly important part of household wealth; the proportion of households owning equities rose from 32% in 1989 to 42% in 1995 (and to 48.8% in 1998 according to the Survey of Consumer Finances). Also, in 1984 the share of real estate in household assets was four times as large as the share of equities. By 1998, equities accounted for 28% of household assets, and real estate 27%.

In conclusion, econometric evidence on the effect of increased wealth on spending is mixed, but changes in housing wealth appear to have a larger and more direct impact on short-term consumption than changes in stock market wealth.<sup>(4)</sup>

(1) 'How important is the stock market effect on consumption', Federal Reserve Bank of New York (FRBNY) Economic Policy Review, July 1999.

(2) 'Stock market wealth and consumer spending', Board of Governors of the Federal Reserve System, *Finance and Economics Discussion Series*, No 1998–20, April 1998.

(4) See for example Poterba and Samwick (1995), 'Stock ownership patterns, stock market fluctuations and consumption', Brookings Papers on Economic Activity; Blinder and Deaton (1985), 'The time series consumption function revisited', Brookings Papers on Economic Activity; Campbell and Mankiw (1989), 'Consumption, income and interest rates: reinterpreting the time series evidence' in Olivier Blanchard and Stanley Fisher (eds), NBER Macroeconomics Annual.

<sup>(3) &#</sup>x27;Are stocks overtaking real estate in household portfolios?', FRBNY Bulletin, April 1999.

#### Chart 17 Euro-area consumer prices



Source: Primark Datastream.

(a) All items excluding energy, food, alcohol and tobacco.

#### Chart 18 (a) Implied distribution for euribor three-month interest rates



#### Chart 18 (b) Implied distribution for euribor three-month interest rates



Sources: LIFFE and Bank of England.

The chart depicts the probability distribution of short-term interest rates, and is rather like a contour map. So at any given point, the depth of shading represents the height of the probability density function implied by the markets over a range of outcomes for short-term interest rates. The markets judge that there is a 10% chance of interest rates being within the darkest, central band at any date. Each successive pair of bands covers a further 20% of the probability distribution until 90% of the distribution is covered. The bands widen as the time horizon is extended, indicating increased uncertainty about interest rate outcomes. refinancing rate was increased by 50 basis points, to 3%, on 4 November and by a further 25 basis points, to 3<sup>1</sup>/<sub>4</sub>%, on 3 February. The ECB cited a number of concerns over medium-term price stability to explain the February rate rise: 'monetary and credit developments contributed to the upside risks to price stability'. The three-month moving-average annual growth rate of M3 rose to 6.1% in December 1999, above the ECB reference value of 4.5%. Growth in private sector credit was strong, at 10.5%, in the year to December. 'Developments in the exchange rate of the euro' were also cited, due to the potential impact on import prices. The upside risks to inflation from both of those developments were seen as important, given the improved prospects for both the world and euro-area economies. Further, although the ECB had been expecting a short-term rise in inflation, 'inflation rates are now approaching higher levels than expected earlier, and larger and more protracted commodity and producer price increases are heightening the risk of second round effects. Against this background it is crucial for wage negotiators to be able to rely on the maintenance of price stability in the medium term'.<sup>(1)</sup>

Charts 18 (a) and (b) show the implied risk-neutral probability distribution of euro-area short-term interest rates expectations, derived from options.<sup>(2)</sup> The darkest band in Chart 18 (a) shows the outcome considered most likely by financial markets following the 50 basis point tightening on 4 November, which suggested that market expectations at that time were for a continued monetary tightening in 2000, with three-month interest rates expected to rise to around 3.8% by September 2000. However, following stronger-than-expected activity data, interest rate expectations subsequently increased further. Following the 25 basis point rise on 3 February (see Chart 18 (b)), the implied mean expectation of three-month interest rates by September 2000 was 50 basis points higher, at around 4.3%. And the probability distribution has become more positively skewed, suggesting that market participants are attaching a greater probability to a sharp increase in interest rates than to a sharp reduction.

The improvement in euro-area prospects partly reflects the upturn in Germany during the second half of 1999. Preliminary estimates for Q4 suggest that the economy grew by 1.4% in 1999 as a whole. The recovery has been led by an increase in exports. Although total employment growth remains weak, that disguises a stronger increase in private sector employment as public employment schemes wind down. The increase in employment, together with the recently announced tax cuts, could help to promote consumption growth.

German GDP grew by 1.4% in 1999, following growth of 2.2% in the previous year. But growth in the second half of 1999 picked up. Industrial production in October and November was below market expectations, but the German Finance Ministry pointed out that the data are likely to be revised upward.

Forward-looking data point to faster growth in 2000. Manufacturing sector orders rose by 1.2% in November, an increase

ECB Press Conference, Introductory statement by Willem F Duisenberg, President of the European Central Bank, and Christian Noyer, Vice-President of the European Central Bank, Frankfurt am Main, 3 February 2000.

<sup>(2)</sup> Using techniques described in Clews, R, Panigirtzoglou, N and Proudman, J, 'Recent developments in extracting information from options markets' in this *Quarterly Bulletin*, pages 50–60.

#### Chart 19 Germany: manufacturing orders



Chart 20 German employment



## Table C Elements of German 'Tax Reform 2000'

	Effective from:	Headline N measures (I	et reductions DM billions)
Income			
taxes	2003	Increase of tax-tree threshold to DM14,500. Reduction of entry tax rate to 17% and reduction of top tax rate to 47%.	13.1
	2005	Increase of tax-free threshold to DM15,000. Reduction of entry tax rate to 15%, reduction of top tax rate to 45% and reduction of other tax rates	1S 21.1
		of other tax rates.	
Componete			34.2
taxes	2001	Corporate taxes on retained (distributed) earnings will be	
		reduced to 25% from 40% (30%).	8.3
Total			42.5
Source: Bun	desministerium	der Finanzen.	

of 12.5% relative to a year earlier. That was driven largely by foreign orders, which rose by 3.6% in November; on an annual basis foreign orders rose to pre-Asian crisis levels (see Chart 19). The rise in orders was mirrored by an improvement in business confidence. The Ifo index, measuring business sentiment in western Germany, rose to 99.6 in December, its highest level since December 1997. The index had increased strongly, from 96.1 in October, as a result of the particularly strong rise in assessments of the current business situation, although assessments of future prospects improved as well.

Employment data were suspended for most of 1999. Recently published data show that the level of employment was 70,000 lower in October 1999 than at the end of 1998 (see Chart 20). But that decline was influenced by a reduction in government-sponsored employment promotion schemes, which reduced employment by 130,000 over the same period. Similarly, recent unemployment rates have been inflated by a decline in both vocational training schemes and government employment schemes. The employment level rose by 62,000 between December 1998 and October 1999 after adjusting for the effects of these schemes.

The German government announced further tax reforms just before Christmas. Table C summarises the composition and timing of the 'Tax Reform 2000', which will reduce the tax burden by an estimated DM42.5 billion (1.1% of GDP). DM34.2 billion of the newly announced income tax cuts will only come into effect in 2003–05, but a net decline in corporate taxes worth DM8.3 billion will come into effect in 2001. On top of these new measures, the government has brought forward to 2001, from 2002, income tax cuts worth DM27.4 billion. The tax cuts are expected to be funded partly by higher growth. Germany's fiscal deficit has fallen markedly in recent years, to 1.2% of GDP in 1999, from 1.7% in 1998 and 2.6% in 1997.

Japanese GDP fell by 1.0% in Q3. However, back-data were revised up significantly. Private demand was still subdued. Workers' real household expenditure fell in Q4 and the Tankan survey suggested a weak investment outlook, notwithstanding the continued recovery in industrial production. Despite the yen's appreciation, exports were stronger than expected in Q4, helped by the Asian recovery.

After two consecutive quarterly rises, Japanese GDP fell by 1.0% in Q3. Although the decline was larger than markets expected, there were substantial revisions to back-data. GDP growth was revised up by 0.9 percentage points in 1999 Q2 (to 1.0%). So even after the decline in Q3, GDP grew by 1.0% in 1999 Q3 relative to a year earlier. Overall, the revisions to GDP growth reflected stronger private consumption and public investment profiles. Net exports were also stronger (see Chart 21).

Headline consumer prices fell by 1.1% in December, relative to a year earlier. Prices were unchanged in Q4 as a whole. But the decline in consumer prices largely reflects base-year effects. Fresh food prices were unusually high in 1998 Q4 following a typhoon. Core consumer prices (which exclude food) fell by 0.1% in the year to December (see Chart 22) and have basically remained unchanged since early 1999. Goods and services prices show a similar picture. Goods prices fell by 2.4% in the twelve months to

Chart 21 Contributions to annual Japanese GDP growth



Chart 22 Japanese consumer prices



#### Chart 23 Contributions to annual Japanese GDP growth



(a) Private consumption and non-residential investment.(b) Government consumption, investment and residential investment.

December while services prices rose by 0.2%. As with core prices, services prices have been largely unchanged since early 1999.

Chart 23 decomposes Japanese final domestic demand into two components: 'public demand' and 'private demand'. Private demand consists of private consumption and non-residential investment. Public demand attempts to measure the impact of fiscal expansion. It represents around one quarter of final domestic demand. Residential investment is included in public demand because the housing market has been considerably influenced by government policy measures. For example, housing starts increased in 1996 ahead of the consumption tax rise in April 1997 and subsequently fell. More recently, mortgage interest tax relief and the subsidised home loan rates included in the November 1998 supplementary budget appear to have encouraged residential investment in 1999.

Chart 23 shows how GDP growth in 1999 was driven by a sharp increase in public demand. It seems that the government was able to implement spending from the November 1998 supplementary budget fairly quickly. Public demand grew by 3.0% in 1999 Q1, contributing 1.0 percentage points to annual GDP growth. It then grew by 2.7% in 1999 Q2, contributing 1.2 percentage points to annual GDP growth. Conversely, private demand was much weaker, contributing negatively to annual GDP growth in 1999 Q3.

Fiscal policy should remain supportive in 2000. In November the Japanese government announced a supplementary budget worth ¥18 trillion (3.6% of GDP). The package was ¥0.2 trillion larger than the November 1998 supplementary budget, comprising ¥6.8 trillion in public infrastructure projects and ¥7.4 trillion in measures to support small businesses, such as an extension of the loan guarantee scheme from March 2000 to March 2001. The initial budget for fiscal year 2000 was also mildly expansionary. Excluding debt repayment, general expenditure is scheduled to increase by 2.6% to around ¥48 trillion in fiscal year 2000, compared with the initial fiscal year 1999 budget. The supplementary budget is expected to support activity from 2000 Q1 onwards, which should help to support the recovery trend. But with the OECD projecting gross debt levels to rise to 114% of GDP by 2000, room for further fiscal expansion may be limited.

The December Tankan survey of business expectations suggested that, notwithstanding the increase in industrial production, which grew by 0.8% in Q4 after a rise of 3.9% in Q3, the investment outlook may remain constrained by the existence of spare production capacity in Japanese industry. Chart 24 shows the survey responses of 'principal' enterprises (large firms). While inventory adjustment seems to have been largely completed, measures of excess production capacity and employment levels still remain significantly above their long-run average levels. It is therefore perhaps not surprising that investment intentions remain weak. On an all-enterprise measure, firms expect investment to have declined by 9.8% in fiscal year 1999, little changed from the June 1999 Tankan survey (which included the first estimates for 1999). Although firms are projecting an increase in profitability in the second half of fiscal year 1999, they appear more concerned to improve their balance sheet positions than to increase capacity.









#### Chart 26 Japanese exchange rates



Source: Bank for International Settlements.

Inventory levels have continued to act as a leading indicator of excess capacity, but the lag between movements in excess inventory levels and excess employment and capacity levels seems to have fallen in recent years. In 1989, inventory levels led by around 18 months, but this had been shortened to around 3 months by 1997 Q1. Looking ahead, a continuation of the short lag could suggest that the outlook for investment might be stronger than the Tankan survey suggests. The recent acceleration in machinery orders is consistent with such a picture. Having fallen in the first half of 1999, core machinery orders (excluding shipbuilding and electrical power) rose by 3.1% in Q3 and by 4.7% in the first two months of Q4.

Having grown by 0.9% and 1.1% in the first two quarters of 1999 respectively, private consumption fell by 0.3% in the third quarter. Consumption growth in the first half of the year was boosted by a series of temporary fiscal measures (such as the shopping voucher scheme) as well as an improvement in consumer confidence (perhaps reflecting the recapitalisation of the banking system). However, with the impact of such measures appearing to have levelled off, consumption now seems to be following income more closely. Workers' real household spending fell by 3.1% in Q4, relative to a year earlier. That reflected a decline in real incomes of 3.6% relative to a year earlier, due to a sharp fall in winter bonuses.

The labour market has stabilised somewhat. The unemployment rate averaged a record 4.7% for 1999 as a whole; but having peaked in June and July, it remained roughly 4.6% between August and December. That small improvement reflects two factors. First, a rise in inactivity offset the decline in overall employment (which fell by 0.8% in 1999). Second, while employment in manufacturing and services sectors has reflected pressures to restructure, employment in the construction sector has been influenced by fiscal policy, if only temporarily (see Chart 25). Employment in the construction sector increased relative to a year earlier from July, before declining by 5.2% in the twelve months to December as public works projects tailed off.

The impact of labour market restructuring on personal income remains unclear. There has been an increase in employment for part-time workers, albeit from a low base, and a decline in jobs for full-time workers. The number of full-time employed workers was 0.9% lower in December than a year earlier, while the number of part-time employees increased by 2.6%, reaching some 20% of total employment. But as part-time jobs tend to be relatively lower-paid, aggregate income could still decline even if the total number of people employed stabilises.

Net exports have been stronger than might have been expected, with the yen appreciating by 9% against the dollar in the twelve months to January. The real effective exchange rate has appreciated by less, but remains some 6% higher than a year ago (see Chart 26). But exports rose by 5.6% in the twelve months to November, their first annual increase for 13 months, and by 3.4% in December.

The international environment article in the November 1999 *Quarterly Bulletin* pointed out that one factor limiting the influence of yen appreciation on exports was the ability and willingness of
#### Chart 27 Japan: contributions to annual export growth



Source: Primark Datastream.

(a) Indonesia, Malaysia, the Philippines, South Korea and Thailand.(b) Hong Kong SAR, Peoples' Republic of China, Taiwan and Singapore

#### Table D

#### Forecasts for emerging markets GDP growth

Per cent

	1999		2000	
	New (a)	Revision (b)	New	Revision
Indonesia	-0.1	-0.2	4.0	-0.1
Malaysia	5.0	0.5	6.0	0.5
The Philippines	0.9	0.0	4.0	0.3
South Korea	9.7	1.1	6.9	0.7
Thailand	4.3	0.2	5.1	0.6
Argentina	-3.2	0.2	3.2	0.5
Brazil	0.3	0.3	3.0	0.0
Mexico	3.6	0.4	4.3	0.3

Source: Consensus Economics.

(a) January 2000 for Asia and December 1999 for Latin America.
(b) Compared with November 1999 for Asia and October 1999 for Latin America.

#### Chart 28 Real effective exchange rates



Japanese manufacturers to reduce export prices in order to maintain volumes.<sup>(1)</sup> Chart 27 suggests that the recovery in the Asian region has also helped. Having troughed in early 1998, export growth to those Asian economies first affected by the crisis picked up from January 1999 onwards. Japanese exports to the 'Crisis 5'<sup>(2)</sup> economies rose by 27.8% relative to a year earlier in December, contributing 3.5 percentage points to annual export growth. Exports to Asian countries have been boosted by the relatively high degree of intra-industry trade between Japan and the region (see below).

Emerging market economies were stronger in 1999 than expected, even at the time of the November Quarterly Bulletin. Growth in Asia is expected to be stronger in 1999 and 2000 than in Latin America, but that at least partly reflects the fact that Latin America experienced a slowdown later. Emerging market bond spreads continued to narrow gradually towards pre-crisis levels.

Growth in the emerging market economies proved much stronger in 1999 than had been expected, even at the time of the previous *Quarterly Bulletin*. Table D shows the latest *Consensus Forecasts* figures for GDP growth in the Asian crisis countries and the three major Latin American ones. Growth in Asia was generally higher than in Latin America in 1999 and is forecast to remain so in 2000, partly reflecting the fact that the Latin American crisis (focused around Brazil) occurred more recently than the Asian one and recovery in the region is less well advanced. The most significant upward revisions to growth have been in South Korea, for both years. Indonesia is the exception to the pattern, with 1999 and 2000 growth revised downwards.

The recoveries in Asia and Latin America differ not only in their timing but also in their dependence on external factors. For example, exports make up 51% of GDP on average in the four Asian crisis economies,<sup>(3)</sup> compared with 13% of GDP in Latin America. As a result, although export growth in US dollar terms in Asia and Latin America was of similar magnitude in 1999 (around 7% and 5% respectively), it made a considerably larger contribution to GDP growth in Asia than in Latin America.

The four crisis economies have benefited from both continued strong world demand and significant real exchange rate depreciation. Real effective exchange rates remain 20% below their levels at the beginning of 1997, as shown in Chart 28. In relative terms, however, the crisis countries' competitive position *vis-à-vis* each other has broadly returned to where it was at the beginning of 1997. The change in Indonesia's real exchange rate is striking: a large part of the gain from the initial nominal devaluation was quickly eroded in the face of stronger domestic inflation. At an earlier stage, these real exchange rate trends had heightened concerns about the sustainability of the *de facto* Chinese peg, but these have subsided in recent months.

The policy-led recovery in Japan and the bounceback in Asia have reinforced each other due to regional trading patterns. Table E

(1) This factor still seems important. Export prices fell by 7.7% in the year to December.

<sup>(2)</sup> Indonesia, Malaysia, the Philippines, South Korea and Thailand.(3) Indonesia, Malaysia, South Korea and Thailand. The Philippines is excluded as the Asian financial crisis did not have as severe an impact there as in the other four countries.

#### Table E Bilateral trade intensity index(a) 1998

	Euro area	United States	Japan	North Asia	Crisis 5
Euro area	1.8	0.5	0.4	0.3	0.3
United States	0.6	n.a.	1.8	0.8	1.2
Japan	0.5	1.9	n.a.	1.8	2.5
North Asia (b)	0.4	1.3	2.2	3.1	2.2
Crisis 5 (c)	0.4	1.3	2.6	2.5	1.7

n.a. = not available

Source: IMF.

Index calculated as share of exports going to a country relative to that country's (a)

hore calculated as share of exports going to a country relative to share of world imports. Hong Kong SAR, Peoples' Republic of China and Singapore. Indonesia, Malaysia, the Philippines, South Korea, and Thailand

(c)

#### Chart 29 **Emerging markets industrial production**



Source: Primark Datastream

Malaysia, Singapore, South Korea, Taiwan and Thailand. The Czech Republic, Hungary, Poland and Russia. Argentina, Brazil, Chile, Mexico, Peru and Venezuela.

(b) (c)

#### Chart 30

#### Sovereign bond yield spreads by region



Bulgaria, Croatia, Greece, Hungary, Russia and Turkey. Argentina, Brazil, Chile, Columbia, Ecuador, Mexico, Panama, Peru (h)

Argentina, Brazil, Chile, Columbia, Ecuador, Mexico, ranama, reru and Venezuela. Malaysia, Peoples' Republic of China, the Philippines, South Korea and Thailand. (c)

shows bilateral indices of trade intensity. The index measures the share of exports to one country, relative to that country's share of world imports. The table shows that Japan trades intensively with the United States, North Asia and the Crisis 5, and that North Asian countries trade more intensively with each other than do the euro-area countries. These trade patterns reflect trade specialisation within the Asian region which has promoted intra-industry trade.<sup>(1)</sup> So as output expands in Japan, intermediate goods or components are imported from the Asian region.

Of the major economies in Latin America, only Brazil has experienced a similar depreciation in its real exchange rate to that in the Asian countries. Furthermore, the decline in non-oil commodity prices in 1998 and most of 1999 resulted in an adverse terms of trade shock, limiting competitiveness gains. Argentina, which operates a currency board, has endured a real effective appreciation, partly because of a strong export dependency on Brazil. Mexico has experienced a substantial real appreciation but export growth has remained strong because of close integration with the buoyant US economy.

The differing growth paths in Asia and Latin America are apparent in industrial production data (see Chart 29). While Asia has experienced a 'V'-shaped path, as production fell sharply after the crisis before recovering strongly, Latin American industrial production has followed more of an 'L'-shaped path to date. The decline in output was smaller, and the subsequent increase in output has also been smaller. However, output in Latin America accelerated in Q4, growing by 4.2% in the twelve months to October, and both Argentinian and Brazilian industrial production rose in November relative to a year earlier.

Sovereign bond spreads declined in all emerging market economies (see Chart 30). That reduction reflects some combination of the following developments in emerging market economies: lower levels of outstanding debt overall (although this has almost exclusively occurred in Asia); an absence of further liquidity crises; progress on fiscal and structural reforms; and an improved macroeconomic outlook.

<sup>(1)</sup> See McGiven, A, 'Trade with newly industrialised economies', February 1996 Quarterly Bulletin, pages 69-78.

### Sterling wholesale markets: developments in 1999

- Sterling wholesale markets grew by £800 billion in 1999, though much of this reflected increased market values rather than new issuance.
- Though the size of markets grew, liquidity in a number of core markets fell, reflecting both the retreat of risk capital following the global financial crisis of 1998 H2 and, in the gilt-edged market, reduced government borrowing and hence lower bond supply.
- The approach of the millennium date change also affected markets in 1999 H2, though liquidity and turnover in December turned out higher than many had expected.
- The Bank made two changes to its open market operations in 1999: a major permanent widening in the list of collateral eligible in OMOs; and, from October, the introduction of temporary three-month repos designed to help firms plan their liquidity over the year-end.

#### **Overview**

The total size of sterling markets grew by £800 billion in 1999, as shown in Table A. At the end of 1999, sterling wholesale markets were equivalent in size to six years' UK nominal GDP. The largest amounts outstanding were in the interest rate swap and equity markets. Those markets grew by 16% and 25% respectively in 1999; most of this reflected increased market valuations, however, rather than new issuance. The money and corporate bond markets grew by around 9% and 23% respectively in 1999, while the gilt market contracted.

### Table ASize of sterling markets

Amounts outstanding; £ billions

	Money market	Gilts	Corporate bonds	Equities (a)	Swaps (b)	Total	Multiple of GDP
1990	181	125	60	486	167	1,019	1.8
1995	194	233	117	849	541	1,934	2.7
1998	433	301	203	1,334	2,360	4,631	5.5
1999 Nov.	473	296	249	1,664	2,732	5,414	6.3

(a) Measured as market capitalisation of FTSE All-Share index; 1990 data are estimated.
 (b) Measured as notional principal outstanding; 1990 data are not available, so the table uses 1992 data; November 1999 data are also not available so June 1999 data are used. Figures quoted for 1998 and 1999 are for single-currency interest rate derivatives, which include forward-rate agreements and options in addition to the largest counterpart, swaps.

Though the size of sterling markets increased, the main feature of 1999 was the fall in liquidity. Two key factors lay behind this. First, following the global financial crisis in autumn 1998, risk-taking in nearly all financial markets was cut back, particularly in the first half of 1999. Second, improvements in the UK government's finances led to lower government bond supply. Liquidity was also affected, particularly during the second half of the year, by expectations of higher short-term interest rates in Europe and the United States, and by the fall in trading and risk-taking ahead of the millennium date change.

Reduced liquidity meant that prices were at times quite volatile, and it became more difficult to interpret them and to infer from them market expectations about changes in interest rates or inflation. For example, at the long end of the gilt market, demand for stock was particularly price-inelastic and supply was constrained by the Government's strong fiscal position. The withdrawal of risk capital from financial markets was also one of the factors behind the sharp rise in implied future interest rates in the short sterling futures market.<sup>(1)</sup>

#### **Turnover and liquidity**

Though the amounts outstanding in sterling wholesale markets rose in 1999, turnover and liquidity in a number of core markets fell (see Table B). Turnover of short sterling futures contracts fell by about a fifth to £54 billion (equivalent) a day. The open interest (amount outstanding) of short sterling futures contracts also fell during the course of the year (see Chart 1). Daily turnover in the cash gilt market averaged £5.3 billion during the first three quarters of the year, compared with £6.3 billion in the same period in 1998. Turnover in the long gilt futures market also fell—it averaged around £3.4 billion (equivalent) a day in 1999, compared with £4.9 billion a day in 1998.

Turnover in the gilt repo market, however, did not fall much in 1999: it averaged £13.6 billion a day, compared with £14.6 billion a day in 1998. And though there are no comprehensive turnover data in the unsecured interbank market, the limited evidence available suggests that turnover

(1) The gap between derived market expectations and economists' expectations was analysed in more detail on page 335 of the November 1999 *Quarterly Bulletin*.

#### **Table B** Market turnover: average daily amounts

£ billions

	1997	1998				1999			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Futures (a)									
Short sterling (b)	40.0	61.0	66.0	80.0	60.0	66.0	69.0	49.0	31.0
Long gilt (c)	3.9	4.2	5.1	6.5	3.8	4.2	3.8	2.9	2.6
Gilts									
Conventional	7.0	7.0	6.0	6.0	5.0	6.0	6.0	4.0	n.a.
Index-linked	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.0	n.a.
Money markets									
Gilt repo	14.8	11.4	16.8	14.7	15.5	12.6	13.5	15.8	12.4
Overnight interban	k 6.1	7.7	7.8	7.1	7.4	8.2	8.3	7.8	7.6
n.a. = not available.									

Sources: Bloomberg and London Stock Exchange

Converted to equivalent nominal amounts. Relates to the front 20 contracts traded in the quarter. Relates to the front 2 contracts traded in the quarter.

#### Chart 1





did not fall in 1999. For example, the amount traded through brokers in the sterling overnight interbank market averaged £8 billion a day in 1999, compared with £7.5 billion a day in 1998 (the broked market accounts for around three quarters of total overnight interbank trade). Interbank volumes fell in December, though turnover rose in January 2000 (see Chart 2).

Falling turnover in some markets coincided with reports of reduced liquidity. In some cases this was reflected in a widening of bid-offer spreads; and in some cases it reportedly became more difficult to execute trades without affecting prices adversely. One indicator of reduced liquidity was the increased volatility of prices. The rolling thirty-day standard deviation of daily changes in thirty-year gilt prices rose from around 12% at the start of the year to 17% by the end of the year; by the same measure, the volatility of ten-year gilts rose from around 13% to around 18%.

In the gilt market, the single most important factor behind lower liquidity was the fall in government bond supply

#### Chart 2 Turnover in the overnight interbank market



relative to continued high, and price-insensitive, demand. Growing price-insensitive demand was particularly important at the very long end of the conventional market and in medium and long-maturity index-linked stock (partly because of regulatory and actuarial requirements which encourage institutional holdings of gilts-see below).

Three other factors helped to explain the broader fall in liquidity in sterling markets. First, there was reduced activity by hedge funds and proprietary desks, whose risk appetite fell following the Russian debt moratorium and the LTCM crisis in 1998 H2; this retreat of risk capital was particularly marked during the first half of 1999. A number of banks closed or scaled back their in-house proprietary bond trading units in 1999. Continuing bank mergers may also have had an impact on trading activity. Second, increases in official interest rates in Europe, the United Kingdom and the United States-and expectations of further rises-led to a bearish and cautious mood in money and bond markets. Third, the approach of the millennium date change added to the reluctance to trade actively: once desired year-end positions had been achieved, market players had little inclination to trade.

The introduction of electronic trading for futures contracts on the London International Financial Futures and Options Exchange (LIFFE)—in April for the long gilt future and in September for short sterling—prompted a debate among market practitioners about the likely impact of electronic trading on trading patterns and liquidity. However, there was little change in long gilt futures turnover between Q1 and Q2; and though short sterling turnover fell sharply in Q3, other factors, such as those mentioned above, were also relevant.

The spread of individual bond yields around the fitted yield curve is another indicator of the liquidity of the gilt market. If the gilt market were 'efficient' and without anomalies, then we might expect bond yields to trade very close to the

fitted curve. The extent to which they diverge from the curve (ie become 'cheaper' or 'dearer' relative to the theoretical yield) is a measure of the relative liquidity premia at different maturities. Chart 3 shows the cheap-dear history of five and ten-year benchmark stocks over the past three years. After the Russian debt moratorium in 1998 H2 these stocks became more expensive, as the 'flight to liquidity' caused these yields to fall relative to the fitted yield. More recently the 'liquidity premium' on benchmark stocks has lessened—they have become less 'dear' relative to the curve—but they are still dearer than they were for most of 1997. That suggests that gilt market liquidity has become more concentrated in benchmark stocks.

#### Chart 3 Cheap-dear: benchmark bonds<sup>(a)</sup>



#### **Money markets**

#### Size and growth of money markets

The sterling money market grew by 9% in 1999.<sup>(1)</sup> Total outstandings were £473 billion at the end of November 1999, compared with £433 billion at the end of 1998 (see Table C and Chart 4). Interbank deposits, certificates of deposit (CDs) and gilt repo continued to account for the largest share of the money market (measured by outstandings). Treasury bill issuance was increased for

### Table C Sterling money markets<sup>(a)</sup>

#### Stering money markets.

Amounts outstanding; £ billions

#### Interbank CDs Gilt Treasury Eligible Stock Commercial Sell/buy Total repo (b) bills bills lending (b) backs (b) bills (c) paper 53 9 2 1990 89 n.a. 23 n.a. 5 n.a. 181 93 66 122 20 6 10 $\overline{2}$ 195 433 1995 8 n.a n.a n.a. 1998 150 95 2 1 17 35 1 5 12 3 1999 Nov. 155 135 100 49 13 473

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.

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

#### Chart 4 Sterling money markets: outstanding amounts



money market management purposes and the commercial paper (CP) market expanded. By contrast, the value of eligible bills outstanding fell.

The interbank deposit market grew by 16% a year on average over the period 1995–98, but grew less quickly, by 5%, in 1999. Nevertheless, it continued to account for the largest share of the sterling money market (see Chart 5); it also continued to be the main means of distributing short-dated liquidity in sterling markets. The approach of the millennium date change may have constrained growth in unsecured (and non-tradeable) interbank exposures, though the CD and repo markets did not increase much in H2 either. One possible longer-term factor affecting growth of the interbank (and CD) markets is consolidation and mergers among financial institutions.

The value of CDs outstanding was £135 billion at end-November 1999, £13 billion higher than in December 1998, following rapid growth between 1994 and 1998 (see Chart 4). Two important structural factors have boosted growth in recent years. First, the sterling stock liquidity regime, introduced in 1996, made it attractive for

#### Chart 5 Sterling money markets: outstanding amounts November 1999



Bank and building society certificates of deposit. Includes Treasury, eligible and local authority bills, commercial paper, and sell/buy backs

banks to fund themselves using CDs, because up to 50% of their five-day wholesale liability outflows could be offset in the calculation of required liquidity with holdings of other banks' CDs (subject to a 15% 'haircut'). Second, CDs are used as collateral in stock borrowing, so that, after the advent of the gilt repo market in 1996, CD activity expanded alongside gilt repo (see below).<sup>(1)</sup>

The gilt repo market grew very little in 1999: the amount outstanding at the end of November 1999 was £100 billion, compared with £95 billion a year earlier. The market grew rapidly from its opening in 1996 and, according to some market contacts, has now reached the point at which substantial further growth may require structural innovation, such as the planned introduction next year of a central counterparty to facilitate the balance sheet netting of inter-dealer gilt repo trades, and the introduction of electronic trading.

There was £49 billion of stock lending outstanding at end-November 1999, up from £35 billion a year earlier. Stock lending and repo have a complementary relationship: 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 cash collateral and would therefore require constant monitoring of the short-term money markets. Instead, they prefer to lend stock to intermediaries in return for a flat fee. Those intermediaries then repo the gilts on to banks and securities houses. High demand for gilts in 1999, when new supply was low, may have led to more borrowing from end-investors and hence greater use of stock lending.

The Treasury bill, eligible bill and CP markets are small compared with the interbank, CD and repo markets. Treasury bill issuance was used actively during 1999 to offset large prospective changes in the stock of (short-term) money market refinancing and hence in liquidity conditions. In February, the Bank introduced a one-month tender (to run alongside the regular three-month tender) for the first time since 1997; one-month bills allow more flexibility to affect the outstanding stock of refinancing quickly. On three occasions in November and early December the Bank sold Treasury bills maturing on 30 December; the maturing of the bills reduced what would otherwise have been a large money market shortage on that day.

The amount of CP outstanding also rose during the year, to £13 billion at end-November 1999, up from £10 billion at the end of 1998. The eligible bill market contracted in 1999 to £12 billion at end-November, from £17 billion at end-1998. This fall in issuance may have partly reflected the widening of collateral eligible for use in OMOs during the past three years. Previously, eligible bank bills had been the 'swing' element in OMO assets, so that when the stock of refinancing rose, the eligible bill market would also expand as it became more attractive to draw bills (because bill rates were pushed down relative to other money market rates by the higher demand for bills in the OMOs). Gilt repo now mostly fulfils the role of swing element in the OMOs.

