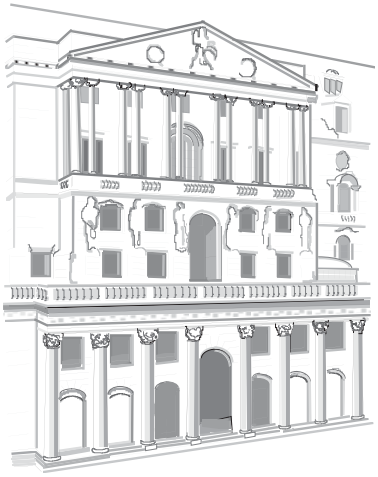
Bank of England Quarterly Bulletin



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The Quarterly Bulletin and Inflation Report

Inflation Report
(published separately)

The *Inflation Report* reviews developments in the UK economy and assesses the outlook for UK inflation over the next two years or so in relation to the inflation target. Section 1 provides an introduction and summary, Section 2 investigates money, credit, and financial market data, including the exchange rate, and Sections 3, 4 and 5 examine demand and output, the labour market and pricing behaviour respectively. The concluding sections present an assessment of medium-term inflation prospects and risks, and information about non-Bank inflation forecasts.

Monetary operations
(pages 329–45)

UK official interest rates were increased twice in the third quarter: the Bank's Monetary Policy Committee raised the Bank's repo rate by 0.25 percentage points on 10 July and 7 August. The UK money and gilt markets have been active: short-term interest rate expectations and longer-term inflation expectations have fallen in the past quarter. The UK yield curve, which was upward sloping at the beginning of the quarter, moved to being downward sloping at the short end. Market views about the short-term interest rate outlook and, in the longer term, entry into EMU, and a reduced potential supply of gilts, were contributory factors. The sterling effective exchange rate depreciated by 1.7% in the quarter, with a larger fall against the dollar than against the Deutsche Mark. Gilt sales were £7.3 billion in the quarter. After six months of the financial year, gilt financing amounted to around 60% of the revised target for the year of £25.1 billion.

The international environment
(pages 346–54)

The main news since the previous *Quarterly Bulletin* is: US GDP continued to grow strongly in the second quarter of 1997, but GDP fell sharply in Japan. Output growth in the major European countries has strengthened, but in Italy it remains significantly weaker than elsewhere in Europe. Growth in Japan, France and Germany is being driven by net exports. In sharp contrast with the United States, the unemployment rate in Germany, France and Italy remains well above 10% of the labour force. Narrow money growth in the major industrialised economies has continued to increase, but broad money growth has remained stable. Equity prices in general continued to grow strongly, though in Japan they have continued to fall. Measured inflation remains low throughout the major six overseas economies. In Europe, consumer price inflation rates have largely converged at slightly above 1.5%. The Bundesbank increased its repo rate in October, leading to increases in several other European policy interest rates. But in the United States and Japan, official interest rates were unchanged.

Public sector debt: end March 1997
(pages 355–67)

This article continues the annual series of articles in the *Quarterly Bulletin* analysing the debt position of the public sector. It considers developments in the net and gross debt of the public sector in the financial year to end March 1997 and analyses the composition and distribution of the national debt.

The external balance sheet of the United Kingdom: recent developments
(pages 368–76)

This article summarises the changes to the net external asset position of the United Kingdom during 1996 and the first half of 1997. It continues an annual series of articles in the *Quarterly Bulletin* begun in 1985.

Research and analysis

(pages 377–423)

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

Decomposing exchange rate movements according to the uncovered interest rate parity condition (by Andy Brigden, Ben Martin and Chris Salmon of the Bank's Monetary Assessment and Strategy Division). This article discusses the relationship between the exchange rate and monetary policy. It sets out some of the difficulties in identifying the underlying causes of exchange rate movements, and outlines one approach, based on the uncovered interest rate parity condition, that can be used to assess how far news about monetary policy has contributed to an exchange rate change.