#### **Open market operations**

There were two major changes to the Bank's open market operations (OMOs) in 1999:

- a major, permanent, widening in the range of collateral eligible for OMOs; and
- temporary changes to the Bank's liquidity provision ahead of the millennium date change.

The Bank has widened the amount of collateral eligible in its OMOs in the past few years. Before 1997, eligible bills were the main instruments against which the Bank provided sterling liquidity. From March 1997, the Bank accepted gilts on repo as part of its daily operations.<sup>(2)</sup> And from autumn 1998 to summer 1999, the Bank made three further extensions to the list of collateral eligible in its operations; the last extension resulted in a sixfold increase in the eligible pool to around £2 trillion (see Table D). The box below describes the collateral extension in 1999 in more detail.

One of the objectives of the extension of collateral was to alleviate pressure on the existing pool of collateral. That pressure reflected the fact that such assets were in demand not only for use in OMOs with the Bank (and for intraday

<sup>(1)</sup> The expansion of eligible collateral in 1999 to include euro debt may mean that CD issuance will be driven less by these factors in future.

<sup>(2)</sup> Gilt repo had been used in the Bank's fortnightly 'rough-tuning' facility since January 1994 (the rough-tuning facility was introduced temporarily in 1992).

#### Extension of eligible collateral in OMOs

The Bank has extended the range of collateral eligible in its sterling OMOs in three stages. The process began in autumn 1998, when certain sterling and euro-denominated bulldog bonds were accepted in the Bank's operations. In the second stage, from 28 June 1999, the Bank extended the securities it accepted to include a range of bonds issued by other central governments in the European Economic Area (EEA) and the major international institutions, where they have been issued directly into the Euroclear and Cedel settlement systems. The Bank accepts bonds issued by these bodies denominated in sterling, and denominated in euro where they are eligible for use in ESCB monetary policy operations.

The third, and largest, phase of collateral extension took effect at the end of August 1999. The pool of securities was extended to include securities denominated in euro issued by the central governments and central banks of the countries of the EEA which are eligible for use in ESCB monetary policy operations, where the central bank in the country in which the relevant securities were issued has agreed to act as the Bank's custodian under the Correspondent Central Banking Model (CCBM). (Because of the settlement timings and lags, CCBM securities are only eligible for use in the 9:45 am round of operations or in the 12:15 pm round on the day of an MPC announcement.) This third phase expanded the range of eligible collateral more than sixfold, to more than £2 trillion.

liquidity in the payments system), but also to meet the FSA's sterling stock liquidity requirement. As an indicator of the relative scarcity of this collateral, Table D shows the stock of eligible assets outstanding and the proportion held by the Bank as assets against which sterling liquidity had

### Table D Collateral eligible in open market operations

End-year	£ billions	of which, held at Bank (per cent)
1990	37	
1995	30	11
1996	34	14
1997	320	2
1998	327	3
1999	2,325	1

been provided. The latest extensions of eligible collateral mean that a much smaller proportion of eligible collateral is now 'locked up' at the Bank: the Bank held about 1% of the stock of eligible collateral at the end of 1999, compared with 14% at the end of 1996.<sup>(1)</sup> Extensions to the eligible collateral pool have led to changes in relative yields on previously eligible assets. Eligible bank bill rates and general collateral repo rates have risen relative to yields on money market assets that are not eligible, such as interbank deposits and CDs. Chart 6 shows the narrowing spread between eligible bill and CD rates after August 1999 when the last and largest of the 1999 collateral extensions came into effect, illustrating that the relative 'dearness' of eligible assets fell in the second half of the year (the rise in spread in December 1999 was Y2K-related).<sup>(2)</sup>

#### Chart 6 CD rate minus eligible bill rate<sup>(a)</sup>



The extension of eligible collateral, though not introduced as a specific Y2K measure, helped to reassure the market that there would be adequate eligible collateral in the run-up to the end of the year. Other countries, such as the United States and Japan, extended the range of collateral eligible in their monetary policy operations, though in both these cases the extensions were temporary.

The Bank made one temporary adaptation to its sterling liquidity operations that was principally designed to address Y2K liquidity concerns. From 13 October, the Bank supplemented its regular two-week repo operations with three-month floating interest rate repos spanning the year-end. In December, these three-month repos were replaced with two-month repos. The purpose of these longer-duration repos was to give market participants an additional tool to help plan and manage their liquidity over the year-end. By providing term financing over the year-end, the Bank enabled counterparties to extend term credit without exposing themselves to roll-over risk on shorter-term liabilities. The longer-term repo operations were well-used: by the end of the year, £8 billion of the Bank's refinancing had been provided through them. That helped to reduce the amount of money market refinancing turning over each day. Both on the day that the Bank

(1) The figure of 14% in 1996 excludes refinancing through the fortnightly rough-tuning facility.

<sup>(2)</sup> Low daily money market shortages may have also reduced the premium on eligible assets towards the end of the year.

announced the long-term repo facility, and on its first day of use (when the full £3 billion on offer was taken up), the implied interest rate on the December 1999 short sterling futures contract fell (by 9 and 7 basis points respectively). This indicated that the term repos increased market confidence about liquidity provision in the final months of the year and helped to reduce pressure on term funding rates. In the event, the transition to the new millennium was smooth: markets functioned in an orderly way, with more turnover and liquidity than some participants had expected (see the box on pages 18–19 of the 'Markets and operations' article).

Chart 7 shows the share of the stock of refinancing held at the Bank accounted for by different instruments over the past few years. Euro-denominated assets accounted for an increasing share after 31 August, as some counterparties substituted them for gilts on repo, though the biggest change followed the introduction of the long-term repo facility: from mid-October the share of the stock of refinancing accounted for by euro-denominated assets rose quickly to around 40% at the end of December.



#### Gilt repo market

There was little growth in the gilt repo market in 1999, according to the Bank's quarterly survey of the main market participants. After the global financial market turmoil of 1998 H2, there was less appetite for risk by the main players, and those that had used repo in leveraged trades in 1998 were less active in 1999. The millennium date change may also have dampened activity towards the end of the year. However the prospective introduction of netting and electronic trading systems in 2000 may boost repo activity (after netting was introduced in the United States, the repo market grew rapidly).

Chart 8 shows repo market activity broken down between banks and other counterparties (such as securities firms and specialised repo brokers). The banks have the largest share of the market but, since the middle of 1997, the non-bank sector has been largely responsible for the growth of the market. The activity of the non-bank sector is also more variable: securities houses, for example, are more sensitive to balance sheet measures used by rating agencies, and scale back their repo activity at certain times of the year more than banks do. They are also more active in using repo to take views on interest rates, whereas the banks' interest rate views may be expressed also through the CD or interbank markets. The FSA's sterling stock liquidity regime, and banks' own internal liquidity guidelines, also give retail banks an incentive to hold gilts, outright and on reverse repo, on a longer-term basis than securities houses.

#### Chart 8 Banas by banks and atl



Specials activity over the year was concentrated on two bonds.<sup>(1)</sup> First, 6% Treasury 2028 was consistently special because it remained in heavy demand in the cash gilt market (see capital markets section). Second, 9% Treasury 2008 was in demand for delivery into the long gilt futures contract because of its status as the cheapest-to-deliver (CTD) by a large margin over other bonds. So in all term trades to the date of contract expiry it showed special rates varying from twenty to several hundred basis points below general collateral (GC) levels. However, this bond dropped out of the delivery basket for the March 2000 futures contract, with 5<sup>3</sup>/<sub>4</sub>% Treasury 2009 becoming the CTD. The latter bond is therefore expected to be actively traded in the specials market this year, though the difference in cheapness to deliver between it and the next CTD is smaller than had been the case with 9% Treasury 2008.

(1) Using gilts in the repo market where the gilts received are not specified is known as 'general collateral' (GC) repo. When a stock is difficult to obtain, its repo rate will fall below the prevailing GC rate. If it is more than 5–10 basis points below GC it is said to be trading 'special'.

Over the summer, the repo rates for a number of shorter-dated bonds maturing in 2000–02 also dropped below GC rates. These are gilts that are held as assets by money market participants and are frequently used by them in the Bank's daily OMOs; they were therefore expected to acquire value over the millennium date change due to the expected large money market shortages at the time, and because they represented a means of ready access to cash in the event of unexpected need. In fact, after the widening of collateral eligible for the Bank's OMOs towards the end of the summer, these bonds lost their special status.

Chart 9 shows the spread between interbank and GC repo rates at the one-month maturity since March 1997. The unsecured rate remained above the repo rate for nearly all of this period, with the gap mostly ranging between 10 and 30 basis points. However, the gap widened sharply at the end of 1998, following the financial turbulence of autumn 1998 and the uncertainties about placing unsecured money over the changeover to the single European currency. The spread fell from September 1999, due partly to the expansion of eligible collateral; it widened in December 1999 ahead of the century date change; but then fell in the new year.





The maturity of gilt repo trades outstanding, shown in Chart 10, varies by type of participant; those that are very active in OMOs, are constrained by capital usage, or use repo mainly to fund other assets, tend to operate at the short end of the curve. Participants who use matched-book repo positions to take views on the path of future interest rates find a niche in the longer maturities. As the chart shows, the share of repo trades at one to three months rose at the end of 1999. That was the counterpart to the rise in reverse repo activity as firms reversed in gilts over the year-end.

The reduction in risk appetite in the gilt repo market was reflected in a rise in the concentration of the market. The

#### Chart 10 Maturity of trades outstanding in the gilt repo market



share of the largest five counterparties (measured by amounts outstanding) rose from 41% to nearly 50% in 1999, suggesting that firms that did not have a core repo business scaled down their operations after the experiences of 1998 H2.

#### **Capital markets**

#### Size and growth of capital markets

Table E shows the overall size of sterling debt and equity markets. By the end of 1999 the market capitalisation of the FTSE All-Share index was about three times that of the sterling bond market. The sterling debt market expanded in 1999, with a rise in net corporate issuance more than offsetting a fall in the amount of gilt-edged securities outstanding. The sharp improvement in public finances (described below) reduced the need to raise funds in the gilt market.

#### Gilt-edged market

The gilt financing requirement for 1998/99 was initially estimated by HM Treasury at £14.2 billion; the final outturn was £4.1 billion. Consequently, with gilt sales for the year of £8.2 billion, an overfinancing of £4.1 billion was carried forward to 1999/2000. The estimated requirement for 1999/2000 has also been revised down (see Table F). A total of £17.3 billion of gilt sales were originally planned in March 1999; however, the estimate was reduced to 14.2 billion in the November Pre-Budget Report. This triggered the cancellation of the short-maturity auction scheduled for March. With total gilt redemptions of £14.9 billion and planned sales of £14.2 billion, there is likely to be a net debt repayment in 1999/2000.

This fall in gilt supply coincided with strong and price-insensitive institutional demand for gilts (see below). As a result, gilt yields were depressed at ultra-long maturities and, with short gilt yields rising in anticipation of

#### **Table E** Sterling capital markets

#### Amounts outstanding and issued; £ billions

	Amounts outstanding					Gross issuance		
	Gilts (a)	Corporates (b)	of which, on issue programme	Total	FTSE All-Share (c)	Gilts	Corporates (d)	
)	125	60	0	185	486	3	12	
5	233	117	14	350	849	31	13	
3	301	203	61	504	1334	8	47	
Ð	296	249	85	545	1664	11	57	

Note: Corporate outstandings are compiled from a different data source from that of gross issues, and so may not give directly comparable figures

Nominal value at end-March, except where stated 1999 data are end-November for outstandings and end-September for issuance (b) ey have been calculated ignoring call and put options;

Pre-Budget

Nominal value at end-whatch, except where stated. 1999 data are end-November to outstainings and end-september to its statuce. These figures include both domestic and international issuance and give the nominal value at period-end. They have been calculated i had these been exercised, total outstandings would typically have a value of around 85% of the figure quoted. Market capitalisation of FTSE All-Share index at period-end; 1990 data are estimated; November 1999 uses 14 December 1999 data. Non-government international bond issue in sterling. (c) (d)

Revision

#### **Table F**

£ billions

#### Gilt financing requirement 1999/2000

-		

		(20/4)	Report
CGNCR forecast	6.2	6.2	1.1
Finance for forex reserves	2.4	2.3	2.3
Gilt redemptions	14.8	14.9	14.9
Gilt sales residual 1998/99	-2.3	-4.1	-4.1
Financing requirement; minus	21.0	19.3	14.2
Sales by National Savings	0.1	0.1	-0.9
Net increase in Treasury bills	3.6	1.9	0.8
Gross gilt sales required	17.3	17.3	14.2
Source: Debt Management Office.			

Remit

higher official interest rates in 2000/01, the yield curve became increasingly inverted (see Chart 11). Market conditions also became less liquid. Strong price-insensitive institutional demand for index-linked bonds also put downward pressure on index-linked yields.





#### Institutional behaviour

Net investment in gilts by institutions (pension funds, insurance companies and trusts) was around £6 billion in the first three quarters of 1999, and continued the recent trend (broken in 1998 Q3 only) of exceeding net gilt issuance (see Chart 12). Institutions' share of the gilt stock therefore increased during the course of 1999. In H1, increased

#### Chart 12 Gilts: net institutional investment and net official sales



institutional investment coincided with a net fall in gilt holdings by the rest of the M4 private sector and by banks. In Q3, the increase coincided with a large fall in gilt holdings overseas.

The largest component of the net increase in institutional gilt investment has been by pension funds. As they mature, pension funds naturally increase their bond holdings to meet pension-in-payment liabilities. In addition, the operation of the Minimum Funding Requirement (MFR) may have reinforced the tendency for funds to switch towards bonds, and gilts in particular. This is because the MFR requires a comparison of current asset values with pension liabilities; in the comparison, future liabilities relating to pensions either already in or approaching payment are discounted by index-linked or conventional gilt yields, depending on the nature of the liability. Matching liabilities with gilts therefore reduces the risk of funds falling short of the MFR, regardless of the level of gilt yields.

Furthermore, if gilt yields fall, future liabilities are discounted at a lower rate. If equities are held to match such liabilities, a scheme may suffer a reduction in the MFR funding position if equity and gilt performance deviate. In this situation, in order to hedge against the risk of not meeting the MFR, funds may seek to increase the gilt component of their assets. So falling gilt yields may encourage pension funds to invest in gilts, adding further downward pressure on yields.

The next largest component of the net increase in institutional investment has been by life insurance companies. Their investment has been related to efforts to hedge against minimum annuity rate guarantees which they issued to policy-holders some years ago at levels well above current market annuity rates. A fall in bond yields can threaten regulatory solvency, because the duration of companies' liabilities is often longer than that of their assets. So a fall in gilt yields can increase companies' asset/liability mismatches and consequently reduce reserves, which are required to meet resilience tests. Insurance companies may respond by buying gilts to hedge risks, which can reinforce the downward pressure on gilt yields.

Long-dated 'swaptions' also affected market dynamics in 1999. These are options to enter into a long-maturity forward swap, receiving fixed income and paying floating, at expiry of the option. One example of such an option would be the right to receive fixed interest, and pay floating-rate interest, for 15 years beginning in 15 years' time. Some insurance companies with guaranteed annuity rate liabilities have hedged their long fixed-rate liabilities by buying long swaptions. Firms that have sold these swaptions become increasingly exposed as gilt yields fall, and have hedged their positions by buying gilts or contracting to receive fixed interest in swaps (and those paying fixed in swaps may in turn need to hedge themselves by buying gilts). Such dynamics may have reinforced the gilt market rally in late October/early November.<sup>(1)</sup>

#### Non-government sterling bonds

The size of the non-gilt sterling debt capital market grew further in 1999 (see Table E). By the end of November 1999, the amount outstanding in these securities was nearly £250 billion, more than 20% higher than a year earlier.<sup>(2)</sup> Gross non-gilt issuance denominated in sterling increased sharply during 1999 to £57 billion, up from £47 billion in 1998, and more than four times the amount of gross gilt supply in 1999. Issuance was strong during the first half of the year, as borrowers were keen to revive their funding programmes following the disturbances to markets in the second half of 1998. Some borrowers were also keen to raise capital well before the end of 1999 because of concerns that investors might be reluctant to lend in the run-up to the millennium date change. Much of the non-government sterling issuance was targeted at UK fund managers seeking to invest in sterling fixed-income securities while maintaining investment returns. UK corporate issuers were able to raise long-term finance at historically low interest rates, and lower-rated companies (even sub-investment grade) gained greater access to capital markets. Strong and price-insensitive demand for long gilts put downward pressure on long swap rates, though there was some widening of swap spreads. This gave AAA-rated borrowers the opportunity to raise cheaper floating-rate finance by issuing fixed-rate sterling bonds and swapping the cash flows into floating-rate sterling, dollar or euro liabilities. The demand for sterling fixed and floating-rate paper also facilitated the growth of securitisation as a corporate finance medium. Long-standing structures used to repackage financial products (mortgages, consumer loans and credit card receivables) into tradeable bonds have been adapted to allow capital to be raised against future income streams from a variety of other assets (ranging from nursing home properties to public houses). This has facilitated the refinancing of corporate takeovers, as well as capital development projects, including those under the government's Private Finance Initiative.

Sterling debt issue programmes (a subset of the non-government issuance described in the previous two paragraphs) have proved to be an increasingly attractive fund-raising channel in recent years: the amount outstanding doubled to £85 billion between the beginning of 1998 and the end of November 1999. Once the necessary documentation and administration is in place, borrowers find debt issue programmes a cost-effective, convenient and flexible way to access capital markets. Under the programme scheme, debt can be issued at any maturity over a year.<sup>(3)</sup> Supranationals and (overseas) government-backed agencies have been among the largest issuers, with much of the issuance driven by swap arbitrage opportunities, where proceeds are swapped back into 'home' currency (in which most of a borrower's liabilities are held). For borrowers with high credit ratings (typically AAA), the most attractive opportunities have generally occurred at very long maturities; the issues have met with high demand by UK pension funds and insurance companies seeking products that are a near-substitute for gilts.

However, while there has been strong demand for non-government bonds, the fact that corporate bonds are not perfect substitutes for gilts limits the 'crowding in' caused by low gilt issuance. Fund managers may not wish to accept the higher credit risk, while regulatory or actuarial and trustee limits may discourage or prevent greater investment in corporate bonds instead of gilts. Fund managers may also fear underperforming their benchmark if continued strong

<sup>(1)</sup> See the 'Markets and operations' article on pages 5–22 for a discussion of gilt market developments in 1999 Q4.

<sup>(2)</sup> This represents non-government UK and international bond issue in sterling, according to Capitaldata Bondware. This figure includes bonds with call or put options and assumes that none of the options is exercised; if all of the options had been exercised, then the amount outstanding would have been £210 billion.

<sup>(3)</sup> This sector has developed from the medium-term note (MTN) market, since the five-year maximum maturity restriction was removed in April 1997.

demand for gilts causes a widening of corporate bond spreads.

#### **Derivative markets**

#### Size and growth of the interest rate swap market

During the 1990s, derivative instruments, including interest rate swaps, have assumed a growing importance in over-the-counter (OTC) trading and in transforming and managing risk. The term 'derivative' covers a range of financial products, including forward-rate agreements, options and swaps. According to data collected by the Bank for International Settlements (BIS), swaps accounted for nearly three quarters of the total notional amounts outstanding in sterling interest rate derivatives at the end of June 1998.<sup>(1)</sup> Here we use two indicators of activity in the sterling single-currency swap market. Data from the BIS mostly record notional values, which can give a good indication of the amount of underlying business being traded and the potential for future gains or losses. By contrast, Bank of England data, which are more up-to-date, record marked-to-market values of UK banks' derivative positions.

Data from both sources suggest that the rapid growth of the sterling interest rate swap market during the mid-1990s may have started to slow in 1999. At the end of June 1999, the BIS estimated that the notional amount outstanding on sterling interest rate derivative contracts was £2.7 trillion (see Table G). That was 16% higher than a year earlier, compared with annual growth rates of 30%-60% between 1993 and 1996. Though much of the activity generated by leveraged players in the swaps market was wound down in 1999, the hedging of new bond issues, mortgage books and

#### **Table G**

#### Sterling single-currency interest rate swaps<sup>(a)</sup>

£ billions

Year (b)	Amount outstanding (c)	New swaps (d)	
1992	167	n.a.	
1993	291	175	
1995	541	275	
1998	2,360	78	
1999	2,732	64	

n.a. = not available

Source: BIS

Figures quoted for 1998 and 1999 are for single-currency interest rate derivatives, which include forward-rate agreements and options in addition to the largest counterpart, swaps. The BIS quoted these figures in US dollars; they have been converted to pounds (a) using year average exchange rates. Year-end values are used for 1992–98, and the end-June value for 1999

This is expressed in terms of the notional principal outstanding, and has been adjusted by the BIS for double-counting for 1998–99. This is expressed in terms of the notional principal outstanding for 1992–97, and the BIS definition of gross market value for 1998 and 1999. (d)

guaranteed annuities still generated a significant amount of business. The gross market value of sterling interest rate derivatives fell by nearly 20% in 1999 H1 to £64 billion.<sup>(2)</sup> This fall followed a sharp rise in gross market values at the end of 1998, probably reflecting a rise in activity to neutralise the effect of the changes in stock and bond markets on existing positions following the Russian and LTCM crises.

Bank of England data show a fall in swap market activity in 1999. By the end of 1999 Q3, the marked-to-market value of sterling single-currency interest rate swaps fell to £38 billion, from £52 billion in 1998 Q4 (see Table H). The fall in marked-to-market positions during 1999 reflected both a fall in swap market activity and price changes in the underlying markets. Typically, yield curve movements have been the dominant influence on the value of marked-to-market positions, though in 1999 Q3 contacts cited subdued business activity as the main explanation of the fall in the value of positions. (At the aggregate level, the link between changes in the yield curve and swap market values is not straightforward, partly because it depends on the precise shape of the curve at the time of trading, and the exact maturity of the swaps undertaken. $^{(3)}$ )

#### **Table H** Sterling single-currency interest rate swap positions<sup>(a)</sup>

	Assets	Liabilities	Net
1998 June	35	38	-3
Sept.	40	39	1
Dec.	52	55	-3
1999 Mar.	55	57	-2
June	45	45	0
Sept.	38	39	-1

(a) Banks; at market values

#### Introduction of LIFFE CONNECT<sup>TM</sup> during 1999 for trading financial futures contracts

In 1999 there was a major shift toward screen-based trading on LIFFE affecting the key short sterling and long gilt futures contracts. LIFFE CONNECT<sup>TM</sup>, LIFFE's proprietary order-matching system, was implemented on 30 November 1998 for individual equity options contracts and was rolled out during 1999 for financial futures contracts. Screen-based trading of bond futures, equity index futures and the euroyen and LIFFE euribor financed bond (EFB) futures was introduced in April and May; and money market futures were included during August and September. The exchange intends that all financial contracts

(1) See the BIS triennial central bank survey of foreign exchange and derivative market activity published in May 1999

- (2) Gross market value is defined as the sum (in absolute terms) of the positive market value of all reporters' contracts and the negative market value of their contracts with non-reporters (as a proxy for the positive market value of non-reporters' positions). It measures the replacement cost of all outstanding contracts, had they been settled on 30 June 1999
- (3) Changes in the gross marked-to-market value of derivative contracts will be influenced by three main factors: Revaluations due to changes in the underlying instruments; when derivatives contracts are traded (i) their marked-to-market value will typically be zero.
  - (ii) Transactions in financial derivatives; because the marked-to-market value of a derivative is equal to the net present value of future payment streams, whenever a payment is made the marked-to-market valuation will be affected.
  - (iii) Changes in the number of contracts held; the more contracts that are traded, the higher will be gross marked-to-market positions.

#### Merger of CGO and CMO with CREST

A consensus of market participants endorsed the recommendations set out in the Securities Settlement Priorities Review for the merger of the gilts, money markets and equity settlement systems within a single system. This was seen as essential to the establishment of the most efficient and effective securities settlement system, and to helping to consolidate London's position as one of the world's key financial centres.

#### **Central Moneymarkets Office (CMO)**

Responsibility for the operation of the CMO service was transferred to CRESTCo on 20 September 1999, although the depository function—required because money market instruments are in bearer paper form continues to be operated by the Bank on behalf of CRESTCo. At the end of September the CMO database was transferred to the CRESTCo site.

#### **Central Gilts Office (CGO)**

Much progress has been made in preparing for the transfer of gilts settlement to CREST. The first phase in this process—the transfer of ownership and responsibility for the existing CGO service—took effect on 24 May 1999. The Bank will, however, continue to operate and support the CGO service on behalf of CRESTCo until the completion of phase 3—the migration of gilts settlement activity to CREST scheduled to take place on 1–2 July 2000.

In preparation for the implementation of phase 3, CRESTCo is undertaking comprehensive liaison to encourage members of both CREST and CGO to start the planning and preparations of their systems. This work has enabled CREST to address the small number of operational and technical differences between the CRESTCo and CGO services and to highlight the preparations that members of both CREST and CGO will need to make before migration can take effect. For

will be transacted entirely electronically by the end of the first half of 2000.

The introduction of LIFFE *CONNECT*<sup>TM</sup> sparked a debate among LIFFE's members over whether money market futures were suited to screen trading; none of the global benchmark short-term interest rate (STIR) futures contracts had yet transferred to electronic trading. Some questioned whether any electronic system could be sufficiently sophisticated to replicate the complexities of floor trading; or indeed whether even 'vanilla' STIR products would migrate easily to screen, given the possible absence of liquidity provided by the locals.

LIFFE responded to such concerns in two ways. First, it introduced enhancements to enable LIFFE *CONNECT*<sup>TM</sup> to

example, members will need to ensure that account structures in the two systems are identical and may also need to change their back-office systems to interface with CREST. There will be a period of trialling in the spring followed by two 'dress rehearsals' in June before the transfer of the gilts database to CRESTCo.

Legislative changes are also needed to facilitate the merger. Holdings and transfers of gilts in CGO are currently governed by the Stock Transfer Act 1982. Legislative changes will be needed to bring gilts under the Uncertificated Securities Regulations 1995 (USRs), made under Section 207 of the Companies Act 1989, which govern the holding and transfer of securities in CREST. These changes are currently being taken forward with HM Treasury and are expected to be put in place during the second quarter of 2000. The Treasury is also consulting on changes to the USRs, to include electronic transfer of title, to eliminate the short lag between settlement and registration.

#### **Future developments**

Once gilts have migrated to CREST, a number of further developments are planned. Work on the introduction of full delivery versus payment-the settlement of CREST transactions in real time against payment in central bank funds—is now under way. This is a joint development between the Bank and CREST for introduction before end-2001. The Bank issued a consultation document, The future of money market instruments, in November. The response indicated unanimous support for their dematerialisation and settlement in CREST. The next stage is to begin preparatory work, involving market participants, and to consider with HM Treasury the necessary secondary legislation. Integration into CREST would create a single unified securities settlement system in the United Kingdom. CRESTCo is also pursuing a series of other initiatives, including cross-border links with other European securities depositories.

accommodate a broad range of strategy trades, for example implied pricing and a trade-matching algorithm for STIR futures based on the pro-rata sharing of business. Second, in contrast to the transfer of bond and equity products to screen, where the floor was closed when LIFFE *CONNECT*<sup>TM</sup> was introduced, it operated parallel screen and pit trading for a period, to allow the market to determine its preferred method of trading. The euroSwiss contract migrated wholly to the screen within days. Short sterling and euribor contracts were slower to migrate; by 25 October, some two months after parallel trading began, LIFFE CONNECT<sup>TM</sup> accounted for a third of total short sterling volumes and around 60% of euribor volumes. On 25 October, LIFFE announced that, from 22 November, all of its STIR contracts would trade exclusively on LIFFE CONNECT<sup>TM</sup>. Following the

announcement, the remaining pit volume migrated quickly to screen.

The effect of the introduction of LIFFE *CONNECT*<sup>TM</sup> on trading volumes and patterns is difficult to identify. Though turnover in both short sterling and euribor contracts fell in the second half of 1999, it had begun to fall before the introduction of electronic trading, with other factors (reported in the section on turnover and liquidity) contributing to the decline. The system's impact on trading patterns and spreads, particularly in less liquid contracts, is not yet clear, though there is some evidence that more trades are now negotiated bilaterally or 'crossed internally' and subsequently executed on-screen. LIFFE has adapted its crossing rules to reflect the dynamics of

trading on LIFFE *CONNECT*<sup>TM</sup>, and introduced a block trading facility earlier in the year to support the evolving needs of its wholesale customers. By the end of 1999, LIFFE *CONNECT*<sup>TM</sup> had helped to cement LIFFE's dominance in euribor futures trading, and the Exchange's market share of euro-dominated STIR futures and options remains above 90%.

In August, LIFFE and the Chicago Mercantile Exchange (CME) announced a strategic partnership. The partnership, planned for early 2000, will have three key elements: cross-exchange electronic access; cross-clearing margin offsets for CME eurodollar and LIFFE euribor contracts; and the establishment of a 'for-profit' joint venture to develop new products and services.

# **Recent developments in extracting information from options markets**

By Roger Clews, Nikolaos Panigirtzoglou and James Proudman of the Bank's Monetary Instruments and Markets Division.

The Monetary Policy Committee is provided with information from options markets to quantify market uncertainty about the future course of financial asset prices. For short-term interest rates, this is shown in the Inflation Report's blue fan chart. Similar information can be obtained from a wide range of other assets. This article compares the performance of alternative techniques for extracting information from options prices. Using a technique for estimating uncertainty about interest rates at a constant horizon a short way into the future, we consider how this uncertainty has evolved since the Bank was granted operational independence in May 1997.

#### Introduction

Virtually all financial assets pay out in the future. So the prices at which different assets trade can tell us something about the market's view of future states of the world. For example, the prices of bonds of different maturities contain information about the expected course of interest rates between maturity dates (see, for example, Anderson and Sleath (1999)).

Options are contracts giving the right (but not the obligation) to buy or sell an asset at a point in the future at a price set now (the strike price).<sup>(1)</sup> Options to buy (call options)<sup>(2)</sup> are only valuable if there is a chance that when the option comes to be exercised the underlying asset will be worth more than the strike price. So if we look at options to buy a particular asset at a particular point in the future but at different strike prices, the prices at which such contracts trade now tell us something about the market's view of the chances that the price of the underlying asset will be above the various strike prices. So options tell us something about the probability the market attaches to an asset being within a range of possible prices at some future date.

Over the last few years, there has been considerable interest among academics, market participants and policy-makers in extracting information of this kind from options prices. The techniques used are described more fully below, but a common way of displaying the information extracted is as an implied risk-neutral probability density function (pdf) for the asset upon which the contract trades.

Chart 1 shows a pdf derived from contracts based on a short-term interest rate (three-month Libor). Possible levels of the interest rate are measured horizontally; probability is measured vertically. The area under the curve sums to 100%. The shaded area for example depicts the probability



<sup>(2)</sup> Options to sell are put options.

#### Chart 1 March 2000 short sterling implied pdf; 5 January 2000



that the interest rate will lie between 5.75% and 6.25%. The area is 24% of the area under the curve; thus there is estimated to be a 24% probability that the interest rate will lie in that range when the contract settles.

The Monetary Policy Committee is provided with information from options prices to assess the degree of market uncertainty. For example, pdfs have proved useful in estimating the market's assessment of the balance of risks associated with future movements in asset prices. Market uncertainty about UK short-term interest rates is shown in the *Inflation Report's* blue fan chart. Chart 2 shows a fan chart using data as at 5 January 2000. This is built up from the risk-neutral pdfs of three-month sterling interest rates, derived from the prices of options on each of the short sterling futures contracts settling at three-month intervals up to December 2000.

The fan chart is rather like a contour map, looking down on the pdf 'hills'. At any given point in time, the depth of the

#### Chart 2 Implied distribution for sterling three-month interest rates



shading represents the height of the pdf implied by the markets over the range of potential outcomes for short-term interest rates. Assuming risk-neutrality, the markets judge that there is a 10% chance of interest rates being within the darkest, central band at any date. Each successive pair of bands covers a further 10% of the probability distribution until 90% of the distribution is covered.

The Bank also estimates pdfs from options for a range of other financial assets. Pdfs for FTSE 100 index options and euribor futures options are estimated from contracts traded on the London International Financial Futures and Options Exchange (LIFFE). A range of pdfs—such as for the S&P 500 index, the Nikkei 225 index, eurodollar and euroyen futures options—is derived from options traded on the Chicago Metal Exchange.<sup>(1)</sup> Pdfs can also be estimated for physical commodities. For example, pdfs for crude oil and gold prices can be extracted from futures options traded on the New York Mercantile Exchange.

In recent years, the pdfs used at the Bank have been estimated using a parametric technique, the mixture of two lognormals, described in Bahra (1996 and 1997). In the following sections of this article, we review recent research carried out in the Bank to evaluate the performance of this technique.<sup>(2)</sup> First, we discuss the quality of the data used to estimate pdfs. Next, we evaluate the parametric technique against a new non-parametric method, the 'smile interpolation', discussed in Bliss and Panigirtzoglou (2000) and Cooper (2000).

Exchange-traded options (for which data are most readily available) settle on particular days in the year. This means that the maturity of a pdf from such a contract gradually gets shorter as time passes. The pdf that we estimate today is not quite comparable with the one we estimated from the same contract yesterday and is much less comparable with the one we estimated a month or a year ago. So in the latter sections of the article we show how the new technique can be used to construct a pdf with a constant-maturity horizon. This can help us to answer a range of questions of interest to policy-makers, such as whether the degree of market uncertainty about short-term interest rates has altered since the Bank was granted operational independence in May 1997.

#### **Extracting information from options prices**

As noted above, options prices can provide us with a guide to the likelihood the market attaches to future values of asset prices. By comparing options with different strike prices, it is possible to infer the probabilities that the market attaches to different levels of the underlying asset price.

Breedon and Litzenberger (1978) derived the result that the probabilities attached to different levels of the underlying asset price may be derived from options prices, if one assumes that investors are risk-neutral. To see intuitively why we would expect the prices of options to reflect these probabilities, suppose that we observe a set of call option prices with the same maturity but with different strike prices. A call option with a lower strike price will always be worth more than a higher strike option. This is because the option with the lower strike price will have a higher pay-off if exercised and has a higher probability of delivering a positive pay-off. This additional probability reflects the chances that the underlying asset price will lie between these strikes. If we have option prices for a range of strikes, it is possible to infer what the probabilities are of the underlying asset price at maturity lying between each of them, by examining the relative prices of options with adjacent strikes.

Under the assumption of risk-neutrality, the distribution is the set of probabilities that investors would attach to future asset prices in a world in which they were risk-neutral. But if investors are risk-averse, risk premia will drive a wedge between the probabilities inferred from options and the true probabilities they attach to alternative values of the underlying asset price. The mean of the risk-neutral pdf, for example, will not equal the expected price of the underlying asset at maturity.

This potential bias may affect the way in which we interpret estimated pdfs, especially those based on equity index futures options.

#### Sources of options data

The accuracy of the pdfs that we estimate depends crucially on the quality of the options prices used as the inputs into the estimation process. One source of estimate instability may be that the end-of-day settlement prices we obtain from

<sup>(1)</sup> These options are American options, which can be exercised at any time before maturity. We adjust for the early exercise premium using the Barone-Adesi and Whaley (1987) approximation.

 <sup>(2)</sup> This article summarises work done in the Bank over the last year, and draws on the contributions of Robert Bliss, Neil Cooper and Gary Xu.

the exchanges, such as LIFFE, may not reflect true market prices across all strike prices.

One reason for this may be low trading activity. To examine this, we analysed the trading patterns of two options contracts—the FTSE 100 index and the short sterling futures options contracts for the period 1990–97. Our main findings were as follows.

- The markets for these contracts were not very liquid. The average daily number of trades for FTSE 100 index options was only 155, for all calls and puts across all strike prices and maturities. The comparable number for short sterling was 80. But there were periods when liquidity was consistently higher than average. For example, the trading volume of short sterling futures options was much higher during the second half of 1998 when, arguably, uncertainty about future short-term interest rates was relatively high.
- Trading was heavily concentrated in options whose strike price was close to the current futures price (near-the-money) or in call (or put) options whose strike price was above (or below) the futures price (out-of-the-money). We illustrate this in Chart 3. The chart shows the number of options contracts on the March 2000 short sterling futures traded at different strike prices on 5 January. It is typical of trading patterns in these contracts. The short sterling futures contract settles at a price equal to 100 minus three-month Libor on the last trading day for the contract. So a higher interest rate means a lower price for the short sterling futures contract. The red central line in the chart denotes the interest rate implied by the current futures price; options contracts with a strike price at this level would be at-the-money (atm). The chart shows that some call option contracts traded with strike prices close to this (near-the-money), but most traded at higher strike prices, ie at an implied interest rate below the current level (out-of-the-money). Some put options also

#### Chart 3

#### March 2000 short sterling; 5 January 2000



traded near-the-money but again most traded out-of-the-money, ie at an implied interest rate above the current level. Note that no contracts were traded very far away from the current price of the underlying asset; ie no contracts traded on strike prices in the tails of the estimated distribution.

- Trading was concentrated in the options contract closest to maturity. For options contracts in which there had been no trading during the day, settlement prices were assigned by LIFFE using a pricing model. The absence of traded prices was a problem, particularly for in-the-money and deep out-of-the-money options and options with a long time to maturity.
- The range of strike prices for which trading was observed was greater for FTSE 100 than short sterling contracts. For example, the median number of strike prices in which trading was observed was 16 for FTSE 100 index options with a time to maturity of around one month, compared with 5 for short sterling options.

These results suggest that some of the options prices we obtain from the financial futures exchanges may be distorted by factors associated with low liquidity. To reduce these distortions, the pdfs we discuss below were estimated using only the near-the-money and out-of-the-money call and put options prices, which are generally traded in more liquid markets.

#### Alternative techniques for estimating pdfs

As discussed above, the value of a call (or put) option depends on the probability of the asset price lying above (or below) the strike price and the value of the pay-off at the expiry of the option. More formally, the call price function relates the price of a call option to its underlying parameters, such as maturity, the strike price of the option and the pdf of the underlying asset price at the expiry of the option.

Many different econometric techniques have been developed to derive pdfs from a range of call options prices of the same maturity. Some of these techniques involve specifying the parameters of a statistical process for the underlying asset price. The parameters of the process can be used to generate a pdf for the underlying asset at the maturity of the option. This in turn can be used to generate a call price function. The parameters of the stochastic process can then be chosen to make the implied call price function as similar as possible to that observed in the data (see, for example, Malz (1995) and Bates (1996)).

Another technique for estimating pdfs is to assume a specific parametric form for the pdf. The parameters of the pdf are estimated in such a way that the implied call price function is again as close as possible to the one actually observed in the data. The mixture of two lognormals is an example (see Melick and Thomas (1997)).

This form is sufficiently flexible to capture features that we might expect to find in the data, such as fatness in the tails of the distribution (excess kurtosis), positive or negative skewness, or bimodality. And the mixture of two lognormals method is parsimonious, in the sense that it can be derived by estimating only five parameters. This parametric approach has been used in recent years at the Bank of England to estimate pdfs, as described in Bahra (1996 and 1997). We describe the technique in more detail in the technical appendix on pages 58–59.

But the parametric approach has, in practice, proved to have some undesirable properties. One is that it can generate pdfs characterised by sharp spikes. This occurs when one of the two lognormals is estimated to have a very small standard deviation, as illustrated in Chart 4. A pdf estimated using an alternative technique—the smile interpolation (see below)—is included for comparison. Another problem is that the parametric method can generate implausibly large changes in the shape of the pdf between consecutive days. This is true particularly for measures of the skewness and kurtosis of the distribution. These problems led us to conclude that the parametric method does not always fit the data well and to consider whether more robust estimation methods exist.

#### Chart 4 March 2000 short sterling implied pdf; 25 January 1999



An alternative technique—such as the smile interpolation would be to estimate a smooth and continuous call price function directly, by interpolating across the call prices we observe for different strike prices. We could then exploit the Breedon and Litzenberger (1978) result that we can infer underlying probabilities directly from the call price function. However, the call price function has a large curvature for options near-the-money and very little curvature for options far away-from-the-money. This can make direct interpolation across the call price function difficult. To avoid this practical problem, we transform the call price function into a particular form of 'volatility smile', estimate a smooth smile, convert it back into a call price function and use that to derive the pdf.

To convert a call price function into the relevant volatility smile (and vice versa) involves transforming both axes in a non-linear way. We convert option prices into implied volatilities. The implied volatility is the volatility of the underlying asset price implied by the Black-Scholes (1973) model and is a non-linear transformation of the option price. A conventional volatility smile plots implied volatility against the strike price, but such smiles can vary in smoothness from day to day, making consistent interpolation problematic. We choose to interpolate implied volatilities across deltas rather than strikes, as illustrated in Chart 5. The delta of an option is the rate of change of the option price with respect to the underlying asset price and is a non-linear transformation of the strike price. These 'delta smiles' have a more stable degree of smoothness from day to day.

#### Chart 5

### Implied volatility smile of the September 1999 short sterling contract; 27 January 1999



The interpolation across the delta smile as in Chart 5 is done using a smoothing spline, which is a flexible non-parametric technique. A smoothing spline is a piecewise cubic polynomial, the smoothness of which is controlled by a single parameter, the smoothness parameter. Because we interpolate across delta space we can hold the smoothing parameter constant from day to day. This means that changes in pdfs from day to day reflect changes in the underlying data, and not in the estimation technique.<sup>(1)</sup>

To compare the parametric and non-parametric techniques, we examined their performance with respect to two criteria, which we discuss in the next section.

#### Comparing the stability of the techniques

Our comparisons of the stability of the implied pdfs derived from the parametric and non-parametric methods are

(1) The complete estimation process is described in detail in Bliss and Panigirtzoglou (2000) and Cooper (2000), and is also summarised in the technical appendix.

discussed in detail in Bliss and Panigirtzoglou (2000) and Cooper (2000).

Given the problems, noted above, with the prices used in estimation, the first criterion was that our technique for estimating pdfs should be robust to small and random errors in the underlying options prices. We therefore examined the extent to which small perturbations in actual options prices generated large changes in the estimated pdfs.<sup>(1)</sup>

The exercise was carried out on more than 700 short sterling futures options contracts and on 1,400 FTSE 100 index options contracts. The test involved repeatedly perturbing the set of options prices for each contract in our sample by a small and random amount. The perturbations were drawn from a uniform distribution between plus and minus one half of one tick-size. The tick-size was chosen as the range of the distribution because this is the smallest observable difference in quoted prices. So prices within one tick-size are observationally equivalent to each other.<sup>(2)</sup>

For each set of simulated prices, we estimated pdfs using both the parametric and the non-parametric methods. This process was repeated 100 times for each futures contract. The parametric and non-parametric methods were then evaluated by comparing the sample distributions of a number of summary statistics—such as the standard deviation, skewness and kurtosis—estimated for each pdf.

The results are summarised in Table A. The dispersion of the summary statistics for the non-parametric method was smaller than that of the summary statistics estimated using the parametric method for all three measures presented. These results suggest that the non-parametric technique is more robust to small and random errors.

#### Table A

#### Standard deviations of estimated summary statistics

Short sterlir	ıg	FTSE 100 index		
Parametric	Non-parametric	Parametric	Non-parametric	
0.020	0.004	2.140	0.150	
0.192	0.068	0.050	0.005	
1.199	0.231	0.165	0.018	
	0.020 0.192 0.199	Non-parametric         Non-parametric           0.020         0.004           0.192         0.068           1.199         0.231	Short sterning         F1SE 1001           Parametric         Non-parametric         Parametric           0.020         0.004         2.140           0.192         0.068         0.050           1.199         0.231         0.165	

Note: The results shown are after filtering potential outliers, defined as any value outside the 0.5 to 99.5 percentiles of the respective distribution.

The second criterion we considered for evaluating the performance of the techniques was their ability to recover accurately a pdf from a set of simulated prices.<sup>(3)</sup> By using simulated prices, rather than actual prices, we can compare the estimated pdfs against the 'true' pdf implied by the underlying stochastic process.

The simulated prices were generated from a general stochastic volatility model, set out in Heston (1993). This is an attractive model because it allows us to simulate

(3) See Cooper (2000).

option prices drawn from a wide range of underlying pdfs; with high or low volatility and kurtosis, and positive or negative skewness. In this model, the dynamics of the asset price are given by the following stochastic differential equation:

$$dS = \mu S dt + \sqrt{v_t} S dZ_1 \tag{1}$$

and

$$dv_t = k(\theta - v_t)dt + \sigma_v \sqrt{v_t} dZ_2$$
<sup>(2)</sup>

where *S* is the asset price,  $\mu$  is its mean rate of drift and  $v_t$  its conditional variance at time *t*. This follows a mean-reverting process such that the variance reverts to a long-run mean of  $\theta$  at a rate *k*. The parameter  $\sigma_v$  is its standard deviation. Finally,  $Z_1$  and  $Z_2$  are Wiener processes whose correlation is given by a value  $\rho$ . By changing  $\rho$ , we can generate skewness in the distribution of the asset price. For example, suppose we have a negative correlation between shocks to the asset price and volatility. This means that, as we get negative shocks to the price, volatility will tend to increase. This increase in volatility then increases the chance that we can get further large downward movements. So a negative correlation will generate negative skewness in the asset price distribution. A positive correlation has the opposite effect.

Using this model, we established a set of six scenarios corresponding to low and high volatility, and positive, negative and no skew. For each scenario, we generated a set of options prices over a range of strike prices and maturities. For each combination of scenario and maturity, we shocked each price by a small and random amount, in the same way as described above. We fitted pdfs to each set of perturbed prices using the parametric and non-parametric techniques and calculated summary statistics associated with each pdf. We repeated this process 100 times for each scenario and maturity.

We assessed the two techniques by comparing the standard deviations of the estimated summary statistics. Table B presents the standard deviations of the estimated summary statistics for one-month pdfs, estimated from both the parametric and non-parametric approaches.

Larger standard deviations of the summary statistics indicate greater instability in the estimated pdfs. For nearly all the scenarios, the parametric technique has larger standard deviations for the three statistics than does the non-parametric method.

The research suggested that the parametric technique is less stable than the non-parametric one evaluated against both the criteria discussed above. This instability is likely to reduce the value of the parametric technique as a practical tool, compared with the non-parametric.

<sup>(1)</sup> See Bliss and Panigirtzoglou (2000).

<sup>(2)</sup> The tick-size was defined as 0.05.

# Table BStandard deviations of estimated summary statisticsfor one-month pdfs

Summary statistic	Scenario	Parametric	Non-parametric
Standard deviation	1	0.0730	0.0110
	2	0.5684	0.0137
	3	7.5644	0.0123
	4	0.0093	0.0095
	5	0.0092	0.0080
	6	2.4101	0.0079
Skewness	1	0.1663	0.0192
	2	0.2341	0.0234
	3	0.1899	0.0166
	4	0.0458	0.0064
	5	0.0055	0.0061
	6	0.1839	0.0066
Kurtosis	1	0.1002	0.0156
	2	0.1835	0.0333
	3	0.3374	0.0296
	4	0.0185	0.0065
	5	0.0274	0.0078
	6	0.3777	0.0150
Note: Scenarios are: (1) (3) positive skew, high volatility; an	negative skew, lo low volatility; (4 d (6) positive ske	ow volatility; (2) no s ) negative skew, high w, high volatility.	skew, low volatility; volatility; (5) no skew,

Intuitively, the greater instability of the parametric approach arises because the pdf is estimated using only five parameters. Small changes in the price of one option can affect the value of these parameters, and hence the shape of the whole pdf. In contrast, when we use the non-parametric method, the effect of changes in the price of one option on the shape of the pdf is more localised. A similar result was found when comparing the stability of parametric and non-parametric techniques for fitting yield curve data (see Anderson and Sleath (1999)).

#### Estimating pdfs over a constant horizon

Options contracts traded on financial futures exchanges, such as LIFFE, have fixed expiry dates corresponding to the maturity of the underlying futures contracts: March, June, September and December. This feature can make comparing pdfs over time difficult. This is because the degree of uncertainty about the price of the underlying futures contract at the expiry date of the option naturally decreases as the expiry date approaches. So the implied volatilities and variances of the pdfs that we estimate diminish over time, without any real change in the degree of uncertainty about the asset. Normally the implied volatility of each contract drifts downwards through the operation of this 'time-to-maturity' effect. The pattern of decaying implied volatilities for successive short sterling contracts is shown in Chart 6. But volatilities can also be shocked by some external event.

To discern more clearly such underlying changes we need a method for stripping out the 'time-to-maturity' effect. Our method for doing this is based on—and is consistent with— the non-parametric technique discussed above. There we interpolated across the implied volatilities of options with different deltas but with the same maturity. Here we interpolate across the implied volatilities of contracts with the same delta but with different maturities. Here too there is an advantage in using deltas rather than strike prices. The range of possible values of delta runs from 0 to 1 and for every maturity there are contracts with deltas covering most of the range. The range of available strike prices by contrast

#### Chart 6 Short sterling atm implied volatility



Chart 7

Short sterling implied volatilities at different maturities; 27 January 1999 (delta = 0.6)



is often quite different at different maturities. An example of the relationship between implied volatilities and maturities of options with the same delta is given in Chart 7.

The volatility of a hypothetical contract with a delta of 0.6 and a six-month maturity can easily be read off the chart. A complete 'delta smile' for hypothetical six-month contracts can be built up from similar charts for contracts with different deltas. And then a pdf with six-month maturity can be constructed from the smile in the usual way. The whole process can be repeated on the next day. Even though actual contracts will have a maturity that is one day shorter, the maturity of the constructed pdf will remain at six months.

In fact, we can construct a surface of implied volatility, as shown in Chart 8. The surface is estimated from the implied volatilities from contracts on all available deltas and maturities. The implied volatility smile of a constant-horizon pdf can be thought of as a cross-section of the surface at a particular date.

#### Chart 8 Short sterling implied volatility surface; 27 January 1999



Interpolating across maturities introduces a source of potential measurement error into the estimated pdfs. One problem is that when the contract closest to maturity expires, it is replaced by another—longer-dated—contract. This may induce instability in the constant-horizon pdfs, particularly at shorter horizons. To test for the size of this effect we estimated the absolute daily changes in a number of the summary statistics of the constant-horizon pdfs, both for when there was contract switching and for when there was none. We then constructed two samples and tested the null hypothesis of equal means.

For all the summary statistics for short sterling, the differences in the means of the two samples were significantly different from zero. Except for the variance, they were also significantly different for all the FTSE 100 summary statistics. However, the differences in the means were very small.

#### The evolution of short-term interest rate uncertainty in the United Kingdom

Investors' uncertainty about the future path of short-term interest rates may partly be related to uncertainty about the monetary authorities' reaction function. But it will be influenced by uncertainty about the shocks to which the monetary authorities react. So changes in market uncertainty may reflect a perceived change in the monetary policy reaction function, and/or a perceived change in the nature of the exogenous uncertainty facing the economy.

Constant-horizon pdfs are a useful tool for evaluating changes in market uncertainty over long periods of time. For example, we can examine the time series properties of the summary statistics. In this section, we consider what constant-horizon pdfs can tell us about the evolution of short-term interest rate uncertainty since January 1997. Did the markets become less uncertain about the outlook for short-term interest rates following the introduction of operational independence for the Bank of England in May 1997? How uncertain about the future course of monetary policy were the markets in the wake of the Long Term Capital Management (LTCM) crisis in autumn 1998?

Chart 9 plots the level and the standard deviation of three-month sterling Libor implied by the constant six-month horizon pdf, from January 1997 to December 1999. The standard deviation is a measure of how dispersed the implied level of the interest rate was seen to be, and hence of uncertainty.

#### Chart 9 Summary statistics of the six-month constant-horizon short sterling pdf



The series of the standard deviation is fairly volatile, but was little changed overall during the period. It rose a little in anticipation of the General Election in May 1997. Uncertainty then fell modestly in the months following the granting of operational independence to the Bank. It rose slightly following the market's response to the 25 basis point rise in the Bank's repo rate in June 1998. But these moves were dwarfed by the large rise in market uncertainty during the period of financial turbulence in the late summer and autumn of 1998.

We can also use the higher moments of the six-month constant-horizon pdf for short sterling to consider the evolution of the balance of risks to monetary policy in the United Kingdom. In Chart 10, we plot the kurtosis and skewness of the same pdf over the same sample period.

Skewness is a measure of the balance of risks attached by the market to different outcomes. Positive skewness occurs when the market attaches a higher probability to a sharp upward movement in short-term interest rates than to a comparable downward movement. Because short-term interest rates are bounded from below by zero, measures of skewness tend to be positive. But since May 1997, the degree of skewness has fallen towards zero, the level at which the pdf is symmetrical. One interpretation is that operational independence for the Bank reduced the

#### Chart 10 Summary statistics of the six-month constant-horizon short sterling pdf



probability the market attached to a sharp upward movement in interest rates. The LTCM crisis may have further reduced the perceived likelihood of a sharp rise in rates. In contrast, the unexpected rise in repo rates in June 1998 was followed by a period of increased variability in the skew. This could indicate market difficulty in assessing the likely consequences of the decision to raise rates. Skewness increased again during the first half of 1999, as the probability of a further sharp easing in rates diminished with the recovery in UK economic activity.

Kurtosis measures the probability the market attaches to extreme levels of interest rates, either up or down. Levels of kurtosis above three indicate that the market attaches higher probability to extreme outcomes than would be implied by a normal distribution. Since May 1997, the level of kurtosis has fallen slightly, indicating that the market has come to attach a lower probability to extreme values of short-term interest rates. This may again be associated with the change in monetary policy regime. Kurtosis increased sharply—but very briefly—following the LTCM crisis.

#### Conclusion

Research provides evidence that a non-parametric technique for estimating pdfs is an improvement upon the parametric one that has been used at the Bank over recent years. This conclusion mirrors a result found in tests on the yield curve (see Anderson and Sleath (1999)).

We can also use a non-parametric technique to estimate pdfs over a constant-maturity horizon. As we illustrate with a simple example, this tool can be helpful for addressing questions such as the evolution over time of market uncertainty about the outlook for short-term interest rates. Using this technique we show that there has been little change overall since 1997 in our measure of market uncertainty, despite the sharp rise following the financial turbulence in autumn 1998. There is also evidence of a fall in the probability the market attaches to sharp upward movements in rates.

In due course, we intend to make our data on pdfs available on the Bank's Internet site, at www.bankofengland.co.uk

#### **Technical appendix**

### Constructing fixed expiry-date and constant-horizon probability density functions from exchange-traded options prices

#### Constructing fixed expiry-date pdfs

The two estimation techniques discussed in this article—the parametric and non-parametric approaches—may be derived from the Cox and Ross (1976) pricing model. This model yields the call option price  $C_t$  at time t as the risk-neutral expected pay-off of the option at expiry T, discounted back at the risk-free rate:

$$C(S, X, \tau) = e^{-r\tau} \int_X^\infty (S_T - X)g(S_T) dS_T$$
(A1)

where  $S_T$  is the terminal underlying asset price at T,  $g(S_T)$  is its risk-neutral pdf, X is the option's strike price and r and  $\tau = T - t$  are the risk-free rate and the maturity of the option respectively. The put price can be recovered either through put-call parity or by replacing the pay-off of the call  $S_T - X$ with the pay-off of the put  $X - S_T$  in equation (A1) and by integrating from zero to the strike price.

#### The parametric method

The parametric estimation approach involves specifying a particular functional form for the pdf— $g(S_T)$ —and fitting this distribution to the observed range of strike prices via non-linear least squares. Although a range of functional forms has been suggested, the most commonly used is the mixture of two lognormal distributions, as discussed in Bahra (1996 and 1997).

This form is sufficiently flexible to capture the features of distributions we might expect to find implicit in the data. And the mixture of two lognormals is parsimonious because it matches these criteria with just five parameters.

The mixture of two lognormals is given by:

$$g(S_T) = \theta L(\alpha_1, \beta_1) + (1 - \theta)L(\alpha_2, \beta_2)$$
(A2)

where  $\theta$ ,  $\alpha_1$ ,  $\alpha_2$ ,  $\beta_1$  and  $\beta_2$  are the parameters to be estimated. The fitted call and put prices are given by:

$$\hat{C}_{t}(S, X_{i}, \tau) = e^{-r\tau} \int_{X_{i}}^{\infty} (S_{T} - X_{i})(\theta L(\alpha_{1}, \beta_{1}) + (1 - \theta)L(\alpha_{2}, \beta_{2}))dS_{T}$$

$$\hat{P}_{t}(S, X_{i}, \tau) = e^{-r\tau} \int_{0}^{X_{i}} (X_{i} - S_{T})(\theta L(\alpha_{1}, \beta_{1}) + (1 - \theta)L(\alpha_{2}, \beta_{2}))dS_{T}$$
(A3)

To fit the parameters of the pdf, we minimise the following expression:

$$\min_{\alpha_1,\beta_1,\alpha_2,\beta_2,\theta} \sum_{i=1}^m (\hat{C}_{i,t} - C_{i,t})^2 + \sum_{j=1}^n (\hat{P}_{j,t} - P_{j,t})^2$$
(A4)

#### The non-parametric method

The non-parametric technique for estimating fixed expiry-date pdfs—described in Bliss and Panigirtzoglou (2000) and Cooper (2000)—exploits the result derived by Breedon and Litzenberger (1978) that the pdf can be recovered by calculating the second partial derivative of the call price function with respect to the strike price. This result can be derived simply by taking the second partial derivative of the call price function (A1) with respect to the strike price *X* to get:

$$\frac{\partial^2 C}{\partial X^2} = e^{-r\tau} g(S_T) \tag{A5}$$

So we just have to adjust the probabilities by  $e^{-r\tau}$  to get  $g(S_T)$ . In practice, we only have a discrete set of strike prices. So to obtain an estimate of the continuous call-pricing function we need to interpolate across the discrete set of prices.

Following Shimko (1993), this interpolation can be done across the volatility smile, using the Black-Scholes formula to transform this back to prices. The reason for doing this rather than interpolating the call price function directly is that it is difficult to fit accurately the shape of the latter. And since we are interested in the convexity of that function, any small errors will tend to be magnified into large errors in the final estimated pdf.

Shimko (1993) used a quadratic functional form to interpolate across the implied volatility smile. Instead, we use a cubic smoothing spline. This is a more flexible non-parametric curve that gives us control of the amount of smoothing of the volatility smile and hence the smoothness of the estimated pdf. But following Malz (1997), we first calculate the Black-Scholes deltas of the options. This is because in practice it is usually easier to interpolate across the volatility smile in 'delta space' than in 'strike price space'. Finally, to generate the implied pdf, we calculate the second partial derivative with respect to the strike price numerically and adjust for the effect of the discount factor.

#### The method for estimating pdfs with a constant horizon

Our technique for estimating constant-horizon pdfs is based on the non-parametric technique for estimating fixed expiry-date pdfs. The technique involves interpolating across the implied volatilities of options with the same delta, but on different maturities. We interpolate across the implied volatilities for each particular delta rather than each strike price because the range of possible values of delta between 0 and 1—is not maturity-dependent. Consider two sets of options contracts on FTSE 100 index futures: the first with two months to maturity and strike prices in the range 5000–6500; and the second with six months to maturity and strike prices in the range 4000–7000. If we wanted to interpolate across implied volatilities for each strike price, the implied volatilities on the second contract corresponding to strike prices outside the range 5000–6500 could not be used. In other words, information on the second contract would be lost if we were to interpolate across implied volatilities for each strike price. This problem does not occur if we interpolate across implied volatilities for each delta, since both contracts have a range of deltas between 0 and 1.

Our technique for estimating constant-horizon pdfs involves the following steps:

- For each delta, we interpolate across the implied volatilities of the options on the different LIFFE contracts using a cubic smoothing spline. We then select the point on the interpolated curve corresponding to the desired maturity of the constant-horizon pdf. For example, to generate the implied volatility corresponding to a value for delta of 0.6 for a six-month constant horizon pdf, we interpolate across the implied volatilities corresponding to a value for delta of 0.6 for the LIFFE contracts with different maturities. We then select the six-month point on the interpolated curve.
- We repeat the process for different values of delta and hence construct a curve of implied volatility against delta—an 'implied volatility smile'—for hypothetical options with six months to maturity.
- We then use the implied volatility smile to generate the constant-horizon pdf using the same

non-parametric interpolation method we use for generating fixed expiry-date pdfs.

#### **Glossary of technical terms**

The *call price function* relates the prices of call options of the same maturity to their strike price.

The *delta* of an option is the rate of change of the option price with respect to the underlying asset price and is a non-linear transformation of the strike price.

The *implied volatility* is the volatility of the underlying asset price implied by the Black-Scholes (1973) model. The implied volatility is a non-linear transformation of the option price.

*Kurtosis* is defined as the fourth central moment of a probability distribution, normalised by the fourth power of its standard deviation.

Moneyness is at-the-money, near-the-money, in-the-money, out-of-the-money. Options which give the right to buy (ie calls) or sell (ie puts) at a level equal to (or close to) the current futures price of the underlying asset are said to be 'at-the-money' (or 'near-the-money'). Call options which give the right to buy at a level higher (or lower) than the current futures price of the underlying asset are said to be 'out-of-the-money' (or 'in-the-money'). Put options which give the right to sell at a level higher (or lower) than the current price of the underlying asset are said to be 'in-the-money' (or 'out-of-the-money').

*Skewness* is defined as the third central moment of a probability distribution, normalised by the third power of its standard deviation.

The *strike price* of an option is the price at which the investor can exercise the option.

#### References

- Anderson, N and Sleath, J (1999), 'New estimates of the UK real and nominal yield curves', *Bank of England Quarterly Bulletin*, Vol 39(4), pages 384–92.
- Bahra, B (1996), 'Probability distributions of future asset prices implied by option prices', Bank of England Quarterly Bulletin, Vol 36(3), pages 299–311.
- Bahra, B (1997), 'Implied risk-neutral probability density functions from options prices: theory and application', *Bank of England Working Paper*, No 66.
- Barone-Adesi, G and Whaley, R (1987), 'Efficient analytic approximation of American option values', *Journal of Finance*, Vol XLII, No 2, pages 301–20.
- Bates, D (1996), 'Jumps and stochastic volatility: exchange rate processes in Deutsche Mark options', *Review of Financial Studies*, Vol 9, No 1, pages 69–107.
- Black, F and Scholes, M (1973), 'The pricing of options and corporate liabilities', *Journal of Political Economy*, 81, pages 637–54.
- Bliss, R and Panigirtzoglou, N (2000), 'Testing the stability of implied pdfs', Bank of England Working Paper, forthcoming.
- Breedon, D and Litzenberger, R (1978), 'Prices of state-contingent claims implicit in options prices', *Journal of Business*, Vol 51, No 4, pages 621–51.
- Cooper, N (2000), 'Testing techniques for estimating implied risk-neutral densities from the prices of European and American-style options', *mimeo*.
- Cox, J and Ross, S (1976), 'The valuation of options for alternative stochastic processes', *Journal of Financial Economics*, 3, pages 145–66.
- Heston, S (1993), 'A closed-form solution for options with stochastic volatility with applications to bond and currency options', *The Review of Financial Studies*, Vol 6, 2, pages 327–43.
- Malz, A (1995), 'Using options prices to estimate re-alignment probabilities in the European Monetary System', *Federal Reserve Bank of New York Staff Reports*, No 5.
- Malz, A (1997), 'Estimating the probability distribution of future exchange rates from options prices', *Journal of Derivatives*, Winter, pages 18–36.
- Melick, W R and Thomas, C P (1997), 'Recovering an asset's implied pdf from options prices: an application to crude oil during the Gulf Crisis', *Journal of Financial and Quantitative Analysis*, Vol 32, 1, pages 91–115.

Shimko, D C (1993), 'Bounds of probability', RISK, Vol 6, 4, pages 33-37.

### Stock prices, stock indexes and index funds

#### By Richard A Brealey,<sup>(1)</sup> special adviser to the Governor on financial stability issues.

In recent years, many UK investors have given up the quest for superior performance and have instead simply sought to match the returns on some broad market index. This has led to the suggestion that the growth in index funds has depressed the stock prices of those companies that are not represented in the index and has thereby increased their cost of capital. This effect may have been accentuated by the actions of fund managers, whose performance is compared with that of a market index and so who also have an incentive to avoid those stocks that are not included in the index. This paper argues that, in practice, these price effects are likely to be very small. In support of this view, the paper examines the price adjustments that occur when a stock is added to, or removed from, a stock market index.

#### Introduction

The well-documented difficulty of choosing an active fund manager who will provide superior performance has led to a rapid growth in index funds in the United Kingdom. These index (or 'tracker') funds do not seek to provide superior investment performance, but instead are designed to match the returns on a broad stock market index.

The distinction between index funds and funds that closely resemble some benchmark portfolio is somewhat artificial, but in 1999 explicitly indexed funds were estimated to hold about £134 billion of equities (see Table A).<sup>(2)</sup>

Table A		
Index funds-	—holdings of equ	ities; 1999
	£ billions	
Pension funds Insurance Retail Overseas	98.1 11.9 2.0 22.0	
Total	134.0	

Although about 22% of pension equity holdings are indexed, the proportion is much smaller for other categories of investor, so that the total estimated investment in indexed funds amounts to 8.6% of the capitalisation of UK-traded equities.

One commonly expressed concern is that the growth of investment in these funds has pushed up the price and lowered the required return of index stocks. Correspondingly, (it is argued), index funds do not hold the stocks of smaller companies that are not included in the market index and this has increased the cost of capital for these companies.<sup>(3)</sup>

Though index funds have an obvious reason to avoid stocks that are not included in the market index, many other funds may also be reluctant to buy such stocks. This reluctance arises from the common practice of measuring a fund's performance against that of a market index. In this case, an investment in the index is effectively risk-free in the eyes of the manager, while investments in excluded stocks are risky and will therefore be held by a risk-averse manager only if they offer a correspondingly higher return. So index funds and performance benchmarking are likely to have similar effects on required returns.