The relationship between openness and growth in the United Kingdom: a summary of the Bank of England Openness and Growth Project (by James Proudman and Stephen Redding of the Bank's Structural Economic Analysis Division). This article summarises the results of the Bank's Openness and Growth Project. The empirical findings suggest that openness is closely associated with growth in productivity both across countries and across sectors within the United Kingdom. Between 1970 and 1992, some 15% of the initial gap in productivity between the United Kingdom and the United States was closed. Of this, roughly half was attributable to the rise in international openness.

Rationalisation of European equity and derivative exchanges (by Claire Williamson of the Bank's Markets and Trading Systems Division). This article outlines recent structural changes in EU equity and derivative markets, and some of the main factors underlying the increasing trading links between exchanges, both within countries and across borders. It concludes that such links are likely to continue to prove attractive, and notes that this raises a number of issues for market participants, exchanges and regulators.

Implied exchange rate correlations and market perceptions of European Monetary Union (by Creon Butler and Neil Cooper of the Bank's Monetary Instruments and Markets Division). A number of 'EMU calculators' have been developed to assess market expectations of the likelihood of particular countries joining European Monetary Union (EMU). Most of these techniques attempt to infer this information from interest rate differentials. Typically they also require assumptions about the level of interest rates that would hold should a country not join EMU. This article discusses an alternative measure of EMU convergence—the expected correlation between currencies implicit in foreign exchange options prices. It shows how implied correlations may be calculated, and how they may be used to gauge expectations of EMU participation by continental European countries and to interpret sterling's movements since mid 1996.

Reports

(pages 424–29)

The Bank's regional Agencies (by John Beverly, the Bank's Agent for the West Midlands). In this article, John Beverly describes the role of the Bank's Agencies. He first sets out a brief history of the Bank's regional representation; the rest of the article outlines the present work of the Agencies within the new monetary policy framework.

The Bank's Centre for Central Banking Studies—an update. This article outlines the work and aims of the Centre, and its programme for 1998.

Monetary operations

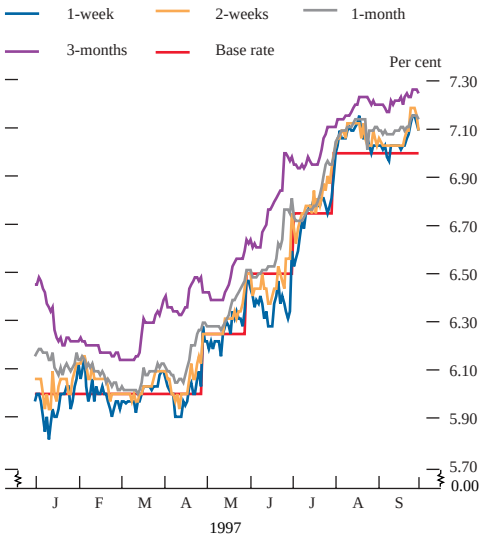
- *UK official interest rates were increased twice in the third quarter: the Bank's Monetary Policy Committee raised the Bank's repo rate by 0.25 percentage points on 10 July and 7 August.*
- *The UK money and gilt markets have been active: short-term interest rate expectations and longer-term inflation expectations have fallen in the past quarter.*
- *The UK yield curve, which was upward sloping at the beginning of the quarter, moved to being downward sloping at the short end. Market views about the short-term interest rate outlook and, in the longer term, entry into EMU, and a reduced potential supply of gilts, were contributory factors.*
- *The sterling effective exchange rate depreciated by 1.7% in the quarter, with a larger fall against the dollar than against the Deutsche Mark.*
- *Gilt sales were £7.3 billion in the quarter. After six months of the financial year, gilt financing amounted to around 60% of the revised target for the year of £25.1 billion.*

Overview

Official short-term interest rates in the United Kingdom were increased by 50 basis points in the third quarter, while rates in the rest of the major industrialised countries were unchanged. This partly reflected different cyclical positions. Longer-term interest rates converged during the quarter: at ten years, the gap between UK and US interest rates halved, and the gap between UK and German rates fell by a third. Within Europe, this narrowing reflected growing market confidence in EMU; outside Europe, yields may have narrowed as markets came to put more weight on the likelihood that global inflation pressures were likely to remain low. Against this background, global financial markets were generally buoyant during the quarter.