These concerns about the effects of index funds and index benchmarking seem to have been heightened by the relatively poor performance of small-firm stocks in recent years, when indexation has boomed. For example, while the Hoare-Govett Smaller Companies (HGSC) index outperformed the FTSE All-Share index by an average of 6.1% a year during the period 1955-86, the average annual return on the HGSC index was 6.4% below that on the All-Share index during the years 1989–98. As will be evident from the discussion below, it is implausible that index funds can account for these sharp differences in stock returns. Nor are alternative explanations lacking, for the underperformance of small-firm stocks during these years has been largely a consequence of their industry composition and has been matched by a lower growth in dividends (see Dimson and Marsh (1999)). Moreover, the indexation argument does not sit easily with the more recent

<sup>(1)</sup> I am grateful to colleagues at the Bank of England and to Elroy Dimson of the London Business School for providing comments on this paper. The paper has benefited from considerable assistance from Louise Boustani and Stephen Senior.

<sup>(2)</sup> I am grateful to Lindsay Tomlinson of Barclays Global Investors for providing these estimates.(3) For example, a CISCO survey of analysts that specialise in small companies found that more than 90%

believed that the growth of index funds is damaging the market for smaller quoted companies. See Thunhurst (1999).

performance of small-cap stocks; in 1999 the HGSC index provided a return of 54.2%, 30% above that of the All-Share index.

The rest of this article is organised as follows. The next section uses a simple mean-variance portfolio model to examine the effect of the portfolio adjustments forced on other investors by index funds. The discussion suggests that it is improbable that the growth of index funds in the United Kingdom has had any economically significant effect on the cost of equity capital. The following section widens the discussion to look at the possible effect on stock prices of using the market index as a benchmark to assess the performance of active as well as passive managers. Since we cannot, a priori, specify managers' reluctance to take on the risk of investing outside their benchmark, we can be less dogmatic about the magnitude of the effect. The fourth section looks at the empirical evidence of the effect of index composition on equity prices. Although this evidence is not unanimous, we place most weight on the modest price effects of adding a stock to the market index or removing it. These effects suggest that adding a stock to a market index is likely to change required returns by only a few basis points. A puzzling finding is that the effect of index changes is not confined to the FTSE All-Share index, despite the fact that this is the benchmark for most index funds and for measuring the performance of active portfolios. This suggests that changes in index composition may have some labelling or information effect. The final section provides a summary and conclusion.

### The effect on stock returns of changing portfolio weights

As index funds are passive investors, their transactions do not provide information to other investors, and these funds take considerable care when trading to demonstrate that their transactions are not information-motivated. So the purchase of stocks by index funds is unlikely to have a significant direct effect on the price of index stocks.

However, the activities of index funds may change the market proportions of large and small-company stocks that are available to non-indexed (or 'active') investors. These investors are therefore obliged to hold a higher proportion of small-company stocks than they formerly held. Since no single active investor is constrained to hold particular proportions of large or small-firm stocks, the stock prices of small firms would need to decline to induce the active investors to increase their holdings. The extent of this decline depends on the magnitude of the changes that the active investors are required to make and the effect of these changes on portfolio risk. For example, if small-firm stocks are close substitutes for large-firm stocks, these investors will require a smaller inducement to make the portfolio shift.

We can put some approximate numbers on the price adjustments needed to bring about the necessary shifts in portfolio holdings. UK index funds hold an estimated 8.6% of the total market, and all but about 5% of these funds are indexed to the FTSE All-Share index. For simplicity, therefore, we assume initially that they invest only in the All-Share index, which accounts for 93.9% of total UK market capitalisation. We use the HGSC index as a proxy for returns on non-index stocks.<sup>(1)</sup> Using index data from January 1990 to April 1999, we estimate the monthly standard deviation of the All-Share index as 4.3% and that of the HGSC index as 4.6%. The correlation between the monthly returns on the two indexes during this period was 0.82.

In the absence of index funds, the representative investor would hold 93.9% of his portfolio in index stocks. If index funds account for 8.6% of the market, then the representative active investor is obliged to reduce his holdings in index stocks to 93.3% of his portfolio<sup>(2)</sup> and to increase correspondingly his holding of non-index stocks. This portfolio shift causes a very small decline in the risk of the active investor's portfolio as it becomes better diversified. The 'beta'<sup>(3)</sup> of the index stocks relative to the portfolio of the active investor increases by a negligible 0.02%, while the comparable beta of the non-index stocks rises by a slightly greater 0.28%.<sup>(4)</sup> Since the required risk premium should be proportional to an investment's beta relative to the mean-variance efficient portfolio,<sup>(5)</sup> the direct effect of an increase in the beta is to increase the required risk premium. If active investors continue to require the same return on their portfolio, the required returns on small-firm stocks would need to rise to compensate for the relative increase in their betas. However, even if the market risk premium were as high as 10%, the increase in the cost of equity for small firms would be less than 3 basis points.

This may not be quite the end of the story, since the risk premium is unlikely to be constant. For example, if investors have constant relative risk-aversion, the portfolio risk premium that they require should change proportionately with the portfolio variance. In our example, the active manager's portfolio becomes more diversified as a

<sup>(1)</sup> Since the HGSC index contains the smallest 10% of stocks by market capitalisation, our use of this index is likely to have somewhat underestimated the standard deviation and overestimated the correlation between index and non-index stocks. The direction of the effect on our results is indeterminate.

<sup>(2)</sup> Calculated as (0.939 - 0.086)/(1 - 0.086) = 0.933.

<sup>(3)</sup> The 'beta' measures the contribution of an investment to the risk of a portfolio. It is equal to the sensitivity of the investment's return to changes in the value of the portfolio. If a portfolio is efficient, the expected reward from each holding is proportional to its beta.

<sup>(4)</sup> The beta of the index stocks relative to the active investor's portfolio increases from 1.00378 to 1.00398 and that of the non-index stocks increases from 0.94205 to 0.94467. Since the weighting of non-index stocks in the portfolio is increased, the weighted average of the betas remains at 1.0.

<sup>(5)</sup> A mean-variance efficient portfolio offers the highest expected return for a given level of portfolio risk (or variance).

result of the increased holdings of small-firm stocks and its risk therefore declines slightly. The net effect is that the required return on small-firm stocks would also decline slightly.

There are several reasons why the estimated effect of indexing on required returns is so low. The first is simply that, while there has been rapid growth in the proportion of pension portfolios that are indexed, the proportion of total market capitalisation that is indexed remains relatively modest, at 8.6%. Second, as most index funds track the All-Share index, which accounts for a very high proportion of market capitalisation, active investors are obliged to make only small portfolio shifts as a result of the activities of index funds. Third, as small-company stocks are relatively good substitutes for large-company stocks, active investors do not require much inducement to make these shifts.

It is useful to check how sensitive these findings are to the choice of parameters. We therefore repeated the exercise assuming separately that index funds account for 20% of market capitalisation, that the index accounts for 70% of the market (roughly the equivalent of the FTSE 100 index), and that the correlation between index and non-index stocks is 0.4. In no case does the beta of the active investor's portfolio increase by more than 0.01.

The changes in the required returns for non-index stocks stem from our assumption that investors who switch to index funds increase their weighting in index stocks from market proportions to 100%. This is not always the case. Some funds use index portfolios simply as a way to manage their existing holdings in large-capitalisation stocks and they continue to maintain their weighting in smaller-company stocks. In addition, some institutional investors also invest their small-firm holdings in funds that seek to track small-firm indexes. If the shift to index funds merely changes the way that investors manage their existing holdings in index stocks, then active investors would not need to make any portfolio adjustments and the growth of index funds would be unlikely to have any impact on prices of small-firm stocks.

It is also important to note that our analysis is partial insofar as it focuses only on the costs of indexation. These costs arise because a portfolio that is invested in an index fund which tracks only a sub-section of the market is mean-variance inefficient. Such funds oblige the representative non-indexed investor also to hold a mean-variance inefficient portfolio and this investor has to be 'bribed' to do so. But the costs to an index fund of omitting some stocks from the portfolio and bribing the active investor to buy them are likely to be far outweighed by the savings in management costs and transaction fees.

These cost savings should be reflected in a decline in the cost of equity for larger firms.<sup>(1)</sup>

Finally, we should note that membership of an index is partly within the control of the firms themselves. For example, if index membership conveyed substantial advantages, then firms whose stocks are included in the index would have an incentive to acquire their less fortunate brethren. While this would eliminate any index effect on returns, the process could involve significant deadweight costs.

#### The effect of performance benchmarks

We have argued that the impact of index funds on the cost of capital for smaller firms is likely to be negligible. However, index fund managers are not the only portfolio managers whose portfolio decisions are affected by the composition of stock market indexes. In this section we broaden the discussion of market indexes to consider the wider issue of the effect of performance benchmarks on the cost of equity.

Approximately 80% of equity funds in the United Kingdom are managed on an agency basis by professional fund managers. The performance of these managers may affect directly the fees that they receive, or it may do so indirectly if it influences the amount of funds under management. Sometimes the performance of a portfolio is measured against that of a peer group; in other cases it is measured against a passive benchmark portfolio, which in the case of UK equity managers is typically the FTSE All-Share index.<sup>(2)</sup> It seems highly likely that a manager's portfolio decisions will be affected by the way that performance is measured.

The implications of a passive benchmark for prices have been analysed in Brennan (1993), who showed that in such a setting expected returns would vary linearly with the expected returns on both the market portfolio and the benchmark portfolio. Other things being equal, stocks that are highly correlated with the benchmark would exhibit lower expected returns. Thus Brennan's analysis of benchmarking implies that the use of market indexes to measure the performance of professional managers is likely to lower the required return on shares that are represented in the index, relative to those of non-index firms.

Investment in the benchmark index is riskless for a manager who is compared against that benchmark; the only risk that matters for him is the covariance between stock returns and the portfolio of non-index stocks. How much of this risk a manager is prepared to assume depends on his risk-aversion. Thus an index fund can be viewed as an extreme case of a

<sup>(1)</sup> Some impression of the potential impact of these cost savings can be gained from Cuoco and Kaniel (1999), who consider the case of proportional management fees on required returns. They conclude that with proportional fees over five years equal to 12% of the terminal value of the portfolio, the equilibrium ratio of reward to risk (the Sharpe ratio) would be between 40% and 60% higher than it would be in an economy in which all investors managed their portfolios directly and costlessly. (2) Foreign investors in UK shares are more likely to be measured against an index of large-cap stocks such as the MSCI index.

benchmarked portfolio, where the manager has infinite risk-aversion and so totally avoids non-index stocks.

Since we do not know the degree of risk-aversion of active fund managers, we cannot predict the magnitude of the effect on prices of the use of indexes to benchmark their performance. Brennan undertook an empirical test of his model using US data. However, such tests of asset-pricing models are notoriously subject to noise and, perhaps not surprisingly, Brennan's results were indeterminate. For the entire 1931–91 period, the estimated expected return declined significantly as a stock's sensitivity to the index increased, but in recent years this effect largely disappeared or was even reversed. When Brennan controlled for a variety of factors, the more recent data were consistent with the hypothesis that a high correlation with a market index reduced expected returns.

More recently, Cuoco and Kaniel (1999) have employed a general equilibrium model to examine the effect of alternative compensation schemes for portfolio managers. They show that with symmetric performance fees, managers will have an incentive to overweight the benchmark portfolio, and this increases the required return on non-benchmark stocks. They estimate that with very high levels of performance fees, the price differential between benchmark and non-benchmark stocks is around 4% if the returns on the two portfolios are uncorrelated, and less than 1% if the correlation is 0.9. As we shall see, these effects are similar in magnitude to the price changes that are observed at the time of changes to index composition.

### **Empirical evidence on the effect of membership of stock market indexes**

We now consider the empirical evidence on the effect of index membership on required returns. Such effects may be due to the role of index funds, to the use of indexes as performance benchmarks, or, more speculatively, to some form of information effect.

Most studies of the effect of membership of a market index have focused on abnormal returns at the time of changes to index composition. Before reviewing these studies, we discuss briefly two other relevant papers: Chan and Lakonishok (1993) and Goetzmann and Massa (1999). Chan and Lakonishok's analysis was based on a sample of returns on all NYSE, AMEX, and Nasdaq stocks with a market capitalisation in excess of \$50 million during the period 1977–91. For each year the authors estimated a cross-sectional regression of return on beta, market capitalisation, the book-to-market ratio, an industry dummy, and a dummy for membership of the Standard and Poor (S&P) Composite.

The regression coefficients for the S&P dummy are reported in Table B and show the excess realised return to membership of the index. The mean excess return is 2.2% per annum and the excess compound return over the

# Table BEstimated excess return to membership of theS&P Composite index

Per cent

Year	Excess return	Year	Excess return
1977 1978 1979 1980 1981 1982 1983 1984	-3.99 -4.85 5.33 2.39 3.17 6.94 1.58 4.69	1985 1986 1987 1988 1989 1990 1991	-0.08 2.21 5.92 3.45 4.87 -2.94 4.15
Mean Source:	4.69 <b>2.19 (t = 2.33)</b> Chan and Lakonishok (1993).		

15 years is 36.0%. It is difficult to know how to interpret these findings. It is possible that the estimated returns to index membership are spurious and that the index dummy is simply proxying for errors in (say) the size variable. If, however, the index composition is the true reason for the excess returns, then one interpretation is that the coefficient on the index dummy is measuring the effect on the equilibrium expected returns. In this case, required returns are substantially higher for index stocks. Alternatively, the succession of positive returns on index stocks may reflect successive unanticipated changes in required returns, perhaps as a result of the growth of index funds. However, it is difficult to reconcile such a large and prolonged excess return with the far smaller price movements that occur when individual stocks are included for the first time in the index.

The view that the growth of index funds has had a major effect on market prices is supported by Goetzmann and Massa (1999), who find a strong contemporaneous correlation since 1993 between daily inflows into three Fidelity indexed mutual funds and changes in the S&P index. The authors argue that the market is reacting to daily demand and that the effects on price are permanent. They estimate the index level, net of any flows effect, and conclude that 'the important role played by the index funds is shown not only by the huge difference (-36%) between the two indexes that can be explained in terms of funds' flows'. Unfortunately for our purposes, the Goetzmann and Massa paper does not examine whether flows into the indexed mutual funds are correlated with similar flows into actively managed funds or whether the price movements are limited to the S&P index. So it is possible that they are simply picking up an example of the impact of mutual fund flows on overall market levels.

We now turn to the effect of changes in index composition. If required returns are dependent upon a stock's inclusion in the market index, then any unanticipated additions or deletions of a stock from the market index should be associated with an abnormal change in price, and this should allow a more direct assessment of the effect on required returns of index membership. There have been a number of studies in the United States of the effect of changes in index composition, the results of which are summarised in Table C. Notice that most deletions from the S&P index are

# Table C Announcement effect of additions to and deletions from the S&P Composite index

		Abnormal re	Abnormal return (per cent)		
	Years	Additions	Deletions		
<b>011</b> (100 c)	10.55 55	0.0			
Shleifer (1986)	1966-75	-0.2	n.a.		
Shleifer (1986)	1976–83	+2.8	n.a.		
Goetzmann and Garry (1986)	1983	n.a.	-2.0		
Harris and Gurel (1986)	1973-83	+1.5	-1.4		
Woolridge and Ghosh (1986)	1977-83	+2.9	n.a.		
Jain (1987)	1977-83	+3.1	n.a.		
Lamoureux and Wansley (1987)	1966-75	+0.5	n.a.		
Lamoureux and Wansley (1987)	1976-85	+2.3	n.a.		
Dhillon and Johnson (1991)	1984-88	+3.3	n.a.		
Edmister and Graham (1994)	1983-89	+3.3	n.a.		
Beneish and Whaley (1996)	1986–94	+4.4	n.a.		
Lynch and Mendenhall (1997)	1990–95	+3.2	-6.3		

n.a. = not available.

the result of mergers or bankruptcy and so the number of useful observations for deletions is much smaller than for additions.

Table C indicates that most researchers find a positive return of about 3% when a stock is included in the index and a negative return for deletions. There is less agreement as to whether these abnormal returns reflect temporary price pressure or are consistent with a permanent change in the cost of capital. For example, Harris and Gurel (1986) find that prices tend to revert to their pre-announcement levels after about three weeks. Lynch and Mendenhall (1997) find further positive abnormal returns between the announcement date and the effective date, which is partially reversed after the effective date. Edmister and Graham (1994) observe a permanent shift in price.

A number of commentators attribute the abnormal returns to the influence of index funds, and there is some evidence that a change in index composition does lead to portfolio shifts (though this need not be a result of the activities of index funds). For example, several studies indicate that stocks that are being added to the index experience an abnormal rise in trading volume. Pruitt and Wei (1989) also find that stocks that are added to the S&P index experience an increase in institutional ownership, and that the abnormal return is positively related to this change in institutional ownership.

To see whether changes in index composition have a similar impact on returns in the United Kingdom, we collected data on all additions to and deletions from the FTSE All-Share and FTSE 100 indexes. The FTSE index committee meets each quarter to consider possible additions and deletions. The proposed changes are announced after market close and, on average, become effective six to seven trading days later.<sup>(1)</sup> These changes largely result from earlier new listings or changes in market capitalisation. Between the regular quarterly reviews, changes are made to the index as a result of changes in corporate structure, such as a merger. We focus here only on changes made at the quarterly review, as the stock returns are less likely to be contaminated by other news. As the principal criterion for inclusion in an index is the stock's market capitalisation, these changes in the index may be partly anticipated and therefore the impact on prices may be underestimated.

Our data samples consist of: (a) all quarterly additions and deletions to the All-Share index between March 1994 and June 1999, and (b) all transfers into or out of the FTSE 100 index from other sections of the All-Share index. So there is no overlap between the two samples. After allowing for missing price data, the sample consisted of 120 additions to and 110 deletions from the All-Share index and 36 additions to and 40 deletions from the FTSE 100 index.

We define the abnormal return as the difference between the return on the stock and the return on the All-Share index. We measure the daily abnormal returns on stocks entering or leaving the index during the days surrounding the announcement date. Since the announcement takes place after market close, we define day 0 as the day following the announcement. The effective day is then typically day six or seven. We calculate the mean abnormal return for each day and, to provide a rough measure of significance, we standardise the mean abnormal returns by the standard deviation of the abnormal returns over a period of 76 days surrounding the eleven-day event period (defined below). Given the small price effects that we observe and the considerable noise in the data, we do not attempt to measure whether any abnormal returns are permanent.

Stocks entering or leaving the All-Share index typically have very low market capitalisations. They are therefore thinly traded, and the effect of the announcement may be delayed. Given the fact that the events cluster in time, mismatches between the returns on the stocks and those of the market index may be common across the different stocks, and this is liable to show up in spuriously large absolute abnormal returns. It therefore suggests that our measures of statistical significance, particularly for changes to the All-Share index, should be treated with considerable caution. As a check that our results are not materially affected by such mismatches, we also examine and report raw returns. The choice between abnormal and raw returns does not materially affect the pattern of the results, though for individual days the two measures sometimes differ markedly.

Table D reports the abnormal returns for a period of eleven days surrounding the announcement date. The first column shows that on the day of the announcement of additions to the All-Share index there is a positive, but not significant, abnormal return and this is followed by a significant rise on the following day. Thereafter, the returns are predominantly negative and over the entire eleven-day period additions to the index are associated with a cumulative abnormal return of just 0.3%. In the case of deletions from the All-Share index, returns are fairly consistently and sometimes

(1) The mean number of days from announcement date to effective date varies from 5.5 for FTSE 100 additions to

7.1 for both additions and deletions to the FTSE All-Share.

#### **Table D**

#### Abnormal returns during the period surrounding the announcement of additions and deletions to the market index, March 1994 to June 1999

	Mean	abnorm	al return ( <i>i</i>	mean raw	v return)				
Day relative to	FTSE	FTSE All-Share			FTSE 100				
announcement	Additions		Deletio	Deletions		Additions		Deletions	
-2	+0.2	+0.1	-0.1	-0.1	+1.4 (a)	+1.4 (b)	-0.6	-0.6	
-1	+0.1	-0.1	-0.4	-0.7	+1.4 (a)	+1.4 (b)	-0.9	-1.0 (b)	
0	+0.5	+0.4	-0.3	-0.7	-0.4	-1.1 (b)	+0.1	-0.7	
1	+0.8 (b	) -0.1	-0.4	-1.1 (b)	-0.4	-0.8	+0.6	+0.1	
2	+0.2	-0.1	+0.2	+0.3	-0.9 (b)	-0.5	-0.1	+0.3	
3	-0.1	+0.1	-1.2 (b)	-0.8	-0.1	+0.2	-0.8	-0.4	
4	-0.5	+0.2	-1.2 (b)	-0.6	-0.2	+0.1	+0.0	+0.3	
5	-0.2	+0.0	-0.3	-0.1	+1.1 (b)	+0.8	-0.8 (	b) -1.0 (b)	
6	-0.2	+0.3	-0.7	-0.8	+1.8 (a)	+1.3 (b)	-1.7 (	a) -2.1 (a)	
7	-0.3	+0.2	-0.4	+0.1	-1.1 (b)	-1.2 (b)	+1.4 (	$^{(a)}+1.3$ (b)	
8	-0.2	-0.1	+0.2	+0.3	-1.4 (a)	-1.3 (b)	+0.7	+0.7	
Ν		120		110		36		40	
<ul><li>(a) Significant at</li><li>(b) Significant at</li></ul>	the 1% lev the 5% lev	vel. vel.							

significantly negative for the entire eleven-day period. The cumulative abnormal return over the eleven days is -4.5%.(1)

The remaining columns of Table D show the effects of transfer into or out of the FTSE 100 index. The puzzle here is the behaviour of the additions to the index, as the returns are large in absolute terms and appear often to be highly significant. However, there is little consistency in the sign of the returns and the total change over the eleven-day period is an insignificant +1.2%. By contrast, the deletions from the FTSE 100 index are predominantly negative and on three days significantly so. The cumulative abnormal return over the eleven-day period for index deletions is -2.0%.<sup>(2)</sup> Since few funds either track the FTSE 100 or are benchmarked to it, the apparent abnormal returns on changes to the FTSE 100 suggest that the effects of index composition may be more complex than a simple tracking or benchmarking effect.

We repeated the exercise with day 0 redefined as the date that the index change became effective. There is no evidence of any effective-day effect for the All-Share index, but there are some quite large changes in the price of stocks entering and leaving the FTSE 100 index. For stocks entering the index there is a mean abnormal return of 2.9% on the preceding day, which is fully reversed on days 0 and +1. For deletions there is an abnormal decline of 2.0% on day -1, which is again reversed on days 0 and +1. This behaviour is suggestive of some anticipatory price pressure.

In summary, stocks that are added to both the FTSE All-Share and the FTSE 100 indexes experience, on average, a positive abnormal return over the eleven-day period immediately preceding and following the announcement. However, this abnormal return is both statistically and economically insignificant. Deletions from the index are

associated with a somewhat larger negative cumulative return.(3)

If the price movements stemming from a change in index composition are indeed permanent and unanticipated, then we can estimate roughly the implied change in the cost of capital. The Gordon growth model states that the dividend yield is equal to (r - g), where r is the required return and g the expected dividend growth rate. It is unlikely that the announcement of a change in index composition affects either the prospective dividend or the expected dividend growth, so the change in the cost of equity is simply equal to the product of the abnormal announcement return and the dividend yield. For example, a permanent 3% rise in price and a 3% dividend yield would imply a 9 basis point decline in the cost of equity. If part or all of the abnormal return is temporary, then the fall in the cost of equity is less than 9 basis points. If the much larger price movements estimated by Chan and Lakonishok and Goetzmann and Massa reflect adjustments to the required returns on index stocks, then the fall in the cost of equity for index stocks is of the order of one percentage point.

#### Summary and conclusion

Accumulating evidence that active portfolio managers do not achieve consistently superior performance has led to a rapid growth in index funds with low turnover and reduced management costs. For the most part, these funds track the performance of major market indexes and therefore tend not to be invested in the stocks of very small firms. This growth in index funds has forced active managers to hold a higher proportion of small-firm stocks than they otherwise would and, since they need to be induced to do this voluntarily, the expected return on these stocks must rise. We have argued that the portfolio adjustments forced on active managers are in practice very small and, since small-firm stocks are fairly good substitutes for large-firm stocks, the effect of index funds on required returns is likely to be no more than several basis points.

If market indexes are used as benchmarks for measuring the performance of professional active managers, then index stocks become effectively riskless for these managers and they need to be induced to hold the remaining stocks. Unlike index-fund managers, these active managers are not totally averse to holding non-index stocks, and so the incremental effect on prices of benchmarking is likely to be less than if these funds were formally indexed.

Most empirical studies of the effect on prices of index composition cannot distinguish the effect of index funds from that of benchmarking or possible information effects. Chan and Lakonishok suggest that membership of the S&P index has had a substantial effect on prices in recent years,

<sup>(1)</sup> For the All-Share index, the cumulative raw returns are +0.9% for index additions and -4.2% for deletions. (2) For the FTSE 100 index, the cumulative raw returns are +0.4% for index additions and -3.1% for deletions.

<sup>(3)</sup> One possible explanation is that stocks that are deleted from the index are likely to be smaller than additions. If an index is weighted by market value, then the returns on the index are more heavily influenced by larger companies, so that the abnormal returns on the smaller-cap stocks are likely to be larger in absolute terms than those of the larger-cap stocks. I am grateful to Elroy Dimson for this observation.

while Goetzmann and Massa find that flows into index funds have also had a marked cumulative price effect. However, it is difficult to reconcile these results with studies of the effect of additions or deletions to the index. In the United States these have typically found a price impact of around 3%, which would imply a shift in required returns of a few basis points. Our sample of changes to the FTSE All-Share and FTSE 100 indexes from 1994 to 1999 indicated that in both cases an addition to the index resulted in a negligible rise in price. Deletions, however, were associated with an eleven-day cumulative abnormal return of -4.5% for All-Share stocks and -2.0% for the FTSE 100 index. If permanent, these returns suggest that index deletions result in a small increase in the required return on equity for the affected firms. However, the fact that abnormal returns are observed for both indexes suggests that the effect is not simply due to the growth of index funds or performance benchmarking.

#### References

- Beneish, M D and Whaley, R E (1996), 'An anatomy of the 'S&P 500 game': the effect of changing the rules', *Journal of Finance*, Vol 51, pages 1,909–30.
- Brennan, M J (1993), 'Agency and asset pricing', unpublished paper, UCLA.
- Chan, L and Lakonishok, J (1993), 'Are the reports of beta's death premature?', *Journal of Portfolio Management*, Summer, pages 51–62.
- Cuoco, D and Kaniel, R (1999), 'General equilibrium implications of fund managers' compensation fees', unpublished paper, The Wharton School, University of Pennsylvania, May.
- Dhillon, U and Johnson, H (1991), 'Changes in the Standard and Poor's 500 list', Journal of Business, Vol 64, pages 75-85.
- **Dimson, E and Marsh, P R (1999),** 'Murphy's law and market anomalies', *Journal of Portfolio Management*, Vol 25, pages 53–69.
- Edmister, R O and Graham, A S (1994), 'Excess returns of index replacement stocks: evidence of liquidity and substitutability', *Journal of Financial Research*, Vol 17, pages 333–46.
- Goetzmann, W N and Garry, M (1986), 'Does delisting from the S&P affect stock price?', *Financial Analysts Journal*, Vol 42, pages 64–69.
- Goetzmann, W N and Massa, M (1999), 'Index funds and stock market growth', NBER Working Paper, No 7033, March.
- Harris, L and Gurel, E (1986), 'Price and volume effects associated with changes in the S&P 500 list: new evidence for the existence of price pressures', *Journal of Finance*, Vol 41, pages 815–29.
- Jain, P (1987), 'The effect on stock price from inclusion or exclusion from the S&P 500', *Financial Analysts Journal*, Vol 43, pages 58–65.
- Lamoureux, C G and Wansley, J W (1987), 'Market effects of changes in the Standard and Poor's 500 index', *Financial Review*, Vol 22, pages 53–69.
- Lynch, A W and Mendenhall, R R (1997), 'New evidence on stock price effects associated with changes in the S&P 500 index', *Journal of Business*, Vol 70, pages 351–83.
- Pruitt, S W and Wei, K C J (1989), 'Institutional ownership and changes in the S&P 500', *Journal of Finance*, Vol 44, pages 509–13.
- Shleifer, A (1986), 'Do demand curves slope down?', Journal of Finance, Vol 41, pages 579-89.
- Thunhurst, J (1999), 'Indexation: the phantom menace for the smaller companies?', *Professional Investor*, October, pages 10–11.
- Woolridge, J R and Ghosh, C (1986), 'Institutional trading and security prices: the case of changes in the composition of the S&P 500 index', *Journal of Financial Research*, Vol 9, pages 13–24.

### **Private equity: implications for financial efficiency and** stability

#### By Ian Peacock and Stuart Cooper of the Bank's Domestic Finance Division.

Private equity has become an important source of finance in recent years for firms wanting to undertake a major restructuring or capital investment. Previously, its increased use was mainly associated with the 'back to basics' policy of many large companies and the consequent sale of non-core subsidiaries. Private equity investment houses have, however, diversified into financing other types of transaction. In doing so, they have achieved some attractive rates of return on amounts invested, which has led to an increase in the funds at their disposal.

This article<sup>(1)</sup> describes the current state of the UK private equity market. It also considers the extent to which private equity promotes efficiency by facilitating the 'shake-up' of businesses, and whether the success of investment houses in attracting substantially increased funds for investment poses any threats to financial stability. Private equity comprises equity investment in all types of unquoted companies, whether provided by individuals, funds or institutions.<sup>(2)</sup> The article concentrates on larger transactions (particularly management buy-outs and buy-ins of over £10 million), and excludes start-up and early-stage venture capital finance, which in effect forms a distinct market with different characteristics.<sup>(3)</sup>

#### **Recent trends in private equity**

Despite many individual differences, private equity investments, particularly the larger ones, have the following features in common:

- A private equity house purchases a major stake in the share capital of a business (often jointly with the managers of the business); sometimes it purchases the entire share capital.
- Injection of equity is usually accompanied by substantial borrowing, so that the business has a highly leveraged capital structure.
- Change of ownership and financial restructuring is frequently accompanied by the installation of a new senior management team, the adoption of a new strategy or a major capital investment.
- The private equity house aims to sell its shareholding typically after two to five years (though sometimes longer), usually by way of a trade sale or listing.

Although private equity investors typically acquire a controlling stake in businesses, they do not see themselves as long-term shareholders. Their role is rather one of

providing support through periods of major changetypically lasting up to five years-after which they will sell their stake in the business, aiming to receive a high return for their investment risk during the period of change.

The availability of private equity has grown substantially in recent years. The annual amount invested by members of the British Venture Capital Association (BVCA), which includes virtually all the major private equity houses based in the United Kingdom, almost quadrupled in the six years to 1998, when funds invested were £4.9 billion (see Chart 1).

Funds raised by BVCA members have grown more erratically, with a particularly large amount in 1997, when some £6.5 billion was committed for private equity investment opportunities. Funds raised in 1998 were lower, at £5.5 billion, although the total rises to just over £10 billion when funds raised by US investment banks are included.<sup>(4)</sup> The heightened investor interest in private equity largely reflects the high returns that have been earned in recent years. Investors are not just re-investing the monies from maturing funds, but appear to be allocating a larger part of their portfolios to private equity.

Specialist investment houses are responsible for virtually all investments of private equity. Most are independent venture

<sup>(1)</sup> Based on discussions with various market participants, to whom the authors are most grateful, and on an earlier Bank of England internal paper by Mark Pratt and Ian Peacock. (2) According to the British Venture Capital Association's definition.

For a description of this market, see Finance for small firms-a seventh report, Bank of England, (3)January 2000.

These US funds are generally for investment internationally, with an indeterminate proportion likely to be invested in the United Kingdom.

capital firms, but some are owned by financial institutions such as banks. They raise finance from a range of investors, the most important being pension funds and insurance companies subscribing to special funds set up for this purpose, although the latter were less important in 1998 (see Chart 2).







Source: BVCA.

(a) By BVCA members.(b) The definition of funds raised has changed over the period.

#### Chart 2 Sources of funding by type of investor



Much of the finance subscribed to UK-managed private equity funds now comes from overseas investors. In 1998, funds raised from UK insurance companies and pension funds both fell, so that funds raised from all UK sources represented only about 30% of the total (see Chart 3), and from UK insurance companies and pension funds, only 13%. Some market participants believe that UK institutions are unlikely to regain their position as major funders of UK private equity in the near future.

#### Chart 3 Private equity: funds raised by source



American investors are particularly significant. American private equity business has become much more competitive in recent years; most US transactions are auctioned, and there are many potential private equity investors and trade buyers bidding for each company to be sold. The United Kingdom is regarded by American investors as a gateway to the wider European market, which is thought to offer considerable potential. As well as the institutional investors themselves, this has also attracted a number of American law firms and investment banks, and, most important, several major American private equity houses have set up operations in London. Mainland European investors (for example Dutch pension funds) have also become significant sources of finance for funds managed by UK-based houses, which are increasingly turning their sights to opportunities in continental Europe.