On the foreign exchanges, sterling rose in July to its highest for nine years, but then depreciated as markets reassessed the outlook for short-term interest rates. The dollar and Deutsche Mark appreciated during the quarter; the yen depreciated sharply as markets interpreted weaker-than-expected macroeconomic data as postponing any potential rise in Japanese interest rates. Some of the smaller Asian currencies and equity markets fell sharply during the quarter. Up to the end of the third quarter, those falls had had little effect on UK financial markets or institutions.

Chart 1
Sterling interbank interest rates(a)



(a) Middle-market rates at 4.30 pm.

Market developments

Short-term interest rates

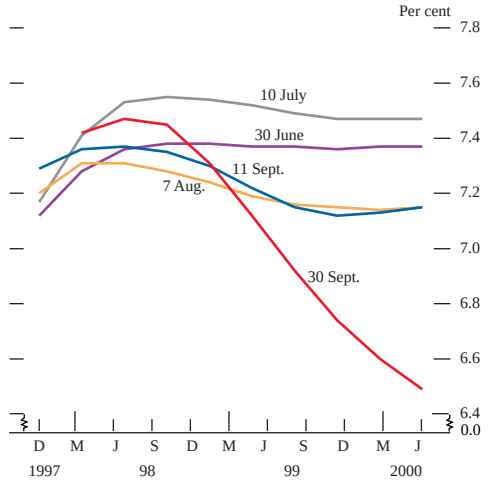
Chart 1 shows the path of short-term interest rates in the United Kingdom since the beginning of the year. The Bank's repo rate was increased twice—on each occasion by 0.25 percentage points—in the third quarter, at the July and August Monetary Policy Committee (MPC) meetings. The rise in August took the repo rate to 7% and was the fourth rise in official rates since May.

Table A
Interest rates, gilt yields and exchange rates(a)

	Interest rates (per cent per annum)					Gilt yields (b) (per cent per annum)				Exchange rates		
	Sterling interbank rates (c)				Short sterling future (d)	Conventionals			Index-linked			
1997	1 month	3 months	6 months	12 months	3 months	Short	Medium	Long	Long	ERI	$/£	DM/£
30 June	6 5/8	6 53/64	6 63/64	7 17/64	7.28	7.05	7.09	7.12	3.63	102.1	1.6636	2.8990
10 July	6 47/64	6 61/64	7 9/64	7 29/64	7.41	7.17	7.08	7.00	3.57	103.8	1.6875	2.9555
7 Aug.	6 63/64	7 7/64	7 7/32	7 3/8	7.31	6.92	6.99	6.95	3.54	102.8	1.5859	2.9707
11 Sept.	7 3/32	7 13/64	7 19/64	7 1/24	7.36	6.94	6.95	6.89	3.53	99.7	1.5880	2.8449
30 Sept.	7 7/64	7 1/4	7 3/8	7 33/64	7.42	6.47	6.43	6.54	3.32	100.4	1.6153	2.8525

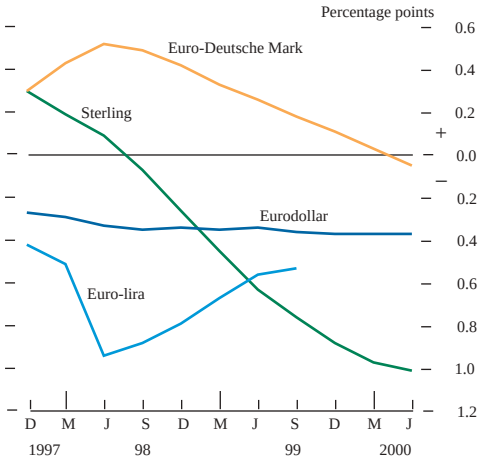
(a) Close-of-business rates in London.
(b) Gross redemption yield.
Representative stocks: short: 7% Treasury 2002; medium: 7 1/4% Treasury 2007; long: 8% Treasury 2021; index-linked: 2 1/2% Index-Linked Treasury 2016 (real yield assuming 5% inflation).
(c) Middle-market rates.
(d) Implied futures rate: December 1997 contract.