The main types of transaction in which private equity (as defined here) is used are:

- management buy-outs and buy-ins (MBOs and MBIs);
- public to private transactions;
- the internal expansion of established businesses; and
- company turnarounds.

Chart 4 presents a breakdown of UK investment by BVCA members during 1998, showing the importance of MBOs and MBIs compared with other forms of private equity, such as early-stage and expansion finance. Separate data, compiled by the Centre for Management Buyout Research (CMBOR), BZW Private Equity and Deloitte & Touche Corporate Finance, show that public to private transactions represented 18.8% of MBOs and MBIs by value in 1998 and that this percentage has fluctuated widely over the last ten years.

#### Chart 4 UK private equity investment by financing stage



Source: BVCA Report on Investment Activity 1998, page 11.

#### The private equity market

Private equity in the United Kingdom grew from venture and development capital, providing start-up and expansion finance for established businesses finding it difficult to go public, or not wishing to do so. During the mid to late 1980s, there was a rapid expansion of MBOs and MBIs, some of which were public to private transactions, but the volume of these deals fell sharply following the failure of some very large transactions, including Magnet and Isosceles. During the early 1990s, smaller MBOs and development capital formed the bulk of the business. There has been further change recently, with the reappearance of both larger MBOs and public to private deals. Development capital, which traditionally provided finance for manufacturing industry, has also increasingly been directed towards services, including technology. A recent innovation is the so-called 'buy and build' transaction, whereby a private equity house will buy different firms in the same sector with a view to merging them and achieving the benefits of synergy as a result.

Private equity houses tend to specialise in types of transaction where they have particular expertise, or in sectors of the economy that they know well. Houses also differ in the size of transactions that they undertake and in the degree to which they become involved in the strategy and management of the businesses in which they invest. A common characteristic of private equity houses, however, is that they monitor closely the performance of the businesses in which they have a stake and will almost always be represented on the board.

Private equity houses work closely with banks and mezzanine houses,<sup>(1)</sup> as equity is usually just part of a wider package of finance. Indeed, most of the larger private equity transactions involve more debt than equity, since, as is

explained below, leveraging is deliberately used to boost the returns on equity. In turn, the debt can be sub-divided into senior and mezzanine layers.<sup>(2)</sup> Mezzanine debt lies between senior debt and equity in terms of priority for repayment. Lenders accordingly look for a return of some 15%–20% a year or more, which includes the benefit of equity warrants. Since it is a less expensive alternative to equity, which seeks returns of at least 25%–30% (see below), the use of mezzanine finance allows financing structures to be more highly leveraged, with a corresponding increase in risk. In the United Kingdom, mezzanine finance for all but the largest transactions is usually provided by specialist funds and banks.

Larger transactions are increasingly being financed partly through European high-yield bond issues.<sup>(3)</sup> Amounts issued in this market during the first ten months of 1999 totalled around \$14 billion, according to Morgan Stanley Dean Witter, with some major recent transactions, including Kappa and Hillsdown, incorporating substantial high-yield debt tranches. There are signs that high-yield debt has become a regular aspect of European private equity financings, though there remain aspects of this market (for example, security, subordination and documentation) which have yet to be standardised.

Chart 5 shows the average proportions of capital represented by debt, equity, and other forms of finance for MBOs/MBIs undertaken in the United Kingdom, and how this has changed over the course of the 1990s. Higher corporate valuations, associated with rising stock markets, and a greater willingness by banks to provide senior debt and by shareholders who are selling to accept subordinated loan notes in part payment, all led to an increase in the leverage of the average UK MBO/MBI during 1997 and the first half





(1) There are a number of specialist mezzanine debt providers and banks that provide mezzanine debt either independently or in association with senior debt. Mezzanine debt is usually in the form of subordinated loans, preferred stock or a combination of the two.

- (2) See Pratt, M J and Crowe, A E (1995), 'Mezzanine finance', *Bank of England Quarterly Bulletin*, Vol 35(4), pages 370–74.
- (3) High-yield debt, like mezzanine debt, lies between senior debt and equity in terms of repayment priority.
of 1998. The proportion of the average MBO/MBI financed by equity fell from 42% to 27% between the second half of 1996 and the first half of 1998. This trend was reversed during the second half of 1998 and early 1999, as banks became more cautious about lending for highly leveraged transactions and the high-yield debt market became inactive. Though the movement towards lower equity resumed during 1999, there does appear to be a resistance level at around 25%-30%.

The investment funds established by private equity houses are usually closed-ended,<sup>(1)</sup> with a planned life-span of ten to twelve years. The fund will be invested in the first four to five years (or sometimes longer), and the investments gradually liquidated thereafter, with the proceeds returned to investors. The nature of the investments means that most funds do not pay an annual dividend but instead make a distribution whenever an investee company is sold or refinanced. Most private equity houses aim for an internal rate of return of 25%–30% a year to investors. Many have, however, been able to achieve annual returns of more than 30% in the past five years.

Private equity houses are remunerated in various ways for managing investment funds. They receive an annual fee, which may be, say, 0.5% on funds committed but not yet invested and, say, 1.5%–2% on amounts invested. In addition, they receive a payment linked to realised profits. This is called 'carried interest' and is usually 20% of any profit (sometimes in excess of a floor). It is designed to align the interests of fund managers and investors, and is paid to the management companies for distribution to themselves and to the individual managers within these companies.

# The returns on private equity and financial efficiency

The development of an active private equity market has facilitated the restructuring of businesses. It has been of particular benefit to private and smaller listed companies which, with the increasing dominance of institutional investors and their focus on larger listed companies, have found listing to be less attractive than before. The high returns that investments have earned in recent years have been partly due to economic buoyancy and rising share prices, but they have also probably reflected improvements in the efficiency of businesses in which investments have been made. This section considers the different ways in which private equity investment houses have been able to achieve these improvements.

Leverage itself, in a perfect market and in the absence of taxation, does not increase the value of enterprises. Yet investors who are regular users of leverage have constantly produced very high returns on their investments<sup>(2)</sup> (see the box opposite). How is this apparent contradiction resolved?

The comparatively high returns on private equity can be attributed to:

- the direct effects of leverage;
- identification of businesses that are undervalued;
- improvement to operational efficiency; and
- rising equity markets.

## The direct effects of leverage

Because interest costs are a tax-deductible expense, whereas dividends only carry a partial tax credit to investors (withdrawn in the United Kingdom since 1997) and retained earnings do not reduce tax at all, leveraged companies can build up more value than non-leveraged ones. Some private equity transactions place considerable importance on tax shields, although it is rare to find a transaction that is proposed on the basis of tax savings alone.

Another factor that could be relevant is that the interest rate on the debt sometimes does not fully reflect the risk taken in leveraged transactions. For example, the losses sustained on US high-yield debt in the early 1990s suggest that the return on this type of debt did not compensate for the risk. To the extent that this is correct, the return on equity may have been greater than was justified by the risk.

Though the direct effects of leverage, arising from tax effects and market imperfections, should not be ignored, the effect that leverage has on corporate behaviour through the incentive effects on management (see below) has probably made a much more important contribution to the equity returns earned.

## Identification of businesses that are undervalued

Private equity investors have become adept at identifying undervalued businesses, especially those with a reliable cash flow. One such class of business comprises subsidiaries of diversified companies which, perhaps because they were not central to their parent's strategy, have been starved of capital and/or good management. Options available to the group management include a trade sale or a flotation on the listed market, but the sale to the subsidiary's current management has for some years been a viable alternative. Between 1989 and 1999, 44% of UK MBO/MBIs of more than £10 million involved subsidiaries and divisions of UK parent companies.<sup>(3)</sup>

A second category of neglected businesses is smaller listed companies which their management and/or shareholders feel

<sup>(1)</sup> With fixed capital, rather than variable like unit trusts or open-ended investment companies.

<sup>(2)</sup> There is a voluminous literature on this subject, but see, for example, Brealey, R A and Myers, S C (1996),

<sup>Principles of Corporate Finance, Chapter 17.
(3) Between 1 January 1989 and 30 June 1999 inclusive. Source: KPMG Corporate Finance, September 1999.</sup> 

## How leveraging ratchets up the returns on equity

A simple example illustrates the basic driver of a private equity transaction, which is the ability to transform a stable non-growing cash flow into a high equity return over a limited period through the judicious use of leverage (albeit with an increase in equity risk).

The base case is a company with stable earnings before interest and tax (EBIT) of 100 and, initially, no debt. This company is not highly rated in stock market terms, so is available for sale at a multiple of 7 times EBIT, ie 700. If the company is financed entirely by equity, the return on that equity is 14.3% (= 100/700).

Year	1	2	3	4	5	6	7	8
EBIT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
interest	50.0	45.0	39.5	33.5	26.8	19.5	11.4	2.6
Starting senior debt	500.0	450.0	395.0	334.5	268.0	194.7	114.2	25.6
Ending senior debt	450.0	395.0	334.5	268.0	194.7	114.2	25.6	-71.8
Ending equity value	250.0	305.0	365.5	432.1	505.3	585.8	674.4	771.8

A private equity fund decides to buy the company for 700, financed as follows: 500 in senior debt and 200 in equity (similar to the average leveraging in the

are undervalued by the market. There has been widespread comment that many smaller companies do not obtain much benefit from listing: there is not much trading in their shares owing to patchy research and institutional indifference, and they face difficulty and expense in raising new capital. The trend towards more passive fund management through tracker funds may have also accentuated the lack of investor interest in smaller quoted companies.<sup>(1)</sup> These trends have prompted a number of companies to de-list since 1997. During the first nine months of 1999, there were 39 de-listings, totalling £3.7 billion,<sup>(2)</sup> compared with 27 de-listings totalling £2.7 billion during the whole of 1998 and an average of less than 5 per year between 1990 and 1997.

Senior management have been the driving force behind many de-listings (although private equity houses have also initiated some). They see purchase by a private equity fund as a foundation for their company's development, which might also allow them to retain their jobs and acquire a stake in their company. Private equity ownership is not, however, an enduring alternative to listing. Private equity houses are concerned primarily with a business's performance over the following two to five years and how they can generate additional shareholder value by way of leveraging and operational efficiencies. Investors in the public market do not look at performance over such a specific period. MBO/MBI market). The senior debt pays interest at 10% per annum. The table shows the development of the company with this capital structure. In year 1, half of earnings (50) go to the payment of senior debt interest (ie interest cover is 2 times). This leaves 50 to repay senior debt (ignoring tax). Gradually over the years, the senior debt balance falls until, at the end of year 8, all senior debt is repaid and there is a deposit balance of 71.8. The sale price is assumed to be exactly the same as the purchase price, ie 700; no improvements have been made in the operations of the company so no change in price is merited.

The bottom line shows the internal rate of return (IRR) to shareholders when they come to sell their holdings. The effect of leverage in isolation, ie without any improvement in profitability or in the price/earnings ratio, produces an equity IRR of between 18% per annum and 25% per annum, depending on the period over which the investment is held. This compares with the non-leveraged return of 14.3%. However, risk has also risen as a result of leverage in the company. For a four-year investment, which is a typical holding period for this type of investment, the equity IRR is 21.2%.

### Improvements to operational efficiency

Improvements to operational efficiency can take a number of forms. Private equity houses work closely with the senior management of the businesses they are supporting and rely on them to deliver efficiency improvements. If they do not have confidence in existing management, they will install replacements and will ensure that there are appropriate incentives by way of an equity stake, share options or a profit-related bonus.

Management will focus on both cost reduction and revenue enhancement. The first is perhaps easier to achieve in the short run, for example by cutting back on working capital, eliminating non-operational assets, such as prestige offices, or reducing head office staff. Indeed, leveraging is itself a strong incentive to cost-cutting exercises, which make an immediate, albeit one-off, contribution to cash flow and may allow an early reduction in borrowing. There is a danger, however, that cost-cutting taken to excess may damage the long-term survival of a business.

There are many possible routes to higher revenues—for example, more aggressive pricing, more effective marketing and re-designed products—but they usually involve a commitment of cash, which is a scarce resource in a leveraged company. Sustained improvements in revenue growth are more difficult to achieve and ultimately must stem from fundamental improvements in the way a

<sup>(1)</sup> The magnitude of this effect is, however, debatable.

<sup>(2)</sup> Sources: CMBOR, BZW Private Equity and Deloitte & Touche Corporate Finance.

## The risks from leveraging

The previous box showed how leverage can increase the returns to shareholders, even if earnings remain static. However, leverage also magnifies their losses should earnings fall. This is illustrated by a simple example.

Case A shows the effect on the previous example of a breakeven year in year 2 and EBIT of 50 in year 3, with earnings recovering to a stable 100 thereafter. As a result, it is assumed that the sales multiple declines from 7 times to 5 times continuing earnings. Both of these assumptions are arbitrary. The decline in earnings is very steep although, as EBIT is the difference between income and expenditure, a comparatively small change in either or both of these measures can have a disproportionately large effect on EBIT. The change in the sales multiple reflects the lower long-term earnings expectations that would probably follow a two-year recession.

#### Case A

Year	1	2	3	4	5	6	7	8
EBIT Senior debt	100.0	0.0	50.0	100.0	100.0	100.0	100.0	100.0
interest Starting senior	50.0	45.0	49.5	49.5	44.4	38.8	32.7	26.0
debt	500.0	450.0	495.0	494.5	444.0	388.3	327.2	259.9
debt Ending equity	450.0	495.0	494.5	444.0	388.3	327.2	259.9	185.9
value IRR	250.0	5.0	5.5	56.1	111.7	172.8	240.1	314.1
IIIII	25.0	-04.2	-09.0	-21.2	-11.0	-2.4	2.0	5.0

The first year is exactly as before (the sale price has been kept at 700 for this one year to reflect the fact that everything appears to be going normally). However, the effect on a leveraged company of the elimination of EBIT in the second year is dramatic. In Case A,

business is managed. Some private equity houses have become more proactive in identifying firms to buy, initiating merger and acquisition proposals, and involving themselves in day-to-day management of the companies. In order to carry out these functions properly, the investors themselves have had to acquire specialist management and industry expertise, even though this increases their own cost base.

Private equity promotes efficiency in three ways. By judicious use of leverage, it encourages a capital structure which maximises post-tax return for a given risk appetite. Second, by identifying inefficiencies in the pricing of businesses, it helps to produce a more efficient allocation of resources. Third, private equity, combined with leverage, encourages operational efficiency, particularly cash-flow efficiency.

It is, however, becoming more difficult to generate returns in the first two ways. Perceptions of maximum prudent degrees of leverage among private equity houses and senior debt goes back to near its original facility amount of 500. The company almost certainly breaches its covenants and there would probably be a payment default, which would entitle lenders to seek repayment. Although the downturn in earnings is short (albeit steep), the equity value is almost completely wiped out by the reduction in the earnings multiple. The IRR is negative until year 7, despite the resumption of EBIT at 50 in year 3 and 100 thereafter. In practice, the company would be reliant on its bankers for several years and, even if supported, would take a very long time to reach a satisfactory IRR.

Case B shows a company that is leveraged at only 20%, which is about average for the UK corporate sector. The impact of leverage in this case is much less during years 2 and 3 than the more highly leveraged company in Case A and, although the equity loses some value, there is little threat to the company's continued existence. After year 4, by which time the IRR is positive again, deposits begin to build up quickly and equity returns are very dependent on the deposit rate.

Case B					
Year	1	2	3	4	
EBIT Senior debt interest Starting senior debt Ending senior debt/deposits Ending equity value IRR	$100.0 \\ 14.0 \\ 140.0 \\ 54.0 \\ 646.0 \\ 15.4$	0.0 5.4 54.0 59.4 440.6 -11.3	50.0 5.9 59.4 15.3 484.7 -4.7	100.0 1.5 15.3 83.1 583.1 1.0	

In summary, an unexpected decline in earnings, particularly during the early years of a leveraged transaction, has a very large effect on equity returns.

investors in listed companies appear to be converging. In addition, vendors now guard against unduly low selling prices by the use of auctions and by retaining a residual stake in businesses that are sold off. Consequently, the likelihood is that private equity houses will increasingly have to look to operational efficiencies for their returns. They are becoming less financial engineers and more hands-on shareholders, and are developing the relevant skills to do this. To this end, many houses are starting to employ more people with specialist management experience and technical knowledge. They are also seeking to secure economies by combining businesses in the same sector. The distinction between private equity houses and non-financial firms which seek to create value by takeover of under-performing firms is becoming more blurred.

## **Risks associated with the private equity market**

The risks of private equity to investors have, in the past, been given more prominence than the efficiency benefits, partly because of certain highly publicised MBO failures in the late 1980s.<sup>(1)</sup> Although there is now greater expertise in the market, so that some of the past mistakes are less likely to be repeated, there remain considerable risks in this type of financing.

## The risks from leverage

Private equity, like all investment, is based on projections for costs and revenues, which, no matter how well researched, are subject to uncertainty. Leverage, however, makes a business susceptible to comparatively small divergences between actual and projected revenues and costs. The box opposite shows how, with a highly leveraged financial structure, a short-lived, albeit steep, decline in earnings can eliminate the returns to shareholders. Leveraged structures are most exposed during the early years of a transaction, before there has been a chance to repay borrowing.

The multi-layered financial structure of many private equity transactions means that when difficulties do occur they may be difficult to correct, because the holders of different types of debt and equity may have conflicting interests. Discussions on restructuring the finances of a business will typically include senior bank lenders, as well as any mezzanine lenders, and it is inevitably harder to obtain a consensus on one way forward, the more interests that are involved.

Transactions where loans have been widely syndicated, or where mezzanine finance has taken the form of a high-yield bond (which is becoming more frequent), are therefore likely to be especially difficult to restructure.

#### The overhang of uninvested funds

In 1998, approximately £5.5 billion of new equity was raised by members of the BVCA for private equity investment in the United Kingdom and continental Europe. A further £4.7 billion was raised by US houses which are members of the BVCA. If, say,  $\pounds 7$  billion<sup>(2)</sup> is invested in the United Kingdom with an average debt to equity ratio of 3:1, this would imply that there is an additional £28 billion of leveraged transactions in prospect. Competition to invest this overhang of funds is leading many UK and US-based private equity houses to look for investment opportunities increasingly in mainland Europe, where prospective returns are thought to be higher. Equity houses are also becoming more active in identifying possible investment opportunities themselves, rather than waiting for deals to be offered to them. More fundamentally, the pressure to invest may be tempting investment houses to relax their investment criteria-ie to write deals which promise a lower return and/or entail more risk than they had previously been willing to accept.

Whether houses succumb to this pressure depends largely on the incentives that they face. There is short-run financial motivation for funds to be invested, insofar as houses receive a higher fee on invested funds than on committed funds. But investment houses are concerned about the threat to their reputation if the deals they write subsequently fail to live up to expectations (and of course the carried interest accruing to fund management companies, and to the individual managers within them, is an important motivator).

Early in 1998, it did appear that the UK private equity market was showing signs of overheating. Some transactions were completed at prices of around 13 times cash flow,<sup>(3)</sup> and some senior banks were prepared to lend up to 8 times cash flow. Such leverage ratios had not been seen since the late 1980s. Furthermore, some lenders who had little or no experience of the leveraged market began to be active in it. The subsequent worldwide financial turbulence resulted in banks being more cautious about lending for leveraged transactions. It also brought about the temporary closure of the fledgling European high-yield market. These developments caused difficulty for the financing of a few transactions, but they seemed to prevent any serious 'bubble' developing. The more stable economic conditions prevailing in 1999 were associated with a strong recovery in volumes of private equity transactions and a revival of European high-yield debt issues. There is little evidence of new, inexperienced lending and investing institutions contributing to overheating at present. However, the volume of money and the competition for new transactions is such that even some experienced houses appear tempted to take more risks. Recent transactions suggest that some banks are again taking very large debt and equity positions in highly priced acquisitions. There is also concern that shortages of skilled personnel are leading to a decline in professional standards in some organisations.

This trend is unlikely to result in a threat to overall financial stability, assuming that the overhang of funds remains at or around the level of £25 billion–£30 billion, as indicated above. While this could represent a very large increase in the size of the United Kingdom's domestic merger and acquisition business (which totalled £29.5 billion in 1998),<sup>(4)</sup> it is equivalent to around 1% of outstanding UK bank lending at end-December 1998, so total financing of UK private equity deals remains a relatively small proportion of UK banks' total business.

On occasion, however, there may be a risk of distortions in particular parts of the market, reflecting sudden swings in investors' sectoral preferences (eg the retail sector in the United Kingdom ten years ago and, from time to time, the media sector in the United States).

See Jackson-Cookland, C, Crowe, A E and Pratt, M J (1998), 'Highly leveraged transactions: management buy-outs', *Bank of England Financial Stability Review*, Issue 4, pages 57–64.

<sup>(2)</sup> The precise amount cannot be calculated from published data.

<sup>(3)</sup> Cash flow as measured by EBITDA, ie earnings before interest, tax, depreciation and amortisation, and therefore ignoring working capital changes.

<sup>(4)</sup> The figure refers to total acquisitions and mergers in the United Kingdom by UK companies. Source: Office for National Statistics, *Financial Statistics*, December 1999.

## Conclusions

The growth in private equity investment in recent years has been strongly associated with the policy of many large companies to sell non-core subsidiary businesses. This has created a financing need that has partly been met by private equity. It has, in particular, helped businesses that have been neglected by their owners (or by the listed market) to raise capital for expansion. Private equity investors have, in effect, assumed the risks of supporting businesses through a period of major change. They are not long-term shareholders, however, and, for this reason, the private equity market is not an enduring alternative to a listing for the companies in question.<sup>(1)</sup>

The private equity market is international. UK-based investment houses obtain much of their funding from overseas, especially from the United States. A number of American investment houses have also set up offices in London, as Europe is seen to offer attractive investment opportunities. The UK investment funds themselves are increasingly investing in continental Europe and to some extent in the United States.

There would seem to be no shortage of investment opportunities for private equity funds. Most large companies continue to maintain a 'back to basics' policy, which entails the disposal of non-core businesses. More fundamentally, technological and economic change creates continuing pressure for the restructuring of both companies and industries. The closer integration of the European market is, in particular, likely to give rise to considerable opportunities for restructuring and hence for private equity investment. The concerns that many smaller companies have expressed about the benefits of a listing have also opened up a new area for private equity investment. In short, the opportunities for private equity investment are unlikely to dry up in the foreseeable future.

Returns of more than 30% a year have attracted substantially increased inflows to private equity funds. These funds have intensified competition among investment houses, which may depress prospective returns. At the same time, the near-universal use of auctions to sell businesses has narrowed the scope for private equity investors to buy into businesses at clearly advantageous prices. These developments are putting pressure on the returns to be expected from private equity investments. They also mean that returns will, to an increasing extent, depend on investors bringing about efficiency improvements in the businesses in which they invest.

The pressure to maintain rates of return is changing the way that private equity houses operate. Many are becoming more pro-active in identifying investment opportunities, and have begun, for example, to look to mainland Europe. Some houses are becoming more involved in the operations of the businesses in which they invest. They are also becoming more ambitious in the scope of their transactions, looking to engineer mergers of companies to achieve cost savings. This will require them to acquire new skills—for example, in technical knowledge and hands-on industrial management.

Private equity is a relatively risky form of investment insofar as it typically relies on leverage for high returns. The current large overhang of uninvested funds has encouraged private equity houses to assume further risk in an effort to maintain their earlier, enviable track record. There were signs early in 1998, for example, that the prices paid for businesses by equity houses were on an upward trend and that structures were becoming more highly leveraged. However, the increased caution of banks in lending following the global financial turmoil of 1998 caused a cooling off, and a temporary closure in the nascent European high-yield debt market. The less turbulent conditions in 1999 encouraged a revival of high-yield debt, which is beginning to show signs of becoming an established form of finance. Some ambitious and complex financings have been seen recently and the pace of the market has increased, though some comfort might be taken from the fact that most of the lenders and investors are experienced professionals, not newcomers to the market.

The development of the private equity market and the levels of gearing that have accompanied it could, in principle, weaken the financial position of lenders. At present, the market is not large enough for this to appear to be a significant threat.

## Back to the future of low global inflation

In this speech,<sup>(1)</sup> DeAnne Julius, member of the Bank's Monetary Policy Committee, considers the possible effects on UK inflation of intensified competitive pressures on the supply side of the economy, stemming from globalisation, new technologies and greater price transparency. She suggests that the direction of their impact will be disinflationary, in contrast to the inflationary supply shocks of the 1970s and 1980s, but that the size of this impact will be difficult to discern from the data until many years hence. Under conditions of such uncertainty, she concludes that monetary policy makers should be sceptical of forecasts built on past relationships, should listen and learn from real-time experience, should pay special attention to prices and, finally, should be pre-emptive, but delicately so.

## Introduction

I am indeed honoured to be here to present the first of these Global Finance Lectures since the renaming of the series after my great friend and colleague, Maxwell Fry. In fact, it was Max who first contacted me with the invitation to speak here last January, and it was his infectious enthusiasm that rapidly won me over to finding an appropriate space in an already crowded diary. Subsequently I had the good fortune of collaborating with Max and several of his colleagues at the Bank of England's Centre for Central Banking Studies (CCBS) on a volume of papers for our annual Central Bank Governors' Symposium last June. Max has always been a key figure in these Symposia. Even before he became director of the CCBS, he was the intellectual leader and instigator of the topics covered by the 50+ central bank governors who attended them. Max has enjoyed ranging far and wide over his field, and he is uniquely capable of doing so. But he is also great fun-and a great friend. The flip side of his intellectual curiosity is the warmth of his personality. Many of the governors who attended those Symposia know him as a friend, as well as an advisor. And it is that combination of lively intellect and personal warmth that makes him so inspirational. He may not physically be here today, but he is very much here in our thoughts, and best wishes go to him and his family this afternoon.

Max encouraged me, as you might expect, to use this speech to explore new ideas, to challenge conventional wisdom. That's not something that comes easily to a central banker, but then I'm rather a recent convert to this profession, so perhaps I haven't yet lost my knack! I did spend several formative years, earlier in my career, using scenario planning techniques precisely to get away from conventional thinking and to help private sector decision-makers 'think the unthinkable', as we called it then. Conventional thinking can be deceptively dangerous when the world is changing. In such times, clinging to old paradigms is at least as risky as embracing new ones before their validity can be fully established. And my thesis today is that some elements of the so-called 'new paradigm' growth theories are simply modern incarnations of the economic trends of an earlier era. Other elements clearly strain credulity. But if I am right that the decades of the 1970s and 1980s were the exceptions rather than the norm, then we must particularly guard against using the paradigms and parameters from those 20 years to shape our views about the present period and our projections for the future.

In my current role as a member of the Monetary Policy Committee (MPC), I spend most of my days thinking about the demand side of the economy. We model that using equations that have been calibrated on data going back to the mid-1970s or early 1980s. Our assigned task on the MPC is to deliver price stability. The Government has set our operational target for this as  $2^{1}/_{2}$ % annual inflation on the retail price index excluding mortgage interest payments (RPIX). To hit that target, we adjust interest rates in order to restrain or stimulate domestic demand whenever it appears that total demand, looking one to two years ahead, is likely to exceed or fall short of the supply capacity of the economy. Monetary policy can do very little to change the supply side. Our lever pushes on demand, and we generally take supply as given.

Today, however, I am going to step out of my usual central banker's preoccupation with demand and instead examine some of the longer-term changes that affect the supply side of our economy. Some of these are international developments. Some relate to new technologies. And some stem from changes in the labour market here in the United Kingdom. They all share two characteristics. First, the direction of their impact on UK inflation, at least over the medium term, is downwards. But second, the size of their impact will be very difficult to discern until many years hence. This is because they are gradual, structural changes whose effect on economic statistics will be overlaid with, and obscured by, the cyclical surges and slowdowns to which we devote so much time and attention. In other words, if we place too much faith in econometric models

(1) Delivered as the Maxwell Fry Global Finance Lecture at the University of Birmingham on 20 October 1999. The speech may be found on the Bank of England's web site at www.bankofengland.co.uk/speeches/speech57.pdf.

calibrated from the 1970s and 1980s, we won't know what's hit us until it's too late!

I'll return to that point when I conclude with what this all means for the United Kingdom. But first, I'd like to examine the key changes affecting inflation at the international level. My title, and my main focus, is on low *global* inflation.

## **Global inflation**

First, the facts. Global inflation has been low in the 1990s relative to the 1970s and 1980s. Chart 1 shows the inflation performance of three representative countries of the G7: the United States, the United Kingdom and France. Though inflation in the United Kingdom was worse than in the other two countries, all three suffered from double-digit rates of price increases for several years during that period. Inflation spikes coincided in the mid-1970s and again in the early 1980s. Britain and the United States had smaller inflation bursts in 1990. But since then, inflation has been well below 5%, not only in these three countries, but across the industrialised world and in most of the faster-growing developing countries.



This is largely explained by changes in the economic and policy environment in the 1990s. Some say we have been lucky. Or, perhaps more accurately, we have not been so unlucky as during the 1970s, with the wars and revolutions in the Middle East that resulted in the 1973 and 1979 oil price spikes. Those reduced growth and increased inflation worldwide, as central banks reacted cautiously and, with hindsight, sometimes wrongly in response to those unfamiliar supply-side shocks. Both companies and policy-makers have learned from that experience. Firms have shifted to energy-saving production processes, governments have increased taxes on oil consumption to encourage conservation and, as a result, industrialised countries are much less dependent on oil today than they were 20 years ago. These shifts are largely irreversible. In 1998, the oil price fell, in real terms, below the level it had been in the early 1970s prior to the Arab-Israeli conflict. Yet oil consumption rose very little, as the tax wedge paid

by consumers and the energy-saving technologies used by firms were unaffected. Similarly, the current surge in crude oil prices, if it were to persist, would have much less effect on economic growth and retail price inflation than did a similar rise in earlier decades. In the United Kingdom, for example, four fifths of the petrol price paid at the pump is actually tax. So if the price of crude oil doubles, the retail price of petrol would rise by, at most, 15%.

There have also been clear shifts in the policy environment since the inflationary failures of the 1970s and 1980s. Many governments have institutionalised their commitment to price stability with the creation of independent central banks. The United Kingdom is a prime, though certainly not the first, example of this. Our Monetary Policy Committee has been given a clear inflation target and the instrument independence to achieve it. Our decisions on interest rates are entirely unaffected by the dates of political party conferences or upcoming elections. The same is true of the new European Central Bank (ECB). Such independence has removed a possible inflationary bias which some have blamed for the persistence of inflation during previous decades.

Thinking on fiscal policy has also evolved. In the United States, the budget deficits that grew out of financing the Vietnam War and the later build-up of defence spending under President Reagan have been tamed and turned into surpluses. Public antipathy towards deficit spending is strong, and support is growing for 'investing' surpluses in the social security fund for future retirement benefits rather than reducing taxes or increasing current government expenditure. The result is low or no government borrowing. This creates room in the financial markets for more private sector borrowing and investment. At least in the United States, the combination of a tight fiscal policy and a relatively accommodating monetary policy is widely credited for the long economic upswing of the 1990s.

In Europe, fiscal deficits rather than surpluses are still the norm, but since the creation of the ECB the relationship between fiscal and monetary policy has become more explicit. The Growth and Stability Pact sets limits on member governments' budget deficits, and the financial markets react nervously if it appears that those limits might be breached. Under the UK system as well, the Government's inflation target provides a clear fulcrum on which the balance of fiscal and monetary policy rests. Interest rates are set to achieve the inflation target, taking into account the Government's announced fiscal plans. If those plans change significantly, and the inflation target remains fixed, then the appropriate level of interest rates will also change. This interdependence of fiscal and monetary policy is as well understood by the financial markets as it is by HM Treasury and the Bank of England. The decentralised decision-making that constitutes the global financial market place is the ultimate 'enforcer' of fiscal prudence and monetary discipline in all countries today. In that respect, it is the modern equivalent of the gold standard and fixed exchange rates.

Though the 1990s may seem like a new era of price stability, a longer historical comparison gives a different perspective. Before the late 1960s, low inflation was the norm rather than the exception (see Chart 2). It took World Wars or oil price shocks or (working in the opposite direction) the Great Depression to knock inflation off course. Throughout most of the late nineteenth century, price falls were common. This was not just because of the greater importance of commodities then; price falls occurred for manufactured goods too.





The supply-side changes in our economies today that are likely to affect inflation prospects over the next decade are broadly similar to those at work during the 50 years that ended with the First World War. Intensified international competition-what some call globalisation-and the spread of new technologies may be thought of, not as elements of a new paradigm, but rather as the current drivers towards the old norm of low global inflation. In my view, these two forces, plus greater price transparency, are the key supply-side changes that will affect global inflation outcomes. Those countries that embrace these changes actively are likely to achieve a more favourable inflation/growth combination than they managed during the 1970s and 1980s. Whether this better combination is transitory-lasting only another five to ten years-or more permanent will depend on whether these forces result in higher rates of productivity growth. But either way, understanding their possible effect on the inflation outlook now and for the next decade will be critical.

Let's examine the three supply-side changes in turn.

## Globalisation

Globalisation, to an economist, means the increasing integration of global product markets. To a businessman, it means global sourcing from the lowest-cost suppliers worldwide, a global investment strategy, and global competition putting downward pressure on output prices in home as well as host markets. To a consumer, it means global shopping with easy access to global products and global brands, whether on the high street or via the phone, fax or Internet.

Only the oldest and most traditional channels for globalisation—trade and foreign direct investment (FDI) are well captured in current statistics. The importance of trade, relative to GDP, has been growing since the end of the Second World War. For the world as a whole, the combined share of imports and exports in GDP rose from around 20% in 1950 to nearly 40% in 1992, and has risen further since then (see Chart 3). This reflects the success of GATT negotiations to remove trade barriers over that period, the quality improvement and cost reductions in transport and communications infrastructure, and the gains from specialisation as developing countries become important producers and exporters of many manufactured goods.



Interestingly, this trend has not been smooth, nor always upward, suggesting that structural changes—to the extent that they are linked to openness—tend to occur in waves. This is even more apparent in the UK data where it is possible to look further back in history. Chart 4 shows that the share of trade in UK GDP rose sharply between 1850

## Chart 4 UK trade share of GDP





and 1920, from 34% to 64%. It then fell back to a trough of 26% as a result of the Great Depression and the World Wars, before beginning the upward march from 1950 shown in Chart 3. But it was not until the 1980s and 1990s that the UK trade share has approached its 1920 elevation. In terms of globalisation through the trade channel, we have gone back to the future.

The FDI channel is more exciting and, particularly for the service sector, which now accounts for at least two thirds of output and jobs in most advanced economies, it is the more important vehicle for global competition. If you are in the retailing business, for example, the way to reach foreign customers is not through trade but through opening up shops in their cities. Often this is done through the purchase of, or an investment partnership with, a domestic retail chain. The current wave of merger and acquisition activity—not only in retailing, but also in insurance, banking, telecommunications and other major service industries—is bringing international cost-cutting techniques and serious price competition directly into large parts of the economy that were formerly rather distant from such global pressures.

Last year the United Kingdom was the second-largest recipient of inward investment, after the United States, and one of the most important outward investors worldwide. FDI inflows last year rose by \$26 billion to \$63 billion—accounting for more than a quarter of all direct investment into Europe (see Chart 5). Outflows rose by more, almost doubling to \$114 billion, and approaching US levels of \$133 billion. British companies are clearly very active in reaching foreign markets through direct investment, and global companies with headquarters elsewhere are raising the competition stakes here in Britain.

#### Chart 5 UK FDI flows



While the United States and Britain lead the pack, globalisation through FDI has been one of the most striking international trends of the 1990s. World FDI flows have increased sharply, rising more than threefold between 1990 and 1998. Chart 6 illustrates the increasing importance of this channel for global integration: FDI flows have outpaced the 30% rise in world GDP and even the 65% rise in world trade. By last year, the total sales of inward investors in their host country markets were worth \$11 trillion, compared with total world exports of \$7 trillion.

## Chart 6 World GDP, trade and FDI



Globalisation means different things to different people. It has many channels and its measurement will never be precise. But there is little doubt that a renewed wave of globalisation is under way, which is spreading international competition into more sectors and engulfing producers in more countries. This has two important effects on the way inflationary pressures develop in any particular country. First, in a more integrated global economy, it is the world output gap, not domestic supply capacity, that matters for many prices. If there is spare world capacity in goods or services that can be transmitted either actually or virtually across borders, then prices will remain low or even fall. And supply bottlenecks at the global level are much less common than domestically, simply because of scale and the global availability of underemployed labour. Second, aside from capacity and business cycle considerations, the faster spread of best-practice management techniques and cost-reducing technologies through FDI means that efficiency inside firms and productivity at the economywide level should also increase.

## New technologies

The current wave of innovation in information and communications technology (ICT) is the second major supply-side development in the global economy. The effect of these technologies—which cover computing power, the development of the Internet, satellite communication, fibre optics and lasers—is to improve the speed, quality and accessibility of information flows at negligible marginal cost.

ICT has a huge potential to increase the efficiency with which capital and labour are combined in production. For many products ICT has already reduced design times, increased quality control, and shrunk the need for precautionary stocks in the production chain. Improved information flows enable firms to respond more efficiently to shifts in consumer preferences, and to customise products and services to their needs. The speed and low cost of information transfer has led to greater outsourcing by producers to the cheapest global supplier, spurring and speeding the globalisation process. As Chart 7 shows, while it took 36 years to achieve 50 million users for radio, 13 years for TV, and 16 for PCs, it has taken fewer than 5 for the Internet!

## Chart 7 Years to achieve 50 million users



The Internet puts ICT directly at the service of the consumer. As shoppers, we can now compare the prices of standard goods and services online and either bypass the middleman and buy them directly or use that information to extract discounts from our local supplier. While my own forays into electronic shopping are so far limited to books, airline tickets and used cars, the price reductions achieved on those items have certainly whetted my appetite for more! As both consumers and search engines become more sophisticated, competitive pressures on prices and distribution margins will intensify and affect many more items in the retail price index.

Unfortunately, statisticians are lagging behind in measuring these new purchasing patterns. No country officially measures e-commerce in its national accounts yet, so estimates tend to be based on private surveys, which may not be representative. With that caveat in mind, e-commerce in the United States is estimated to be worth around \$35 billion, or 0.4% of GDP.<sup>(1)</sup> In the United Kingdom, BRMB Internet Monitor recently reported that £2 billion was spent online in the past twelve months-a tenfold increase from a year ago. In just six months, the number of people using the Internet for shopping rose by one third to 2.5 million; this now represents about a quarter of UK Internet users. Verdict Research estimates that online shopping in the United Kingdom will rise to 2.5% of retail spending in the next three years. Others have made higher forecasts. If US patterns of Internet penetration and use are

followed here with a lag, then e-commerce would reach 4% of GDP by 2002.

This is likely to intensify the downward pressures on retail margins, especially for goods which are easy to compare such as books. More than 2% of all books sold in Britain are already sold online. Prices are said to be 10%–50% below those in retail outlets. Capturing such transactions and prices in the official statistics will become increasingly important. The recent statement from the Office for National Statistics, that it is examining how it can include online shopping in the retail price index, is to be welcomed.

But the biggest impact of e-commerce will probably come through its effect on the ability of firms to reduce costs through outsourcing and more efficient supplier relationships. Currently, four fifths of e-commerce is business-to-business use rather than business-to-consumer, and this share is expected to remain stable as Internet usage rises. Again the United States appears to be moving faster than Europe. A recent study by Andersen Consulting found 77% of US senior executives agreeing that e-commerce is 'a significant part of the way we currently operate', while only 39% of European executives said so. But these percentages are growing rapidly. As Chart 7 shows, Internet use is spreading much faster than previous ICT innovations.

The effects are likely to be seen first on prices and margins, and then on productivity. Of this trio, only prices are measured in a reasonably accurate and timely way. Margins are estimated from input and output price series but do not take proper account of capital and labour inputs. Productivity is estimated indirectly from output and employment data, where the former are subject to large revisions years after they are first published. A recent staff research paper from the US Federal Reserve Board showed how monetary policy mistakes of the 1960s and 1970s 'could be attributed in large part to a change in the trend growth of productivity in the economy which, though clearly seen in the data with the benefit of hindsight, was virtually impossible to ascertain in real-time'.<sup>(2)</sup> Our successors at the Bank of England could be saying the same thing about us in ten years time if we rely too heavily on current productivity estimates when we have reason to believe that historical trends may be changing.

## **Price transparency**

The third structural change exerting downward pressure on inflation, relative to the 1970s and 1980s, is increased price transparency. Part of this is interwoven with the rise of ICT and Internet shopping as just described. But there are two other contributory factors. The first is low inflation itself. Stable prices overall make it easier for consumers to spot relative price increases, by removing the background confusion of high and variable general inflation. It is also

(1) 'e-commerce @ its best', September 1999, Report by Performance and Innovation Unit (PIU), Cabinet Office. (2) Athanasios Orphanides, 'The quest for prosperity without inflation', staff paper, Federal Board of Governors,

May 1999.

harder for producers to move off their 'price points', even when their costs are rising. The Bank of England's regional Agents report ubiquitous anecdotes from their business contacts about consumers becoming more price-conscious. 'They look, they have money in their pockets, but they don't buy unless they think it's a bargain.' Even in the banking sector, low nominal interest rates have meant more shopping around by savers and more complaints by consumer groups about the margins between banks' lending and savings rates. Margins of 2% or 3% are much more noticeable now when official rates are 5% or 6% than when they were 15%.

Price transparency in Europe is also being increased by the introduction of the euro. This will become even more apparent to consumers when euro-denominated notes and coins replace national currencies in just over two years time. Then it will become even easier to compare prices and make purchases in neighbouring countries. For companies, the removal of foreign exchange risk in dealing with purchasers and suppliers in other euro-zone countries has been widely anticipated. It is beginning to feed through into increased merger activity, although it is impossible to say how much of that is driven by the euro and how much by cyclical and other factors. There are already a few instances reported of contracts negotiated in euros even where one party is outside the euro zone, for example BMW with Rover suppliers in Britain. Whether Britain is in or out in the future, the consolidation of 15% of world GDP into a single currency brings greater price transparency to a large share of its market.

To summarise so far, there are three powerful and partly interconnected trends in the world economy at the turn of the century that can be expected to exert downward pressure on prices from the supply side: intensified globalisation; the rapid diffusion of ICT; and greater price transparency, due in part to the introduction of the Internet and the euro. These certainly will not remove the necessity for monetary policy makers to remain alert for signs of inflation, and to raise interest rates whenever it appears that prospective demand growth is excessive in relation to prospective supply. But they do imply that prospective supply will be more difficult to estimate from historical relationships, and that domestic price-setting behaviour will be more constrained than in recent decades by international competitive forces. Monetary policy can only influence nominal demand growth. The split of nominal growth between output and prices is determined by the bargaining outcomes between buyers and sellers, and between employers and employees throughout the economy. If global competitive forces bear down on domestic prices more strongly, then in the short to medium term domestic inflation will be lower and output growth higher. If those same forces drive improvements in domestic productivity, then a more permanent shift can be made to a higher growth path consistent with low and stable inflation.

Let's turn now to the United Kingdom. We live in an open economy, with a higher than average share of trade in GDP, where the absolute level of inward investment last year was second only to the United States, and where Internet use by business ranks seventh in the world.<sup>(1)</sup> On top of that, our exchange rate has been rather strong, at least against the euro and its constituent currencies, for the past three years. We should be feeling the chills of these global competitive winds more than most. What evidence is there that they are having an effect, first on our prices and second on our sustainable rate of growth?

## **Retail prices in the United Kingdom**

Recent UK economic performance has been impressive. Output has grown for 28 consecutive quarters over this recovery, the longest sustained expansion since recent records began in 1955. This has been accompanied by a fall in the unemployment rate to 4.2% on the claimant count measure-its lowest rate for nearly 20 years-or 5.9% on the broader Labour Force Survey measure. Since the recovery began, output growth has averaged 3% per year while inflation has averaged just 2.8% (see Chart 8). Based on past experience, many economists would have predicted that such high rates of growth and employment would generate high wage pressure and rising inflation. On the contrary, inflation has been broadly stable over the 1990s and is currently, at 2.1%, below the Government's target. The so-called headline rate has fallen to 1.1%—its lowest rate since 1963.



Though the overall inflation rate is a product of monetary policy, trends in individual price components can provide some insight into what lies behind the favourable split between growth and inflation in recent years. The degree to which policy needs to be tightened in order to keep inflation from rising depends on the strength of upward price pressure from wages and margins when unemployment is low and the economy is growing rapidly. Offsetting these 'bottom up' cyclical pressures are the 'top down' structural forces from global competition, new technologies and greater price transparency that I have already discussed. If these

(1) As measured by Internet hosts per thousand inhabitants, reported by the OECD Internet Software Consortium.

downward structural pressures are increasing, then they will limit or delay the rise in interest rates necessary to keep inflation from rising when domestic demand is strong.

The relative importance of cyclical and structural factors in price setting is rarely clear-cut, but micro and survey evidence, to which we now turn, can help to establish whether particular prices rise and fall with demand, or exhibit longer-term, structural behaviour.

The obvious place to look for structural pressures on margins through international competition is in the prices of goods that are both widely traded and traditionally purchased through retailers. Three examples are apparent among the major categories that make up the RPIX. Household goods exhibit a clear deflationary tendency since 1996, as shown in Chart 9, despite strong demand growth in that category for much of the period. Demand for textiles, clothing and footwear has seen some major ups and downs over the past five years, while prices have been flat or falling (see Chart 10). The picture for electrical goods is even more striking (see Chart 11). Prices have been falling over most of the 1990s, while demand has grown very strongly. Of course, part of the fall in electrical goods prices is probably explained by technical progress, but this picture is also consistent with an increase in global capacity in these sectors and competitive pressure on retailers. Temporary factors such as sterling's appreciation and the Asian crisis probably accelerated these deflationary trends, but they do not map cleanly onto them. And despite strengthening domestic demand, new retail competitors in these and other sectors such as food may cause these price declines to accelerate.

### Chart 9 Household goods



There is also evidence from the CBI survey of manufacturing firms on the weakening link between domestic capacity utilisation and prices. Chart 12 shows the falling trend of expected output prices since the mid-1990s, despite relatively high levels of capacity use at least between 1995 and 1998.

A third source of evidence on this point comes from the September 1999 survey carried out at the MPC's request by

## Chart 10 Textiles, clothing and footwear











the Bank's regional Agents on the question of structural changes in retailing. This is not a statistically robust national sample but rather a reasonably diverse collection of information by those with in-depth knowledge of the respondents' businesses. The Agents spoke with 102 firms covering retail goods and household services (such as insurance) across the country (see Chart 13). They asked about the extent of price discounting and the reasons behind it. We were trying to gain an insight into whether those reasons were structural or cyclical.





Confirming the picture in official statistics, the survey results showed that most of the pick-up in retail sales values over the past year had resulted from higher volumes, not higher prices. And more than half of all respondents reported larger or more frequent discounting over the past twelve months compared with a year ago (see Chart 14). Only 5% of the sample reported less discounting. Discounting had particularly increased for food, cars and clothing.

## Chart 14 Discounts over past year



Around two thirds of respondents cited either changes in consumer behaviour or new or existing competition as reasons for greater discounting—in other words, structural rather than cyclical changes were responsible (see Chart 15).

New competitors were particularly referred to by leisure and DIY contacts—less so by food and clothing retailers. However, the 'Walmart effect' is focusing minds in areas such as clothing, because of their global buying power, and the Internet is perceived as a growing influence driving down prices. Retail pricing points are an integral feature of the market and resistance to changing them is significant, especially as the customer wants to benchmark his/her bargain against a known price. Overall, this survey showed discounting to be a widespread phenomenon which is becoming an expected feature of the market, at least in sectors such as mixed retail, food and clothing. This reflects perceptions that consumers are now accustomed to looking for bargains, and retailers say that this is unlikely to change.





On the prices front, then, there is considerable evidence in the United Kingdom to suggest that long-term structural changes are bringing effective downward pressures to bear on prices and margins, even during times of relatively robust demand and high domestic capacity utilisation.

# Are these competitive pressures feeding through to a supply-side improvement?

Unfortunately, the short answer to this question is 'we won't know until at least ten years hence'. Productivity improvements take time to germinate and statisticians take even longer to confirm them.

In the United States, some evidence of a productivity growth shift has begun to emerge. Since 1996, US labour productivity has risen at an average annual rate of 2.0%, well above its average of 1.4% since 1970. Moreover, this is more than appears to be explained by the growth of capital inputs —total factor productivity has risen also. However, there is debate about the extent to which higher productivity is concentrated in the computer sector where sharp price falls have boosted output (see Gordon (1999)).<sup>(1)</sup>

In the United Kingdom, which is generally thought to be about three years behind the United States in ICT penetration, annual labour productivity growth has slowed since 1995, averaging around 1.5%, compared with a long-run average of just above 2.0%. The MPC suggested in its May *Inflation Report* that this slowdown may partly be

 Gordon, R J, 'Has the 'new economy' rendered the productivity slowdown obsolete?', NorthWestern University, June 1999. explained by firms anticipating only a temporary slowdown in demand. If so, this and other cyclical factors, such as capacity utilisation, may be obscuring underlying improvements in productivity. In fact, from productivity data itself it is difficult to discern either structural or cyclical patterns (see Chart 16).

## Chart 16 US and UK labour productivity



In any case, labour productivity provides only a partial explanation of trend growth. In a growth accounting framework, real GDP growth can be decomposed into the growth of capital inputs, labour inputs, and the efficiency with which these inputs are combined in production—or total factor productivity growth. It is more useful to analyse these determinants over longer time horizons when cyclical influences are less predominant.

Chart 17 shows a decomposition of UK growth by decade since 1963. It shows how growth was affected by the oil shocks, falling from an annual average rate of almost 3% in 1963–70 to below 2% in 1971–80. Part of this fall is accounted for by capital inputs, whose contribution to growth virtually halved between the 1960s and subsequent decades. There was a sharp decline in productivity after 1973 as well, but the slower growth of investment and the



capital stock mattered more. Shorter working hours and a stagnant labour force have meant that the contribution of labour inputs has been negative in three out of the last four decades, with the industrial stoppages of the 1970s particularly affecting that decade. Labour inputs have been an important swing factor in delivering higher growth. During the 1980s, higher employment and hours worked made a positive contribution to growth, more than accounting for the increase in growth rates over the 1970s. Demography and better industrial relations partly explain this, but social and economic changes which increased female participation in the labour force were also important.

Against this historical backdrop, it is interesting to analyse the growth patterns of the 1990s in more detail (see Chart 18). As the upswing gathered pace, both employment and total factor productivity switched from making negative to making positive contributions to growth. Employment growth has continued over the decade as unemployment has fallen and, at least until very recently, the rate of labour force participation has risen. There is scope for a further rise if female participation rates continue to converge with those in the United States, and if government programmes such as the New Deal and the Working Families Tax Credit succeed in drawing more people into employment. Both prospects are made more likely by the current tightness in the labour market, as signalled by the low unemployment rate. Once in the labour force, those formerly without a job gain experience that can make them more attractive to the next employer. Such hysteresis effects mean that prolonged periods of low unemployment can gradually reduce an economy's natural rate of unemployment that is compatible with stable inflation. Only time will tell if that is currently happening in Britain.



The other factor behind the United Kingdom's growth performance during the 1990s has been the strong increase in investment (see Chart 19). Business investment has risen at an annual average of 6.8%, compared with a long-run average since 1965 of 2.7%. It reached a record high in

## Chart 19 UK business investment



1998 of 14% of GDP, compared with a long-run average of around 10%. We don't know how much of this increased investment has been in computers and related new technologies because no separate estimates are available in the United Kingdom. But investment trends in the United States and United Kingdom have been similar, and we know that much of the growth in the United States can be attributed to ICT investment. In the United States, there was a five-year lag between the rise in investment and the eventual rise in measured, economy-wide productivity. If the United Kingdom were to follow that pattern, then evidence of an improvement in productivity would begin to emerge next year. But recall Chart 16 showing the huge year-to-year swings in measured productivity, both in the United States and the United Kingdom. Even if our recent investment patterns launch us into the new Millennium at a higher rate of productivity growth, we probably will not be able to confirm that for at least another decade.

## **Implications for policy-makers**

To conclude, let me try to distil some practical advice for policy-makers out of the picture that I have been painting of change and inevitable uncertainty.

Be sceptical of forecasts. They are necessarily built upon the behavioural relationships of the past. Many of these will persist into the future. But in the case of global inflation, the 1970s and 1980s were particularly unfortunate decades. Dependence on oil and the Middle East, coupled with the abandonment of fixed exchange rate anchors, produced inflationary tendencies in the global environment that policy-makers of the time were slow to recognise. In other decades, both past and present, the prevailing global forces have been mildly deflationary, driven by declining production costs and expanding competition. This change in 'wind direction' is too subtle, too pervasive and too recent for conventional forecasting models to incorporate.

Historically calibrated models of the United Kingdom are likely to pose particular risks in this regard

because of Britain's exceptionally poor inflation performance during the 1970s and 1980s. In the forecasting work that we do at the Bank of England we try to take account of this by regularly reviewing discrepancies between our equation forecasts and actual outturns, and then imposing judgmental changes on the equations where we think they may be misleading us. We also try to illustrate the high degree of uncertainty around our forecasts by presenting them as fan charts of probability distributions rather than point estimates. But this does not address the bias that may be present in the model itself, and there is still a tendency by commentators to focus on the central forecast point at the two-year horizon, and use the difference between that and our point target for inflation as the central guide to policy.

- Listen and learn from real-time experience. If model-based forecasts are highly uncertain and potentially misleading, then it is especially important to seek out complementary sources of information and interpretations of economic developments from those actually in the thick of the action. The Bank's regional Agents hold detailed discussions with business people around the country to provide us with such feedback. In addition, I find that first-hand meetings and visits often yield insights into puzzles in the data, or provoke new ideas for our econometricians to test back in London. The many membership surveys that are carried out by organisations such as the CBI, BCC, CIPS, EEF and so on also help to shed light on current and future developments as revealed through orders and expectations. In changing times it pays to be eclectic.
- Pay special attention to prices. Economists are trained to think of prices as information signals. They are sensitive indicators, revealing even small shifts in supply or demand. They are readily observable, unlike output gaps, natural rates of unemployment or trend productivity. One particular set of prices is also our inflation target, and every sportsman knows the value of keeping a close eye on one's target! But the lags between changes in interest rates and inflation are such that we must also watch prices all along the supply chain. Input prices-from oil and other commodities to wages and commercial rents-will eventually influence retail prices. This 'bottom up' view of pricing is incorporated into the Bank's and most other forecasters' models. But output pricesand output price expectations-will also influence margins, and eventually wages, rents and other negotiated input prices. In a world of stronger global competition and more price transparency, one might expect such 'top down' price-setting behaviour to become more widespread. So as well as looking at model-based inflation forecasts, we should remember that current prices, at all levels, remain our most accurate and timely barometers of inflationary and deflationary pressures in the economy.

• Be pre-emptive, but delicately so. If one suspects that the economy is in a period of transition and that the trends from the 1970s and 1980s no longer provide a confident grounding for forecasts, then one needs to tread carefully. It is still right, given transmission lags, to move interest rates before inflation deviates significantly from target. But firms and households are learning new behavioural patterns in response to the new technologies and competitive pressures facing them. Aggressive patterns of policy change, or activist attempts at fine-tuning, carry particular risks during such junctures.

This is not a new insight in response to a new paradigm. It is another example of applying the lessons of the past. Orphanides concluded, $^{(1)}$  after his examination of the policy

mistakes in the United States that led to what he calls the 'Great Inflation of the 1970s', as follows:

'Fundamentally, it may matter not so much whether policy is driven by rule versus discretion but whether policy reflects prudence versus overconfidence. This indicates the profound importance of appreciating the information problem for successful policy design... Activist discretionary policies as well as activist rules will fail to deliver on their promise when they are based on a false presumption of confidence about the policy-maker's understanding of the economy.'

To avoid the policy mistakes of the past, one should be open-minded about the paradigms—new or old—that will shape our future.

## British unemployment and monetary policy

In this speech,<sup>(1)</sup> Sushil B Wadhwani, member of the Bank's Monetary Policy Committee, argues that the NAIRU has fallen significantly over the last decade. However, the evidence suggests that the NAIRU today is probably higher than it was in the 1960s, but is likely to be heading lower because of factors like the Internet.<sup>(2)</sup>

## **1** Introduction

Many economists use the notion of the so-called 'natural' rate of unemployment (or the allied concept of the non-accelerating inflation rate of unemployment—the NAIRU) in thinking about the labour market. Of course, the NAIRU is extremely difficult to measure, and there is often significant disagreement about what it is at any given moment in time.

Since 1992, British economic forecasters have tended to overpredict the level of unemployment, while simultaneously also overpredicting inflation. It is likely that these forecast errors have come from being too gloomy about the NAIRU. I discuss this in Section 2. In Section 3, I discuss econometric evidence suggesting that, in the 1990s, the traditional relationship between inflation and unemployment broke down.

It is likely that a whole host of structural changes in the labour market (Sections 4 and 6) and the product markets (Section 5) have contributed to a significant fall in the NAIRU in the 1990s. However, it is unlikely that the level of equilibrium unemployment has, as yet, fallen to the 'golden age' levels of the 1960s (see Section 7).

Looking ahead, there are some factors that might increase the NAIRU (Section 9.1). But there are several other labour and product market factors which should allow the equilibrium unemployment rate to continue to fall in coming years (Sections 9.2 and 9.3), with the magnitude of the fall depending importantly on how quickly the Internet affects margins and costs, and also, perhaps, on the degree to which the Government extends its New Deal for the unemployed. So the NAIRU today is higher than in the 1960s, but probably lower than in the 1980s. And it is probably heading even lower. Of course, a belief that the NAIRU has fallen and is likely to fall further is 'good news', but it does not, of itself, imply that one could become complacent about inflation. In that regard, the Monetary Policy Committee (MPC) shall continue to look at a wide variety of indicators to assess the prospects for inflation.

# 2 Consensus forecasts of the NAIRU have been too gloomy

Most economists rely on the concept of the NAIRU to analyse the UK labour market. For example, as Budd (1999) notes, all the members of the MPC in their responses to the House of Commons Treasury Committee in 1998 said that the 'natural' rate was a useful concept.<sup>(3)</sup>

Table A, which is drawn from Robinson (1997), shows how the estimates of the NAIRU in the United Kingdom have evolved over time. The average estimate of the NAIRU has changed significantly over the period, ranging between 2.9% and 7%. Moreover, there is much disagreement about what the NAIRU is at any given moment in time—the range of estimates is typically rather wide. There is also a tendency for estimates of the NAIRU to fluctuate with actual unemployment. This property of NAIRU estimates appears to be more general—Palley (1999) reports a regression of the OECD's estimates of structural against actual unemployment rates in 1986, 1990 and 1996, and finds that every percentage point increase in the actual unemployment rate is associated with a rise of 0.915 percentage points in the structural rate!

Another interesting feature of Table A is that the average estimate of the NAIRU barely changed between 1981–87 and 1995–96, despite a whole host of structural changes in the labour and product markets. So it is hardly surprising

(2) I am extremely grateful to Damon Clark, Joanne Cutler, Mark Dean, John Henderson and Duncan Melville for their help and advice on this work. I have also learnt a great deal by talking to William Brown, Richard Layard and Stephen Nickell. Ian Bond, Phil Evans, Paul Fisher, Mike Joyce, DeAnne Julius, Mervyn King, Gus O'Donnell and John Vickers provided me with helpful comments on an earlier version. The views expressed in this paper are personal and do not necessarily reflect any views held by either the Monetary Policy Committee or the Bank of England.

Given to the Society of Business Economists on 2 December 1999. The speech may be found on the Bank of England's web site at www.bankofengland.co.uk/speeches/speech64.pdf.
 I am extremely grateful to Damon Clark, Joanne Cutler, Mark Dean, John Henderson and Duncan Melville for

<sup>(3)</sup> It is standard practice to draw a distinction between the long-run NAIRU and a shorter-run NAIRU. The latter concept, as its name implies, allows some factors (eg lagged unemployment, import prices) to affect the equilibrium level of unemployment temporarily, without affecting the long-run NAIRU. Some authors (eg King (1998)) prefer to describe the long-run NAIRU as the 'natural' rate. In what follows, I focus primarily on the determinants of the long-run NAIRU, though inevitably I will also discuss some factors that affect only the short-run NAIRU.

that when attempting to forecast the year-ahead unemployment rate, UK economists have recently tended to overpredict unemployment-in every year since 1993, unemployment has fallen by more than the consensus projections (see Table B).

## **Table A** NAIRU estimates in Britain(a)

Per cent

Year	Average estimate of NAIRU	Range of estimates	Actual rate
1969–73	2.9	1.6-5.6	2.5
1974-80	5.7	4.5-7.3	3.8
1981-87	7.0	5.2-9.9	10.1
1988-90	6.1	3.5-8.1	6.8
1995–96	6.7	3.5-8.9	8.2

Source: Robinson (1997)

(a) Claimant count (as percentage of the labour force).

## **Table B Unemployment**—actual vs forecast

r	er	cent	

Year	Year-ahead forecast (a)	Actual outturn	Forecast error
1993	3.15	2.79	-0.36
1994	2.73	2.46	-0.27
1995	2.24	2.21	-0.03
1996	2.16	1.98	-0.18
1997	1.81	1.43	-0.38
1998	1.30	1.29	-0.01
1999	1.57	1.26 (b)	-0.31
Average f	-0.22		

Source: HM Treasury Panel of Independent Forecasts

(a) One year ahead forecast made in December of the preceding year (eg '1994' refers to the forecast made in December 1993).
(b) Actual outturn for 1999 is for Q3.

On average, the consensus of estimates has overpredicted the number of unemployed by as much as 220,000 per year-this is a strikingly large error given that unemployment has fallen by an average of about 219,000 a year over this period.

A notable feature of the last few years is that the tendency to overpredict unemployment has gone hand-in-hand with a tendency to overpredict inflation (see Table C)-for example, the Panel of Independent Forecasts has overestimated RPI inflation in five of the last seven years, with an average forecast error of -0.4 percentage points. A

## **Table C** Inflation—actual vs forecast

similar picture emerges for forecasts of RPIX inflation (an average forecast error of -0.4 percentage points, which is high in relation to a target of  $2^{1/2}$ %), and for average earnings growth (an average forecast error of -0.5 percentage points).

Table D displays the forecast errors that were made vis-à-vis unemployment and average earnings growth together to illustrate the improvement in the inflation-unemployment trade off. Although unemployment fell by more than was expected in every year between 1993 and 1997, earnings growth was also lower than expected, a clear case of an improvement in the trade-off. It is only in 1998 and 1999 that earnings growth has been (modestly) higher than expected, though in 1999 that is probably attributable to the level of unemployment being 310,000 lower than had been expected.

## **Table D**

## Unemployment and average earnings forecast errors

Year	Unemployment forecast error (Q4, millions)	Average earnings forecast error (percentage change on year earlier)
1993	-0.36	-1.9
1994	-0.27	-0.3
1995	-0.03	-1.3
1996	-0.18	-0.6
1997	-0.38	-0.4
1998	-0.01	0.3
1999	-0.31	0.3
Average forecast error	-0.22	-0.5
Source: See Table B.		

As both inflation and unemployment have turned out better than expected, there would appear to be prima facie evidence of the Panel having systematically overestimated the NAIRU and/or some change in the historical relationships that these economists were (implicitly or otherwise) relying on.

#### 3 A breakdown of traditional economic relationships

In the United States, economists have increasingly questioned the stability of the standard Phillips curve, in which price inflation depends on the unemployment rate,

RPI (Q4) (Annual growth)		RPIX (Q4) (Annual growth)			Average earnings (Annual growth)				
Year	Forecast (a)	Actual outturn	Forecast error (actual minus forecast)	Forecast	Actual outturn	Forecast error (actual minus forecast)	Forecast	Actual outturn	Forecast error (actual minus forecast)
1993	3.3	1.6	-1.7	4.4	2.7	-1.7	5.0	3.1	-1.9
1994	3.4	2.6	-0.8	3.5	2.3	-1.2	3.9	3.6	-0.3
1995	3.5	3.2	-0.3	2.9	2.9	0.0	4.4	3.1	-1.3
1996	2.6	2.6	0.0	2.8	3.2	0.4	4.2	3.6	-0.6
1997	3.5	3.7	0.2	3.0	2.8	-0.2	4.6	4.2	-0.4
1998	3.2	3.0	-0.2	2.8	2.5	-0.3	4.8	5.1	0.3
1999 (b)	1.5	1.2	-0.3	2.2	2.2	0.0	4.3	4.6	0.3
Average f	orecast error 1	993-99	-0.4			-0.4			-0.5

Source: See Table B.

(a) One year ahead forecast made in December of preceding year.(b) Actual outturn is for Q3 for RPI and RPIX, and average of January-September for earnings growth.

past price inflation and standard measures of price supply shocks. For example, a recent paper by researchers at the Federal Reserve Board argues that:<sup>(1)</sup>

"... the tendency of our baseline equations to significantly overpredict inflation since the mid-1990s, however, is an indication of structural change—perhaps a decline of the NAIRU."

Using different specifications, Stock (1998) and Katz and Krueger (1999) have also concluded that the relationship between inflation and unemployment in the United States has changed during the 1990s.

In the United Kingdom too, there is some evidence that the relationship between inflation and unemployment might have shifted during the 1990s. Table E reports two different pieces of evidence. The first run contains the results of estimating a standard, expectations-augmented Phillips curve-type specification for wages—we find that, from 1993 onwards, such an equation overpredicts wage growth by about 0.65 percentage points. The second run reports qualitatively similar results from a corresponding exercise carried out for the wage equation in the Bank of England's core macroeconometric model (see Bank of England (1999)). What is particularly striking about this result is that it occurs despite the core model already implicitly building in a fall in the NAIRU over the 1990s. Of course, one interpretation of these results is that there has been a fall in the NAIRU. Such a fall in the NAIRU would provide a coherent explanation of why the average economic forecaster has been too gloomy about both unemployment and inflation since 1992.

T E	Table EEvidence on the stability of wage equations				
	Alternative models	Coefficient of dummy variable (a)	t-ratio		
Ι	Expectations-augmented Phillips curve (b)	-0.65	-1.97		
II	Core model wage equation (c)	-0.27	-2.50		

(a) Dummy variable that takes value one from 1993 Q1.
 (b) Regression of four-quarter change in earnings growth on five lags of the dependent variable, four-quarter change in RPI inflation, log of the unemployment rate lagged four periods and seasonal dummies.
 (c) We dependent of Each of Each of Could (1000)

(c) Wage equation as described in Bank of England (1999).

## 4 Why has the NAIRU fallen since 1992?

In attempting to explain why the NAIRU might have fallen since 1992, I initially draw on the standard reference works that try to explain UK unemployment, ie Layard, Nickell and Jackman (1991), Minford (1994) and Nickell (1998).

Beginning with proxies for union power, note that union membership (as a fraction of total employment) has fallen from 36% in 1992 to 30% in 1998 (see Table F). Strike activity has also diminished from the already low levels of 1992. Another factor that historically has played an important role in unemployment fluctuations is the oil price—in real terms, it was much lower during 1998 than in 1992, although it has clawed back part of its losses during 1999.<sup>(2)</sup> It is commonplace to hear that the UK NAIRU might have risen because of increased imbalances between the pattern of labour demand and supply—in other words, because of greater mismatch. Table F contains indices of regional and skill mismatch (based on the definitions in Layard, Nickell and Jackman (1991)). On both dimensions there appears to be less mismatch in 1998 than in 1992 (especially on the regional dimension).

Table F			
Some conventional fa	ctors af	fecting the NAI	RU
Factors	1992	1998_	1980
Union density	0.36	0.30	0.49
Number of working days			
lost (thousands)	48	30	957
Real oil price	13.2	7.8	40.4
Mismatch:			
Regional	1.01	0.24	1.54
Skills	6.15	5.22	5.00
Long-term unemployment			
(ratio of total unemployment)	37.7	31.4	34.8
Replacement ratio	0.18	0.18	0.24
Tax wedge	0.34	0.36	0.35
			5100

It is also plausible that the long-term unemployed might affect the NAIRU, either because they lose skills and become demotivated, or because they face employer discrimination. Hence the fall since 1992 in the proportion of total unemployment that is accounted for by the long-term unemployed, ie who have been unemployed for more than twelve months, (the LTU ratio), might also have reduced the NAIRU.

Turning to the unemployment benefits regime, the conventional replacement ratio (ie the ratio of out-of-work benefits to estimated in-work income) has remained constant. However, the New Deal and other measures which have tightened the availability of benefits have probably worked towards reducing the NAIRU.

Of the factors listed in Table F, the only variable that has moved in a NAIRU-increasing direction is the total 'tax wedge' between product and consumption wages, ie the sum of payroll, income and consumption tax rates. This appears to have edged up between 1992 and 1998 (from 0.34 to 0.36), though it is worth emphasising that the empirical evidence linking the tax wedge to unemployment is somewhat fragile (see Nickell and Layard (1998)).

Our discussion of the factors that plausibly might have lowered the NAIRU between 1992 and 1998 has focused, rather mechanically, on how these variables actually evolved between those dates. However, if one adopts a longer time-frame, some of these variables have changed by rather more. For example, Table F shows that union membership was as high as 49% in 1980 (compared with 30% in 1998 and 36% in 1992). Strike activity was much higher in 1980; 957,000 working days were lost to strikes, compared with

<sup>(1)</sup> See Brayton, Roberts and Williams (1999), page 9.

<sup>(2)</sup> Of course, in some accounts (eg Layard, Nickell and Jackman (1991)), oil price changes have only a temporary effect on the NAIRU.

just 30,000 in 1998. The real oil price in 1980 was nearly three times as high as in 1992, and around five times as high as in 1998. Similarly, an index of regional mismatch in 1980 was around 50% higher than in 1992, which, in turn, was around four times as high as in 1998. Further, the replacement ratio in 1980 was higher than in 1992 or 1998. Also, the benefits system was progressively tightened from 1986 with the Restart programme, under which unemployed people on benefits were interviewed every six months in order to ensure that they were looking for work, and to provide them with a menu of help. Notwithstanding the significant improvement between 1980 and 1992 in the underlying variables that are supposed to lower the NAIRU, much of the evidence on improved wage performance for a given level of unemployment appears to post-date 1992.

Industrial relations experts, such as Professor William Brown of Cambridge, argue that the structural improvements in the labour market between 1980 and 1992 did not translate into improved wage performance until other catalytic events induced firms to undertake radical industrial relations changes 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. Case-study evidence suggests that both these factors have played some role (see for example Brown *et al* (1998)). Other possible catalytic events include the adoption of an explicit inflation target after 1992.

Personally, I have no problem with the notion that structural changes can take time to manifest themselves in improved macroeconomic performance. Any change to the way in which labour is used (eg reforming pay systems, improving selection, etc) requires managerial effort, and takes time to put in place and be effective. Given how much some of the factors that are thought to affect the NAIRU have changed between 1980–98, I find it rather surprising that the average estimate of the NAIRU changed hardly at all between 1981–87 and 1995–96 (see Table A). As the claimant count rate of unemployment has now fallen to 4.2%, one suspects that the consensus estimate of the NAIRU has, in time-honoured fashion, now followed the actual unemployment rate down to some extent.

# 5 Product market competition and the NAIRU

I have so far concentrated largely on a variety of labour market factors which have probably contributed to a reduction in the NAIRU since 1980. However, I would expect an increase in product market competition to lead to lower wages, as the relevant firms will tend partially to offset the effect on their profit margins—eg Rose (1987) found that, between 1979 and 1985, there was a decline of approximately 40% in the size of the union wage differential in trucking in the United States, following the trucking regulatory reforms of the late  $1970s.^{(1)}$ 

Nickell, Vainiomaki and Wadhwani (1994) present evidence, based on observing some 800 British manufacturing firms over time, that product market power has a positive effect on wages, and that product market power also reduces the size of the negative effect of unemployment on wages, thereby making the labour market less 'flexible'.

One reason that there has probably been an increase in product market competition is globalisation, ie the increasing integration of global product markets. Chart 1 suggests a striking increase in the degree of import penetration.



My colleague, DeAnne Julius (1999),<sup>(2)</sup> recently reminded us that foreign direct investment (FDI) has also played an important role in this context, with the United Kingdom now one of the most important outward investors worldwide. Increased globalisation implies that the world output gap can be more important than domestic supply capacity for many prices. In a UK context, anecdotal evidence suggests that, in many industries, a combination of low-cost imports and the threat of relocating a plant abroad has had a substantial effect in terms of keeping a lid on wages, and preliminary econometric work (see Clark and Wadhwani (1999)) also supports this notion.

Evidence of increased product market competition has not just been confined to globalisation. Government action has also played a role. Privatisation and/or regulatory changes in a whole host of industries (including gas, water, telecoms, electricity, airports, rail, the docks, and broadcasting) have led to rather more competitive product market conditions. Note that many of these regulatory changes occurred in the 1980s or early 1990s, and may plausibly also explain why the NAIRU has fallen over this period.

<sup>(1)</sup> Most union bargaining models and efficiency wage models would yield the result that intensified product

market competition would reduce wages and the NAIRU.

<sup>(2) &#</sup>x27;Back to the future of low global inflation', pages 77-87.

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 also hear much about the 'price wars' in retailing. In a survey carried out at the MPC's request by the Bank's regional Agents in September 1999, about half of all respondents reported more discounting over the previous twelve months than a year earlier (see Chart 2). Moreover, more than half of the respondents cited structural rather than cyclical reasons for increased discounting (see Chart 3).

## Chart 2 Discounts over the past year



## Chart 3 Reasons for discounting



Further evidence for an intensification of product market competition is shown in Chart 4—which is suggestive of a change in the relationship between domestic capacity utilisation and the balance of firms who expect to increase prices; in the late 1990s, the perceived ability to increase prices seems lower, at any given level of utilisation, than in the 1970s or 1980s (though the 1960s look similar).

The Internet may also be relevant to competitive considerations in the conjuncture; I defer discussion of this until later.

## Chart 4 CBI survey: capacity utilisation and price pressures



## 6 Other factors

I have, so far, discussed a number of labour and product market factors which might plausibly have contributed to a fall in the NAIRU since 1980. However, my discussion did not pretend to be comprehensive—in this section, I want to mention some more factors which may also have been relevant, though, of necessity, much of this is conjectural.

It is important to remind ourselves that much of the increase in employment in recent years has been associated with a rise in the female participation rate—since 1984, the female employment rate has risen from around 58% to about 69% now, while the male employment rate has risen only modestly (from 77.4% to about 79%). Evans (1998) argues that better childcare provision might have contributed to a reduction in the NAIRU for females— Chart 5 shows the significant increase in the number of daycare places for three and four year olds that has occurred during the last 30 years. More importantly, the greater availability of flexible and family-friendly working practices, as evidenced by surveys carried out by the

#### Chart 5 Childcare provision



# Table G Availability of selected workplace arrangements to help mothers with young children

Percentage of firms offering:	1979 survey	1988 survey	1996 survey (a)
Part-time	39	36	79
Job sharing	n.a.	6	35
Flexi-time	12	12	32
Shift work	11	9	26
Some work at home	3	4	17
Career break at home	n.a.	4	23
Help with childcare	3	4	9 (b)
n.a. = not available.			
Source: Callender et al (1997).			

(a) The 1996 survey asked if employers operated any of the arrangements in the table, and the 1988 survey asked if they operated them 'for people doing your kind of work'. To the extent that respondents to the 1996 survey said that their firm operated an arrangement without it actually being available to that person, it will produce higher estimates than in 1988.
 (b) Workplace nursery or creche only.

Policy Studies Institute, may also have played a role (see Table G).

Another factor that has plausibly contributed to a fall in the NAIRU is the greater decentralisation and individualisation of wage bargains. Some years ago, Calmfors and Driffill (1988) argued that wholly centralised and entirely decentralised wage-bargaining systems delivered lower unemployment than intermediate degrees of centralisation. One can plausibly argue that the United Kingdom has moved from an intermediate degree of centralisation in the 1970s to an increasingly decentralised and atomistic labour market. This has not only happened in a formal sense (given the fall in union coverage and density), but also in terms of perceived pay pressures. The CBI, as a part of their Pay Databank questionnaire, regularly ask respondents whether a particular factor was an important influence on their pay settlements. Chart 6 is consistent with a trend decline in the importance of the national comparisons in firm-based wage settlements, while Chart 7 suggests that even intra-firm wage comparisons have become less important.

Another factor that might have reduced the NAIRU is the decline in the number of young people entering the labour force. The November 1999 *Inflation Report* notes that, between 1989 and 1999, the 16–24 year old age group fell from 19% to 14% of the over-16 population. This matters because the young have above-average rates of unemployment. A crude way of attempting to calibrate the potential importance of this is to compare the actual unemployment rate with a hypothetical value calculated assuming a constant age-composition of the workforce. Bank work based on calculations of this kind (reported in the November 1999 *Inflation Report*) suggests that this demographic factor might account for a decline in the unemployment rate of about half a percentage point.

Hence there are a whole host of factors which plausibly have reduced the NAIRU since 1980, and the unemployment rate (claimant count) is now close to a record low for the past two decades (see Chart 8). However, it remains well above its average for 1950–75. Is it plausible that the NAIRU has fallen to the levels of that 'golden age' period?

## Chart 6 Pressures on pay settlements: national comparisons (manufacturing)



#### Chart 7

## **Pressures on pay settlements: intra-firm comparisons (manufacturing)**



## Chart 8 Claimant count unemployment rate



# 7 Has the NAIRU fallen to 'golden age' levels?

At first sight, it may seem quite likely that the NAIRU has fallen to its 'golden age' levels of the 1960s. First, union

density is now rather lower (see Chart 9), and working days lost in stoppages have almost vanished (see Chart 10).



Chart 10 Working days lost in stoppages



Second, the ratio of out-of-work benefits to in-work income is lower than in the 1960s (see Chart 11), and the real level of the oil price is not much different (see Chart 12).

In addition, as noted above, import penetration has steadily increased over the period (see Chart 1), as has childcare provision (see Chart 5), and the extent of family-friendly workplace practices (see Table G). Further, as discussed above, deregulation and privatisation have probably helped to intensify the extent of product market competition.

However, there are several factors that have moved in the direction of increasing the NAIRU. Perhaps the most striking and direct evidence of the post-1960s deterioration of the UK labour market is the fact that at any given level of vacancies, we have much more unemployment than we did before, ie the so-called Beveridge curve has moved outwards (see Chart 13). This must have occurred either

## Chart 11 Replacement ratio<sup>(a)</sup>







due to a reduction in the search effectiveness of the unemployed, or because of an increase in mismatch.<sup>(1)</sup> Note that the reduction in search effectiveness might arise from either firms or workers becoming more choosy.

## Chart 13 Unemployment vs unfilled vacancies, 1965–99 Unfilled jobs (thousands)



(1) Another possible explanation is that registered vacancies may now be a smaller fraction of the stock of 'true' vacancies (including newspaper advertising, headhunters, the Internet, etc).

In his persuasive review of this question, Nickell (1999) points to several relevant considerations. First, perhaps encouraged by the indefinite availability of benefits for much of the period, the proportion of long-term unemployed has been high. Although it has fallen in recent years, it remains above the average level of the 1960s (see Chart 14).

#### Chart 14

Long-term unemployed ( $\geq 12$  months)



Second, he points out that, in some respects, the benefit system is less job-friendly than in the 1960s (notwithstanding the decline in the replacement ratio). In particular, housing benefit (which pays the rent) represents a significant fraction of total benefits for single persons who are unemployed, with a high implicit marginal tax rate of 65%. Third, the demand for unskilled workers has probably fallen (perhaps because of technical change and competition from the Newly Industrialised Countries) by more than its supply. On one index of skill mismatch, there is evidence that, on average, mismatch is higher than it was in the 1960s (see Chart 15).



Fourth, the average level of UK unemployment in the 1950s and 1960s was unusually low by long-term historical standards, and it is possible that the 1960s were an anomalous period. In addition to Nickell's arguments above, there are at least two more considerations that are worthy of our attention. First, Andrew Oswald (1997) shows that over the last 30 years, countries with the fastest growth in home-ownership have also had the fastest growth in unemployment. In addition, countries with high levels of home-ownership also appear to have higher unemployment. Oswald presents evidence suggesting that:

- Unemployed home-owners are much less willing to move areas to find work than private renters. The latter have a notably fast outflow rate from unemployment into jobs.
- (ii) UK regions with larger proportions of private renters have higher outflows from unemployment and larger numbers of movers per head.

Clearly, at this point, we only have a few intriguing correlations, and much more research is needed. However, if Oswald's preliminary research is validated, then one could no longer regard the rise in owner-occupation (see Chart 16) as an unmixed blessing, because, notwithstanding other social benefits, it would help to keep the NAIRU higher than it need be.



Another factor that might have contributed to a rise in the NAIRU since the 1960s is the rather higher level of the tax wedge (see Chart 17).



Economists are fond of the notion that, in the long run, a rise in the tax wedge has no consequences for the level of unemployment, with the labour market behaving as if labour supply is inelastic, so taxes are all shifted onto labour. However, Nickell and Layard (1998) record that the empirical evidence on this issue is mixed, so the rise in the overall tax burden remains a candidate explanation for the NAIRU being higher now than in the 1960s.

# 8 Setting policy with uncertainty about the NAIRU

The above leaves me necessarily uncertain about the level of the NAIRU. One can be relatively confident that it has fallen over the last two decades, but also that it is still probably higher than in the 1960s. Given that it is difficult to obtain a reliable estimate of the NAIRU, how should policy respond?

Given that monetary policy has long and variable lags, we have to act on our inflation forecast, and, therefore, implicitly or otherwise, make a guess about the NAIRU. On the other hand, we have to guard against the possibility of what Palley (1999) describes as the 'structural unemployment trap'; if every time unemployment rises policy-makers decide that the rise is structural rather then cyclical, then, by ruling out countercyclical macroeconomic policy, cyclical unemployment can be transformed into long-term structural unemployment through standard 'hysteresis' channels, such as the possibility that the long-term unemployed become demotivated and/or are discriminated against. To guard against this trap, one might want to pursue a 'testing the water' approach to monetary policy, which appears to characterise the behaviour of the US Federal Reserve over the last few years. Looking at it as an outside observer, it would appear that the FOMC has essentially taken a 'wait and see' approach, in which the unemployment rate has been allowed to fall below the then prevailing estimates of the NAIRU, and has instead attempted to look at more direct indicators of inflationary pressure.

The traditional view in the economics literature is that such experimentation *vis-à-vis* the NAIRU is ill-advised. There is, after all, a long tradition, dating back at least to Keynes (1936), of believing that the supply of output is elastic until we approach the price level that is consistent with 'full employment', but that supply is completely inelastic for output prices above that level. It is this belief (ie the assumption that the Phillips curve is convex) that underlies the view that the costs of the disinflation that would be necessary if one overshot the NAIRU by pursuing a policy of 'wait and see' would be higher than the extra employment generated by letting the expansion run on, because the higher demand would lead largely to higher prices and to only a relatively small employment gain.

Of course, if the Phillips curve were not convex but linear, then experimentation *vis-à-vis* the NAIRU has zero expected cost and if, as Joseph Stiglitz (1997)—the former Chairman of the Council of Economic Advisers (CEA)—suggests, the Phillips curve is concave, then there might indeed be benefits to experimentation.

One must recall that the earliest formulation of the Phillips (1958) curve was convex, and recently Bean (1999) reported evidence for a modest degree of convexity in most OECD countries. However, Stiglitz (1997, page 9) says that:

"... empirical research at the CEA has found that when we run Phillips curve regressions allowing for a kink at the NAIRU, we find that the best fit is with a concave function."

Hence, this is clearly an area that deserves further research, although the bulk of the evidence favours convexity. Though it is worth reminding ourselves that the existence of hysteresis effects potentially reinforces the case for 'testing the water', as one can actually lower the NAIRU by holding unemployment low for a while.

In practice, one would therefore look for direct indicators of labour supply shortages and evidence that they are placing upward pressure on pay. Currently, the evidence on labour shortages is somewhat mixed. The BCC surveys suggest that recruitment difficulties are well above average (see Chart 18). However, the CBI skilled labour shortages indicator is still below its long-term historical average.

### Chart 18 Skill shortages and recruitment difficulties



On a variety of measures, real earnings growth is higher than it has been in recent years (see Chart 19), though at least some of the rise is probably attributable to the fact that actual RPI inflation was well below what was expected a year ago (see Chart 20). Forthcoming developments in the labour market should, therefore, continue to deserve careful monitoring.

### Chart 19 Growth in real earnings and labour costs



## Chart 20 Actual and expected inflation



## 9 Outlook for the NAIRU

Although there is uncertainty about the current level of the NAIRU, it is still important to incorporate any prospective changes in the NAIRU into inflation forecasts, although this is necessarily speculative.

## 9.1 Factors that might increase the NAIRU

Minford and Haldenby (1999)—MH, hereafter—have argued that a variety of recent legislative changes should, over the medium term, increase unemployment by nearly 900,000 (see Table H).

### Table H

## Minford-Haldenby estimates of the likely increase in the NAIRU

Factor:	Estimated impact on unemployment (by year six)
Higher union membership	395,000
Minimum wage	217,000
Increase in business costs	37,000
Additional impact (a)	229,000
Total	878,000

Source: Minford and Haldenby (1999).

(a) Designed to reflect the fact that 'the sum is greater than the parts', ie an interaction effect which captures the additional impact of all these changes occurring simultaneously.

They argue that the new statutory procedure for trade union recognition will boost union membership by around 1 million and, using the Liverpool econometric model, this is postulated to increase unemployment by as much as 400,000!

In my view, one needs to be sceptical about such estimates. Although variations in 'union power' might have some effect on wages, it is important to emphasise that, of course, 'power' and 'membership' are not the same thing. Even though the recognition procedures are to be amended, a host of other pieces of legislation that reduced the power of unions (see Brown and Wadhwani (1990)) remain on the statute book. It remains more difficult to strike, and there are far fewer examples of successful militancy to persuade the average union member that militancy is effective. The Employment Relations Act 1999 need not necessarily lead to a rise in trade union membership-indeed, some informed observers believe that all it might do is slow the current decline. Moreover, the intensification of product market competition probably implies that there is less in the way of rents for unions to capture anyway. It is notable in this context to record the fact that though wages depend on union membership in the Liverpool econometric model, Layard, Nickell and Jackman (1991) found that, in the context of their wage equation, a measure of the union/non-union wage mark-up performed rather better than membership. Hence, I think that it would be wise to assume that the possible rise in union membership over the next decade will only have a very small effect on the NAIRU.

Turning to the National Minimum Wage (NMW), I must confess that, once again, the MH estimates of the impact on unemployment appear to be implausibly high. MH estimate the effect of the NMW by assuming that it is equivalent to a 2% rise in unemployment benefits in the Liverpool model. This is unlikely to be a reliable way of capturing the true effect. In terms of the employment effects of the NMW, one would expect important offsetting effects from employers incorporating non-wage elements into the package. Further, turnover rates sometimes exceed 100% per annum in lower-paying firms in the United Kingdom (see Brown et al (1999)), and so turnover costs can reach 20% of the total wage costs over a worker's expected duration with a firm. A NMW can help to reduce turnover costs—though the offset will, of course, only be partial. Further, there is anecdotal evidence that some employers have coped with the NMW by improving efficiency of labour utilisation. In addition, if monopsonistic wage-setting is relevant in some segments of the labour market, then a NMW need not even reduce employment in those cases. The academic literature on the effect of minimum wages on employment produces rather mixed results (see Gregg (1999) for a review), although the bulk of it does suggest that youth unemployment might be affected, so that the starting-level of the minimum wage will have to continue to be set with care.

Survey evidence does not suggest that the NMW has been a significant factor in wage settlements, and so fears of

pressures on wages because of differential restoration appear to have been misplaced. Indeed, some industries that were disproportionately affected by the NMW (eg retail and textiles) have seen a deceleration in the growth of wage settlements in the first half of 1999, perhaps reflecting the intensification of product market competition. Moreover, the CBI, on the basis of consulting its members, says that the NMW, at its current level, has had little noticeable effect on employment. Some researchers now believe that the number of employees affected by the NMW is, in any case, less than early estimates had suggested. Although it is far too early to be confident, it does seem likely that the NMW, set at its current level, will have only a very small impact on the NAIRU.

## 9.2 Labour market factors that might reduce the NAIRU

There are, on the other hand, some labour market factors that might reduce the NAIRU (we consider some product market factors below).

Recall that we discussed the scarring effects of long-term unemployment, and the possibility that by becoming detached from the labour market, the long-term unemployed exert little or no downward pressure on wages. Hence, one could reduce long-term unemployment with little upward pressure on pay. This is what the 'New Deal' was set up to do. Under the New Deal for 18–24 year olds, introduced in April 1998, when a young person reaches six months of unemployment, they initially have to enter a 'gateway' of up to four months where they receive help with job search and careers advice from a personal adviser. If they do not find unsubsidised work during this period, they are given four options:

- (i) subsidised employment;
- (ii) education/training;
- (iii) environmental task force; and
- (iv) voluntary sector option.

Of around 350,000 young people who have joined the New Deal, about 145,000 have secured jobs, and approximately 90,000 are engaged in one of the training or work experience options. Independent research from the National Institute of Social and Economic Research (see Anderton, Riley and Young (1999)) finds that:

- (a) About 50% of individuals leaving unemployment via the New Deal would have done so in the absence of the programme.
- (b) The programme has had a modest positive effect in that it has reduced youth unemployment by approximately 30,000 relative to what it would otherwise have been (which is equivalent to a reduction in youth long-term unemployment of nearly 40%).
- (c) Obviously, if macroeconomic conditions were to deteriorate and unemployment were to rise, then the

New Deal could be expected to have a bigger quantitative impact, as more people would be affected by it.

The New Deal has since been extended to: lone parents (October 1998), partners of the unemployed (April 1999), and the over 50's (Pathfinders started in October 1999, to be extended nationally in April 2000). Note that these are all voluntary programmes, unlike the New Deal for 18–24 year olds, which is mandatory. The Government has also, since June 1998, operated a New Deal for 25+, but it has been confined to those who have been unemployed for more than two years. By August 1999, around 172,000 people had been through this Deal, of whom only 24,000 had found jobs.

The Government intends to intensify and extend the New Deal for 25+ from April 2001, with the important requirement that personal advisers will try to establish why a particular person cannot take one of a number of suitable vacancies. It is not entirely clear, as yet, who will participate in this scheme (ie those who have been unemployed 6, 12, or 24 months). The cut-off level will obviously be important in determining the empirical effects of this measure.

In order to get a crude sense of how important each of the different New Deal schemes might be, Table I attempts to compare the target population in each case at a given moment of time. The scheme for young workers would have affected around  $8^{1/2}$ % of the unemployed in October 1997, and the proportion of the unemployed in that particular category had halved by October 1999. Similarly, a scheme for the 50+ could affect up to 9% of the current unemployed—although this scheme is only voluntary. By contrast, if the Government were ambitious enough to offer a scheme for all those who were 25-49 and unemployed for more than six months, that would affect as many as 27.2% of the current claimant count, and so would potentially have a rather larger effect on the NAIRU than any of the existing individual New Deal schemes (which, so far, have only had relatively small effects).

## Table I

## **Unemployment**<sup>(a)</sup> by category

Category	Number	Percentage of unemployed	Date
18–24 and unemployed for more than 6 months	121,300	8.5	October 1997
18–24 and unemployed for more than 6 months	49,400	4.2	October 1999
25–49 and unemployed for more than 6 months	322,500	27.2	October 1999
25–49 and unemployed for more than 12 months	200,800	16.9	October 1999
25–49 and unemployed for more than 2 years	92,600	7.8	October 1999
50+ and unemployed for more than 6 months	106,000	8.9	October 1999
50+ and unemployed for more than 12 months	74,400	6.2	October 1999

(a) Claimant count-computerised claims only.

A second reason for believing that a New Deal for 25+ might have a larger impact than the scheme for young people is that there is some evidence (see Arulampalam, Booth and Taylor (1998)) that the 'scarring' effects of past unemployment experience are greater for mature men (25+) than for younger men. This might be because job-shopping is a more acceptable form of behaviour among the young.

In addition, under the so-called 'ONE' scheme, there will be a single point of contact for all benefits and work issues. From April 2000, it will be compulsory for all new claimants to attend a work-focused interview to discuss their options, and, by April 2001, all benefit claimants of working age will have a personal adviser to help them find work. The tightening of the benefits system can reasonably be expected to have some impact in terms of reducing the NAIRU.

In addition to the New Deal and the tightening of the benefits system, another factor that might help to increase effective labour supply is a redesign of the tax and benefits system to sharpen the incentives to work. Independent research by the Institute for Fiscal Studies (reported in the February 1999 *Inflation Report*) suggested that the Working Families' Tax Credit (WFTC) would boost labour supply by a small amount (a point estimate of around 30,000). A study by Gregg, Johnson and Reed (1999) suggested that the effect of the WFTC, accompanied by changes to income tax and NICs, would boost labour supply more significantly.

Many of the programmes mentioned above might individually have a relatively small effect on the NAIRU added together, however, the effect could be quite significant, depending largely on how extensive the New Deal scheme for 25+ is (and, indeed, how effective it proves to be).

## 9.3 Product market factors that might reduce the NAIRU

Section 5 discussed a variety of factors that have led to an intensification of product market competition in recent years—including globalisation, regulatory changes and retailing 'price wars'. One might reasonably expect all three of these factors to exert further downward pressure on margins. Trade and FDI flows are likely to continue to trend higher. Although regulatory changes have been important in the past, in the MPC's best judgment, forthcoming price cuts in electricity and water warranted special treatment in our inflation forecast (see the November 1999 *Inflation Report*). Moreover, the investigation into car prices is widely perceived to be having an effect.

Over the next few years, though, a potentially important reason for intensified product market competition and/or efficiency gains is the development of the Internet. As my colleague, DeAnne Julius (1999)<sup>(1)</sup> has pointed out, it took 36 years to achieve 50 million users for radio, 13 years for TV, 16 for PCs, but, for the Internet, it has taken fewer than 5! (See Chart 21.)

## Chart 21 Years to achieve 50 million users



In the retail market, the main reasons for expecting lower prices included the following:

- (i) Standard theory predicts that high search costs allow prices to be above marginal costs in equilibrium (see, for example, Salop (1979)), so one would expect the lowering of search costs associated with the Internet to lower prices.
- Lower market entry costs will limit the price premiums sustainable by existing market participants, by increasing actual or potential competition.
- (iii) By shortening the supply chain, distribution and inventory costs will be lower.

Hence it is hardly surprising that Brynjolfsson and Smith (1999) found that the prices for books and CDs sold via the Internet were 9%-16% lower than in conventional outlets, even after accounting for costs of shipping and handling, delivery, and local sales taxes. Internet penetration is still low in the United Kingdom compared with the United States (see Table J), though it is higher than in Germany or France. BRMB Internet Monitor recently reported that £2 billion was spent online in the last twelve months in the United Kingdom, which was a tenfold increase from a year ago. Verdict Research estimates that online shopping in the United Kingdom will rise to 2.5% of retail spending in the next three years. In any case, traditional bricks-and-mortar retailers will be under increasing pressure to match the prices of the e-tailers, so online shopping could have a

## Table J

Internet usage

Per cent	Proportion of population using the Internet
United States United Kingdom Germany France	34.0 13.9 8.7 4.8
Source: Owen (1999).	

<sup>(1) &#</sup>x27;Back to the future of low global inflation', pages 77–87.

disproportionate effect on the RPI. Note also that, currently, four fifths of e-commerce is business-to-business use rather than business-to-consumer, so the biggest impact might come through cost reduction.

All in all, in my personal view, it seems reasonable to believe that the net impact of all the product and labour market changes discussed above will probably be to lower the NAIRU further.

## **10** Conclusions

I have argued that there are persuasive reasons for believing that the NAIRU has fallen significantly since 1980. Furthermore, and more speculatively, one can identify a variety of product and labour market factors which might plausibly lead to a further fall in the NAIRU over the next few years. The extent to which the NAIRU falls will partly depend on the degree of penetration of the Internet, and also on how comprehensive the New Deal for the unemployed becomes.

A belief that the NAIRU has fallen and is likely to fall further does not, of course, necessarily imply that one could be complacent about inflation. As my colleague, Willem Buiter (1999) has reminded everyone, inflation is ultimately a monetary phenomenon. A fall in the NAIRU does imply that, other things being equal, nominal interest rates can, in the short term, be lower at any given level of unemployment than they would otherwise have been. However, once the unemployment rate falls to the new level of the NAIRU, interest rates must rise back to their original level. The unemployment rate today is already at a 20-year low, though it is much higher than its average level in the 1960s. The MPC shall, of course, have to continue to look at a wide variety of indicators in order to assess the prospects for inflation.

## References

- Anderton, B, Riley, R and Young, G (1999a), 'The New Deal for young people: early findings from the Pathfinder areas', NIESR paper presented at the Education and Employment Economics Group Annual Conference, Wales, July.
- Arulampalam, W, Booth, A and Taylor, M (1998), 'Unemployment persistence', University of Essex Discussion Paper.
- Bank of England (1999), Economic models at the Bank of England.
- Bean, C (1999), 'The convex Phillips curve and macroeconomic policymaking under uncertainty', London School of Economics, *mimeo*.
- Brayton, F, Roberts, J and Williams, J (1999), 'What's happened to the Phillips curve?', Federal Reserve Board, Washington, *mimeo*.
- Brown, D, 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*.
- Brown, W and Wadhwani, S (1990), 'The economic effects of industrial relations legislation since 1979', *National Institute Economic Review*.
- Brown, W, Deakin, S, Hudson, M, Pratten, C and Ryan, P (1998), 'The individualisation of employment contracts in Britain', Department of Applied Economics, University of Cambridge.
- Brynjolfsson, E and Smith, M (1999), 'Frictionless commerce? A comparison of Internet and conventional retailers', *Working Paper*, MIT Sloan School.
- Budd, A (1999), 'The MPC and the natural rate', New Economy, pages 69-73.
- Buiter, W (1999), 'Monetary misconceptions', Bank of England, mimeo.
- Callender, C, Millward, N, Lissenburgh, S and Forth, J (1997), 'Maternity rights and benefits in Britain 1996', DSS Research Report, No 67, London, The Stationery Office.
- Calmfors, L and Driffill, J (1988), 'Centralisation of wage bargaining and macroeconomic performance', *Economic Policy*, No 6, pages 13–61.
- Clark, D and Wadhwani, S (1999), 'Modelling wages', Bank of England, forthcoming.
- Evans, P (1998), 'Why has the female unemployment rate in Britain fallen?', *Bank of England Quarterly Bulletin*, Vol 38(3), pages 248–55.
- Gregg, P (1999), 'The use of wage floors as policy tools', University of Bristol, mimeo.
- Gregg, P, Johnson, P and Reed, H (1999), 'Entering work and the British tax and benefit system', *The Institute for Fiscal Studies*, March.
- Julius, D (1999), 'Back to the future of low global inflation', the Maxwell Fry Global Finance Lecture, University of Birmingham.
- Katz, L F and Krueger, A B (1999), 'The high-pressure labor market of the 1990s', *Brookings Papers on Economic Activity*, 1:1999.
- Keynes, J M (1936), 'The general theory of employment, interest and money', Macmillan: London.

- King, M A (1998), 'Monetary policy and the labour market', Employment Institute Lecture.
- Layard, R, Nickell, S and Jackman, R (1991), 'Unemployment: macroeconomic performance and the labour market', Oxford University Press.
- Minford, P (1994), 'Deregulation and unemployment—the UK experience', *Swedish Economic Policy Review*, Vol 1, No 1–2, pages 113–41.
- Minford, P and Haldenby, A (1999), 'The price of fairness', Centre for Policy Studies.
- Nickell, S (1998), 'Unemployment: questions and some answers', The Economic Journal, 108, May, pages 802–16.
- Nickell, S (1999), 'Unemployment in Britain', Centre for Economic Performance, London School of Economics, mimeo.
- Nickell, S and Layard, R (1998), 'Labour market institutions and economic performance', *Centre for Economic Performance Discussion Paper*, No 407.
- Nickell, S, Vainiomaki, J and Wadhwani, S (1994), 'Wages and product market power', Economica, Vol 61, pages 457–73.
- Oswald, A (1997), 'The missing piece of the unemployment puzzle', University of Warwick, mimeo.
- Owen, D (1999), 'The Internet and RPI inflation', Dresdner Kleinwort Benson.
- Palley, T (1999), 'The structural unemployment trap', New Economy, pages 79-83.
- Phillips, A W (1958), 'The relationship between unemployment and the rate of change of money wage rates in the United Kingdom, 1861–1957', *Economica*, August.
- **Robinson, P (1997)**, 'Is there a pay problem?', in Michie, J and Smith, J G (eds), 'Employment and economic performance', Oxford University Press.
- Rose, N L (1987), 'Labour rent sharing and regulation: evidence from the trucking industry', *Journal of Political Economy*, Vol 95(6), pages 1,146–78.
- Salop, S (1979), 'Monopolistic competition with outside goods', Bell Journal of Economics, Vol 10, pages 141-56.
- Stiglitz, J (1997), 'Reflections on the Natural Rate Hypothesis', *Journal of Economic Perspectives*, Vol 11, No 1, Winter, pages 3–10.
- Stock, J H (1998), 'Comment' in Brookings Papers on Economic Activity: 2, pages 334–41.

## Before the Millennium: from the City of London

In this speech,<sup>(1)</sup> the **Governor** surveys the current shape of the City and the reasons for its success, identifying the ethos of a free, competitive market place as the predominant factor. The **Governor** then looks forward to the challenges facing the City: in particular the euro, the advance of technology and rising public expectations, concluding that the City can look to the future with every confidence.

As we approach the end of every year we naturally tend to look back at the past, to take stock, and to look forward to the challenges ahead. The temptation to do that this year, on the brink of the new Millennium, is almost irresistible. But nevertheless I will start from where we are now—which is a good place to start, because by and large the City is in pretty good shape.

It is, of course, the hub of the financial and business services industry of this country, which, broadly defined to include shipping and real estate as well as other forms of intermediation and the accountancy and legal professions, contributes directly something like a quarter of total national output—with some 7%–8% coming from the financial services sector alone.

And, whatever the periodic outcry whenever something goes wrong-as it will from time to time-the demand for these services does not of course exist in a vacuum; it exists because of the very positive contribution that the business services sectors, including financial services, makes to growth and employment and rising living standards in the wider economy. That is true nationally, but it is equally true in a global context. Indeed the unique characteristic of the City is its role as the predominant international financial centre. It accounts for a fifth of all international cross-border lending, for example; for a third of global turnover in foreign exchange and OTC derivatives; and as much as two thirds of issuance and secondary trading in eurobonds, or of global turnover in international equities, with more foreign firms listed on the London Stock Exchange than on any other exchange. And London has a near-monopoly in exchange-traded short-term euro interest rate derivatives.

I will not labour the point further, Mr Chairman. Despite or perhaps driven by—a continuous stream of shocks and competitive challenges, the City has in fact gone from strength to strength, most recently coming through the global financial turbulence of the last couple of years as well as the advent of the euro at least as strong as before.

It is perhaps worth asking why the City is as strong as it is.

Certainly it is partly to do with history. The emergence of the City owed a good deal to Britain's earlier position as the world's leading industrial and trading nation and international power. But that does not explain its continuing strength.

To explain that, there are lots of factors one might point to—the English language, the European time zone, the sheer momentum of the City's critical mass, supported by the availability of a professionally qualified and technically skilled workforce which gives the City remarkable resilience and flexibility, aspects of our commercial and physical infrastructure, and so on. All of these factors are certainly relevant.

But if I had to identify one factor above all that helped to explain the continuing phenomenon of the City, it would be what I can only rather vaguely describe as the surrounding ethos of a free, competitive, market place.

I do not at all mean by that that the City is a lawless jungle where anything goes! In fact quite the reverse. You cannot have an effective competitive market without reasonably clear rules of the game, both to protect society as a whole from disruption and to retain the confidence of both the providers and users of the market by ensuring that they know what is expected of them and what they can reasonably expect of others. The evolving legal and regulatory framework in this country, together with the self-regulatory disciplines applied by the relevant market organisations and professional bodies have been—and remain—a vitally important asset for the City in this context.

It is not just the structure of these arrangements but their substance and the manner of application of the rules of the game that matters.

It is all too easy to err on either side. The rules may be so loosely drawn that market participants and market users lose confidence and go elsewhere; or they may be so tightly drawn that they discourage competition and inhibit innovation. Equally, the actual, as distinct from the intended, balance between social protection and fairness on

<sup>(1)</sup> Given at the first City of London Biennial Meeting, organised by City University Business School and held at the International Maritime Organisation on 7 December 1999. This speech is available on the Bank of England's web site at www.bankofengland.co.uk/speeches/speech65.htm

the one hand, and competition on the other, may be affected by the approach adopted by the various arbitrators. Theirs is a difficult job at the best of times. We've all seen matches ruined by either unduly lax or unduly officious refereeing. But ultimately the character of the game depends upon the self-discipline, as well as the skills, of the players.

In general I believe that we in this country have been well served in these respects. There has been relatively little systemic disturbance in recent years, and what there has been has required relatively modest commitment of public funds. There have, it is true, been periodic concerns about business behaviour. Where these have been general concerns—often reflecting the rapid evolution of the market place or rising public expectations—they have mostly been addressed by reinforcing the rules of the game. Or where they have reflected the behaviour of individual firms or their employees they have been pursued—not least to encourage others. Of course we need to remain constantly vigilant in all these areas to retain confidence in our market place. But all the evidence suggests that such confidence remains strong by any international standards.

There are three characteristics of the City's market ethos that I would point to in particular.

Quite early on in my career at the Bank—more years ago than I care to remember—I was profoundly influenced by the man then responsible for administering Exchange Control—Brian Bennett. He had, framed on his desk, a wartime poster which read 'Freedom is in peril—defend it with all your might'. And he explained to me that this was to remind him that his job was not simply to apply the Exchange Control regulations—though that certainly was his job; it was also to help people to do what they were seeking to do, consistently with both the spirit and the letter of the law. I like to think that that philosophy has informed—and continues to inform—the approach to applying the rules of the game more generally in the City.

A related characteristic is that apart from defining, and applying, constructively, the rules of the game, the various authorities do then leave the market to get on with it-they do not by and large seek to tell the various markets, or firms operating within them, what they should or should not do. In the Bank, for example, we always stand ready to help when market participants collectively seek our help-say, in relation to market infrastructure projects where, working with market participants, we took on the development and introduction of new settlements systems for the gilt-edged, money and equity markets and new wholesale payments systems-but we try to avoid either dirigisme or unnecessary conservative resistance to market initiatives, whether collective initiatives, such as the creation of LIFFE, or initiatives at the level of the individual firm. We may act as a catalyst, encouraging different sectors of the market to address emerging problems, either on their own or by coming together, but essentially we take the view that the markets and firms themselves are best placed to find the way ahead.

The third characteristic of what I've called the free market ethos—and one which is absolutely crucial to the City's success—is impartiality and even-handedness, both in the application of the rules of the game and in terms of business opportunities—applying the same standards to all market participants or would-be participants, regardless in particular of nationality.

Some people still find this difficult to understand. A few years ago Japanese bankers used to tease me by asking what I thought of the 'Wimbledonisation' of the City-meaning that this country organised the best competition in the world but the visitors carried off the prizes. I used to explain to them that it was activity-rather than nationality of ownership or even control-that mattered in terms of the City's contribution to the wider economy, and in terms of its direct contribution to growth or employment, or of income or tax base in this country; I even suggested that Tokyo would benefit as a financial centre if it became more open to overseas players. I don't think that they were convinced at the time. But now that has begun to happen, and some of my Japanese banker friends tell me they finally see the point. It is in fact of course more generally a lot harder to see the benefits of increasing global competition if you are an existing producer, whether an individual business or the national representatives of businesses directly in the firing line, than if you are looking at it in terms of the health of the macroeconomy. But there is no doubt that it is this characteristic of openness to competition perhaps above all that explains the uniquely international nature of the City (with more foreign banks represented here than in any other centre) and accounts for much of the City's continuing success.

So much then, Mr Chairman, for the past, let me turn now to the challenges and prospects for the future.

The most immediate challenge is to get through to the next millennium without significant mishap—to demonstrate that we have indeed succeeded in overcoming the Y2K bug. In fact I have no misgivings on that score as far as the City is concerned. The preparation has been immensely thorough. The Bank, with our colleagues in the FSA, and with our counterparts abroad, has worked with the financial markets, both on that technical preparation and to ensure that the necessary liquidity will be in place. That in turn has provided a degree of reassurance—to financial intermediaries and to the public more broadly—that should help to avoid undue precautionary behaviour which might otherwise prove disruptive.

A second challenge is the advent of the euro—and on this score, too, I have very few misgivings. Even before the introduction of the new currency the City played a very positive role in its technical preparation—and one which has been widely acknowledged. And since that introduction the City has continued to play a very active part in the development of the broader, more liquid, financial markets which the euro has made possible, and which are vital to its success as a widely used international trading and investment currency. This activity is in fact the greatest contribution that the United Kingdom can make to that success from the outside. Of course the City is in competition with other financial centres elsewhere in Europe. But as I have often pointed out before, at the macroeconomic level such competition is a positive, not a zero-sum game from which we collectively, borrowers and lenders and market intermediaries, all stand to gain. I have every confidence in the ability of the City to thrive in this competitive environment—but it will thrive not at the expense of the rest of Europe but alongside other European financial centres. And in that context, suggestions that we should be somehow artificially disadvantaged are irrational.

The third challenge confronting the City-and a much more fundamental one-is the accelerating advance of information and communications technology which is currently sweeping across the whole of the global economy. In the financial services sector in particular it is the major driver of change and innovation. It makes possible the introduction of a whole raft of essentially new financial services and products, and it is radically changing the way in which they and existing services and products are delivered, whether in wholesale or retail financial markets, at a fraction of the existing cost. In wholesale markets it will affect the whole spectrum of activity-from trading through payments and settlements, across the whole range of financial instruments and across national boundaries--not simply within Europe, although that is an immediate focus of attention-and it has the potential to alter fundamentally the relationships between end-users of the markets, intermediaries and exchanges. And, at the retail level, too, we will all eventually need to learn to live with totally new, and more efficient, ways of doing things-though that will no doubt come harder to people of my generation!

I don't think anyone at this stage can see at all clearly the end-point of all this or even necessarily the appropriate next steps. And that is why we are seeing a continuous, and often bewildering, stream of new individual and collective initiatives, many of them involving the same participants, both in this country and abroad. Some of these initiatives will inevitably fall by the wayside-that's part of the process by which the market as a whole discovers the way ahead. But those that do succeed will succeed because they add value by meeting more effectively the needs of the consumers of the products and services they provide. As an intensely interested-but non-commercial-observer of it all, I find the whole process hugely stimulating and encouraging. I recognise that I might feel differently if I were a commercial rather than a central banker, but I'm impressed by the fact that most of the commercial bankers I talk to see it in terms of opportunities rather than threats.

The other challenge to the City that I would draw attention to is the quite different challenge associated with growing social concerns and rising public expectations, which are probably heightened by the rapid pace of financial change associated with advancing technology. In part these concerns relate to perceptions of increased risk of financial instability. There has been, and I suspect will continue to be, increasing public emphasis—both domestically and internationally—within the IMF, the new Financial Stability Forum and the BIS, for example, notably in the wake of the recent global financial turmoil—on reducing systemic financial risk and on how to handle systemic disturbances when they occur.

But the social concerns go well beyond this sort of systemic issue. They include growing concerns about organised criminal abuse of the financial system, for example; they include an increasing emphasis on consumer protection particularly protection of the less financially sophisticated in an increasingly complex environment; and they include questions relating to the financial exclusion of disadvantaged sectors of the community. In all these respects, too, the concerns are not just domestic concerns but have close parallels internationally.

It seems to me that in many instances the new technologies, appropriately deployed, actually improve the capacity of the financial system to address these concerns. But if they are not adequately addressed—whether within the system as a whole or at the level of the individual market or individual firm—they could—like purely financial failures—weaken public confidence or attract public responses, which would have a damaging effect on overall activity.

Mr Chairman, I can't imagine that anyone working in the City will become bored as we move into the new millennium in the face of these challenges.

How successful we are in confronting them will depend, as in the past, upon the interaction of the technical and professional skills and self-discipline of the market and the structure, substance and application of the rules of the game as they are reflected in public policy.

We have unique experience within the City on which to build.

The market has repeatedly demonstrated its capacity to respond successfully to new challenges, and currently attracts representatives of the strongest participants from all parts of the world. It is supported by very highly qualified professionals and professional bodies which play an important role in setting and maintaining standards. It is supported, too, by an extraordinary range of specialist professional and technical organisations, which help to ensure that the rules of the game are sensibly formulated and clearly understood. And it is supported by a very strong tradition of technical training and education through this University and the various financial institutes, a tradition which I hope may soon be bolstered by the development of a coherent set of professional qualifications across the different financial market sectors.

But how far we remain successful will depend importantly, too, on how far we are able to maintain what I have

described as the ethos of the competitive market place in a rapidly changing environment, and that will represent a considerable challenge to public policy. Given market self-discipline, I have every confidence that the various competent authorities will remain constructive and impartial in their approach to defining and applying the rules of the game, and open to innovation and wide participation, so that the City retains its position as an attractive location for the provision of financial and business services.

So, Mr Chairman, I look to the future of the City with very considerable confidence. On recent form it has little to fear and great opportunities to look forward to. But I don't say that it will be easy.

## **Contents of recent Quarterly Bulletins**

The articles and speeches which have been published recently in the *Quarterly Bulletin* are listed below. Articles from November 1998 onwards are available on the Bank's web site at www.bankofengland.co.uk/qb/qbcontents.htm

## Articles and speeches (indicated S)

#### August 1996

Simple monetary policy rules The industrial impact of monetary policy Probability distributions of future asset prices implied by option prices Expected interest rate convergence Payment and settlement strategy Practical issues arising from the single currency Economic growth and employment through stability (S) EMU—a British perspective (S) The economics of equal opportunity (S) Gilt repo—and beyond (S) November 1996 Interpreting sterling exchange rate movements The demand for Divisia money by the personal sector and by industrial and commercial companies International monetary policy co-ordination: some lessons from the literature The external balance sheet of the United Kingdom: recent developments Public sector debt: end March 1996 How should central banks reduce inflation?-conceptual issues

Developing voluntary domestic markets for government debt

*Financial Stability Review*—a profile of the new publication Research and policy at the Bank of England (S) Practical issues arising from the introduction of the euro (S) Economic policy approaches—some reflections (S) Risk reduction in payment and settlement systems (S)

## February 1997

Recent yield curve behaviour—an analysis Increasingly weightless economies Monetary policy implementation in EMU The gilt-edged market: developments in 1996 New arrangements for issuing banknotes The financing of technology-based small firms Britain's regional economies: how different are they, and how should those differences affect monetary policy? (S) Monetary stability: rhyme or reason? (S) Evolution of the monetary framework (S) Prospects for monetary stability and the economics of EMU (S) Financial regulation: why, how and by whom? (S) Are banks still special? (S)

## May 1997

Comparing the monetary transmission mechanism in France, Germany and the United Kingdom: some issues and results May 1997 (continued) Economic models and policy-making The information in money Features of a successful contract: financial futures on LIFFE The first year of the gilt repo market The gilt-edged market: the Bank of England's relationship with the gilt-edged market makers and inter-dealer brokers The Bank of England's operations in the sterling money markets Executive summary of the single monetary policy in Stage 3 The financing of technology-based small firms: an update International regulatory structure: a UK perspective (S) Bond yields and macroeconomic behaviour (S) Monetary policy and the exchange rate (S) European central banking—East and West: where next? (S)

#### August 1997

Changes at the Bank of England

- Quantifying some benefits of price stability
- Inflation and inflation uncertainty
- Quantifying survey data
- The evolving role of the IMF in the light of the 1994/95 Mexican crisis
- The euro area from the perspective of an EU central bank (S)
- Reforms to the UK monetary policy framework and financial services regulation (S)
- Monetary policy in Britain and Europe (S)

#### November 1997

Public sector debt: end March 1997

The external balance sheet of the United Kingdom: recent developments

Decomposing exchange rate movements according to the uncovered interest rate parity condition

The relationship between openness and growth in the United Kingdom: a summary of the Bank of England Openness and Growth Project

Rationalisation of European equity and derivative exchanges Implied exchange rate correlations and market perceptions

- of European Monetary Union
- The Bank's regional Agencies

The Bank's Centre for Central Banking Studies—an update Prospects for the City—in or out of EMU (S)

The inflation target five years on (S)

## February 1998

The *Inflation Report* projections: understanding the fan chart

Investment in this recovery: an assessment
#### February 1998 (continued)

Macroeconomic policy and economic performance in developing countries

Gilt-edged and sterling money markets: developments in 1997

Upgrading the Central Gilts Office UK monetary framework and preparations for EMU (S) Recent problems in Asia (S)

May 1998

The Bank of England Act Recent developments in financial markets Growth in UK manufacturing between 1970–92 Competition and co-operation: developments in cross-border securities settlement and derivatives clearing The financing and information needs of smaller exporters The New Lady of Threadneedle Street (S) Exchange rates: an intractable aspect of monetary policy (S)

#### August 1998

The UK personal and corporate sectors during the 1980s and 1990s: a comparison of key financial indicators Are prices and wages sticky downwards? Why has the female unemployment rate in Britain fallen?

Testing value-at-risk approaches to capital adequacy The cyclicality of mark-ups and profit margins: some evidence for manufacturing and services

Three views of macroeconomics (S)

Trade and investment in the light of the Asian crisis (S) The UK economy and monetary policy—looking ahead (S)

Recent economic developments and the MPC approach to monetary policy (S)

Financial services into the year 2000 (S)

### November 1998

Public sector debt: end March 1998

Inflation and growth in a service economy

The foreign exchange and over-the-counter derivatives markets in the United Kingdom

Recent changes to the national accounts, balance of payments and monetary statistics

November 1998 (continued)

Inflation targeting in practice: the UK experience (S) The objectives and current state of monetary policy (S) Economic policy, with and without forecasts (S)

# February 1999

Sterling wholesale markets: developments in 1998 The external balance sheet of the United Kingdom: recent

developments

The impact of inflation news on financial markets

Monetary policy rules and inflation forecasts

The yen/dollar exchange rate in 1998: views from options markets

Risk, cost and liquidity in alternative payment systems

February 1999 (continued)Monetary policy and the international economic environment (S)Monetary policy and the labour market (S)EMU: a view from next door (S)Central bankers and uncertainty (S)

# May 1999

The transmission mechanism of monetary policy Monetary policy and the yield curve The Bank's use of survey data Monetary policy and uncertainty An effective exchange rate index for the euro area The financing of small firms in the United Kingdom Structural changes in exchange-traded markets Developments in small business finance (S) Economic models and monetary policy (S) Inflation and growth in the services industries (S)

#### August 1999

What makes prices sticky? Some survey evidence for the United Kingdom
The use of explicit targets for monetary policy: practical experiences of 91 economies in the 1990s
Financial sector preparations for the Year 2000
The Asian crisis: lessons for crisis management and prevention (S)
The MPC two years on (S)
Price stability in the United Kingdom (S)
The impact of the international environment on recent monetary policy (S)

# November 1999

Sterling market liquidity over the Y2K period Public sector debt: end March 1999 The external balance sheet of the United Kingdom: recent

developments News and the sterling markets

New estimates of the UK real and nominal yield curves

Government debt structure and monetary conditions

Challenges for monetary policy: new and old (S)

Sterling's puzzling behaviour (S)

Monetary policy and asset prices (S)

Interest rates and the UK economy—a policy for all seasons (S)

# February 2000

Sterling wholesale markets: developments in 1999Recent developments in extracting information from options marketsStock prices, stock indexes and index fundsPrivate equity: implications for financial efficiency and stabilityBack to the future of low global inflation (S)

British unemployment and monetary policy (S)

Before the Millennium: from the City of London (S)

# **Bank of England publications**

# **Working Papers**

*Working Papers* are free of charge; a complete list is available from the address below. An up-to-date list of *Working Papers* is also maintained on the Bank of England's web site at www.bankofengland.co.uk/wplist.htm, where abstracts of all *Papers* may be found. *Papers* published since January 1997 are available in full, in PDF format.

<u>No</u>	Title	Author
76	Electronic versus open outcry markets: the case of the Bund futures contract (January 1998)	Francis J Breedon Allison Holland
77	Productivity convergence and international openness (March 1998)	Gavin Cameron James Proudman Stephen Redding
78	Some costs and benefits of price stability in the United Kingdom (March 1998)	Hasan Bakhshi Andrew G Haldane Neal Hatch
79	Bank capital and Value at Risk (May 1998)	Patricia Jackson David J Maude William Perraudin
80	Are there downward nominal rigidities in product markets? (June 1998)	Simon Hall Anthony Yates
81	Are UK inflation expectations rational? (July 1998)	Hasan Bakhshi Anthony Yates
82	Downward nominal rigidity and monetary policy (August 1998)	Anthony Yates
83	The demand for M0 in the United Kingdom reconsidered: some specification issues (August 1998)	Norbert Janssen
84	Averaging in a framework of zero requirements: implications for the operation of monetary policy (October 1998)	Haydn Davies
85	Exchange rates and prices: sources of sterling real exchange rate fluctuations 1973–94 ( <i>October 1998</i> )	Mark S Astley Anthony Garrett
86	Shoe-leather costs reconsidered (October 1998)	Jagjit S Chadha Andrew G Haldane Norbert G J Janssen
87	Why has the female unemployment rate fallen so much in Britain? (October 1998)	Phil Evans
88	Incentive schemes for central bankers under uncertainty: inflation targets versus contracts (November 1998)	Eric Schaling Marco Hoeberichts Sylvester Eijffinger
89	Optimal currency areas and customs unions: are they connected? (November 1998)	Marion Kohler
90	Bank capital and risk-taking (January 1999)	Alistair Milne A Elizabeth Whalley
91	Forward-looking rules for monetary policy (January 1999)	Nicoletta Batini Andrew G Haldane
92	Coalition formation in international monetary policy games (February 1999)	Marion Kohler
93	Business cycles and the labour market can theory fit the facts? (March 1999)	Stephen Millard Andrew Scott Marianne Sensier
94	Asset price reactions to RPI announcements (March 1999)	M A S Joyce V Read
95	Price formation and transparency on the London Stock Exchange (April 1999)	Victoria Saporta Giorgio Trebeschi Anne Vila

96	Uncertainty and simple monetary policy rules—An illustration for the United Kingdom ( <i>June 1999</i> )	Simon Hall Chris Salmon Tony Yates Nicoletta Batini
97	To trim or not to trim? An application of a trimmed mean inflation estimator to the United Kingdom ( <i>July 1999</i> )	Hasan Bakhshi Tony Yates
98	The non-linear Phillips curve and inflation forecast targeting (July 1999)	Eric Schaling
99	Should uncertain monetary policy-makers do less? (August 1999)	Ben Martin Chris Salmon
100	Money, credit and investment in the UK corporate sector (September 1999)	Andrew Brigden Paul Mizen
101	Monetary policy loss functions: two cheers for the quadratic (September 1999)	Jagjit S Chadha Philip Schellekens
102	Monetary stabilisation policy in a monetary union: some simple analytics (October 1999)	Andrew Brigden Charles Nolan
103	Inflation and real disequilibria (December 1999)	Mark S Astley Tony Yates
104	Openness and its association with productivity growth in UK manufacturing industry ( <i>December 1999</i> )	Gavin Cameron James Proudman Stephen Redding
105	Caution and gradualism in monetary policy under uncertainty (December 1999)	Ben Martin
106	Monetary policy surprises and the yield curve (January 2000)	Andrew G Haldane Vicky Read
107	Must the growth rate decline? Baumol's unbalanced growth revisited (January 2000)	Nicholas Oulton
108	The sensitivity of aggregate consumption to human wealth (January 2000)	Hasan Bakhshi

#### **Statistical Abstract**

The annual *Statistical Abstract* comes in two parts: Part 1 contains a range of banking and other financial data; Part 2 provides longer runs of monetary statistics and related items. For 2000, each part is priced at £25.00 (including postage) in the United Kingdom. A concessionary price of £20.00 per part is available to academics in the United Kingdom and £15.00 per part to students and secondary schools in the United Kingdom.

#### **Monetary and Financial Statistics**

A monthly publication, *Bank of England: Monetary and Financial Statistics (Bankstats)*, was launched in January 1997. This comprehensive publication (priced at £90.00 per annum in the United Kingdom for 2000) contains detailed data on money and lending, bank and building society balance sheets, international positions of banks operating in the United Kingdom, government financing and the money markets (including gilt repo and stock lending), issues of securities and short-term paper, interest rates and exchange rates; it also contains occasional background articles. If you would like more information, please contact Daxa Khilosia, Monetary and Financial Statistics Division, HO-5, telephone 020–7601 5353.

The following articles have been published in recent issues of *Monetary and Financial Statistics*. They may also be found on the Bank of England web site at www.bankofengland.co.uk/mfsd/article

Title	Author	Month of issue	Page numbers
Statistics for European Monetary Union: a report of a half-day meeting of the Financial Statistics User Group	Jenny Dawuda and Neil Walker	January 2000	1–5
Derivative statistics: a report of a half-day meeting of the Financial Statistics Users' Group	Gillian Finbow and Mike Shemwell	November 1999	1–3
A strategy and work programme for official financial statistics	Bank of England and Office for National Statistics	November 1999	4–7

Financial market data for international financial stability	Robert Heath	August	1–3
Internationalisation of financial markets and implications for data collection and statistics	Robert Hamilton	August	4–7
Statistics for international financial markets	Michael Bollan and Robert Hamilton	August	8–11
Developments in international banking statistics in 1998	Michael Bollan	July	1–6
Monetary statistics and the monetary financial institutions consolidated balance sheet	Sue Docker and David Willoughby	July	7–12
New data on financial derivatives for the UK National Accounts and Balance of Payments	Andrew Grice	July	13–19
1998 gilt ownership survey	Jonathan Bailey	July	20–23

### **Targeting Inflation book**

In March 1995, the Bank hosted a conference of central banks currently adhering to inflation targets. This book, edited by Andrew Haldane, draws together contributions from each of the eight countries represented at the conference. It details cross-country experiences of this monetary framework and the key operational and theoretical issues it raises. The book is suitable for both academics and practitioners. The price of the book is £20.00 plus postage and packaging.

#### **Index-linked debt book**

In September 1995, the Bank held a conference to discuss a broad range of theoretical and practical questions raised by index-linked debt in general, and the UK experience in particular. This book contains revised versions of the papers presented at the conference, as well as the papers that were circulated by the Bank ahead of the conference, setting out background information and key policy issues. The price of the book is £10.00 plus postage and packaging.

#### **Openness and Growth book**

The *Openness and Growth* book, published in October 1998, contains the proceedings of an academic conference held at the Bank of England in September 1997. The research described in the book investigates the link between productivity growth and the international openness of the UK economy. The price of the book is  $\pounds 10.00$  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.

#### 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.

These publications are available from Publications Group, Bank of England, Threadneedle Street, London, EC2R 8AH; telephone 020–7601 4030; fax 020–7601 3298; e-mail mapublications@bankofengland.co.uk

General enquiries about the Bank of England should be made to 020–7601 4444. The Bank of England's web site is at: http://www.bankofengland.co.uk The web site gives details of job opportunities at the Bank, at http://www.bankofengland.co.uk/employment

# **Quarterly Bulletin and Inflation Report subscription details**

Copies of the *Quarterly Bulletin* and *Inflation Report* are available from the Bank as a **combined** package; the *Inflation Report* is also available separately. The prices are set out below:

Destination		2000				1999			
		Quarterly Bulletin and Inflation Report package		Inflation Report only (1)		<i>Quarterly Bulletin</i> and <i>Inflation Report</i> package		Inflation Report only (1)	
		Annual	Single	Annual	Single	Annual	Single	Annual	Single
United Kingdom by first-class mail (2)		£40.00	£10.00	£12.00	£3.00	£40.00	£10.00	£12.00	£3.00
Academics, <b>UK only</b> Students, <b>UK only</b>		£27.00 £14.00	£6.75 £3.50	£8.00 £4.50	£2.00 £1.50	£27.00 £14.00	£6.75 £3.50	£8.00 £4.50	£2.00 £1.50
European countries including the Republic of Ireland, by letter service		£48.00	£12.00	£14.00	£3.50	£48.00	£12.00	£14.00	£3.50
Countries outside Europe: Surface mail		£48.00	£12.00	£14.00	£3.50	£48.00	£12.00	£14.00	£3.50
Air mail:	Zone 1 (3)	£64.00	£16.00	£21.00	£5.25	£64.00	£16.00	£21.00	£5.25
	Zone 2 (4)	£66.00	£16.50	£22.00	£5.50	£66.00	£16.50	£22.00	£5.50

(1) There is a 25% discount if five copies or more of the same issue are purchased.

(1) There is a 22 % discount if the copies of motor of the same issue are plantace.
 (2) Subscribers who wish to collect their copy(ies) of the *Bulletin* and/or *Inflation Report* may make arrangements to do so by writing to the address given below. Copies will be available to personal callers at the Bank from 10.30 am on the day of issue and from 8.30 am on the following day.
 (3) All countries other than those in Zone 2.

(4) Australasia, Japan, China, the Philippines and Korea

Readers who wish to become **regular subscribers**, or who wish to purchase single copies, should send to the Bank, at the address given below, the appropriate remittance, payable to the Bank of England, together with full address details, including the name or position of recipients in companies or institutions. If you wish to pay by Visa, Mastercard, Switch or Delta, please telephone 020–7601 4030. Existing subscribers will be invited to renew their subscriptions automatically. Copies can also be obtained over the counter at the Bank's front entrance.

The **concessionary rates** for the combined *Quarterly Bulletin/Inflation Report* package and the separate *Inflation Report* are noted above in *italics*. Academics at UK institutions of further and higher education are entitled to a concessionary rate. They should apply on their institution's notepaper, giving details of their current post.

**Students and secondary schools in the United Kingdom** are also entitled to a concessionary rate. Requests for concessionary copies should be accompanied by an explanatory letter; students should provide details of their course and the institution at which they are studying.

The *Quarterly Bulletin* is also available from Bell & Howell Information and Learning: enquiries from customers in Japan and North and South America should be addressed to Bell & Howell Information and Learning, 300 North Zeeb Road, Ann Arbor, Michigan 48106, United States of America; customers from all other countries should apply to White Swan House, Godstone, Surrey, RH9 8LW, telephone 01444 445000.

An index of the *Quarterly Bulletin* is also available to customers free of charge from Publications Group at the address given below. It is produced annually, and lists alphabetically terms used in the *Quarterly Bulletin* and articles written by named authors.

Bound volumes of the *Quarterly Bulletin* for the period 1960–85 (in reprint form for the period 1960–80) can be obtained from Schmidt Periodicals GmbH, Dettendorf, D-83075 Bad Feilnbach 2, Germany, at a price of DM190.00 per volume or DM4,380.00 per set.

The Quarterly Bulletin is available on the Bank's web site at www.bankofengland.co.uk/qb/index.htm

# Issued by Publications Group, Bank of England, Threadneedle Street, London, EC2R 8AH; telephone 020–7601 4030; fax 020–7601 3298; e-mail mapublications@bankofengland.co.uk