Chart 2
Short sterling futures(a)



(a) Three-month Libor rates implied by short sterling futures prices.

Chart 3
Changes between end June and end September in three-month interest rates implied by futures contracts



Expectations about short-term interest rates changed markedly during the quarter, particularly after the August MPC meeting. The rise in the repo rate on 10 July was mostly anticipated by financial markets: the short sterling curve, for example, changed little on the day. The rise on 7 August, however, was less than fully anticipated. The MPC's accompanying press release led to a reassessment of market expectations for official interest rates. The August *Inflation Report*, published the following week, reinforced that assessment.

Chart 2 shows how the path of short-term interest rates implied by sterling futures prices changed during the quarter. At the end of June, three-month interest rates were expected to peak at a rate of around 7.4% in the middle of next year and to remain broadly flat in 1999. By the end of September, the implied peak in rates had moved nearer and was expected to be in March 1998, at a rate of around 7.45%; the futures curve for the second half of 1998 had inverted, as the chart shows, with futures prices implying three-month rates of 6.5% at the end of 1999.

Three-month sterling futures prices are used as a guide to market expectations of official interest rates, but the relationship between the two is neither direct nor simple, as the box on page 331 explains. With the Bank's repo rate at 7%, an implied three-month futures rate of 7.45% for December is likely to be consistent with an expectation of one more quarter-point rise in official interest rates, rather than two.

Expectations of short-term interest rates in the other major countries also changed markedly during the quarter. Chart 3 shows how the paths of implied futures rates changed between the end of June and the end of September. Markets ended the period anticipating a higher path than three months previously for German short-term interest rates. Toward the end of August, the Bundesbank announced that its repo rate would be set each week at its weekly repo operation on Tuesdays, rather than announced in advance at the fortnightly Council meetings; this led markets to expect an early rise in German interest rates. In early October, the Bundesbank increased its repo rate by 30 basis points to 3.3%, a larger-than-expected move. The move was quickly followed by a number of other continental European countries.

Inflation and interest rate expectations in the United States both fell during the quarter, as US macroeconomic data were interpreted as

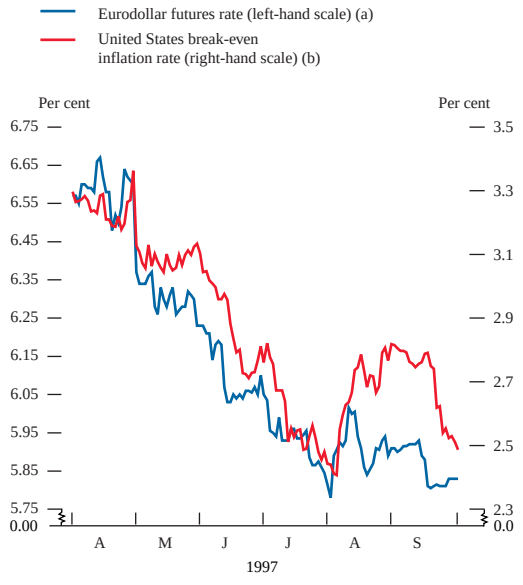
Comparing the short sterling future with the Bank's repo rate

Short sterling futures prices are often cited as the best guide to the market's view of short-term official interest rates. The short-term interest rate contract traded on the London International Financial Futures and Options exchange (LIFFE) is the future value of the British Bankers' Association three-month Libor setting.

How does this relate to the Bank's two-week official rate? We need to take account of technical differences between the two rates, which at the end of September were equivalent to about one fifth of a percentage point, with the components roughly as follows:

	Approximate size
The BBA three-month rate has persistently been above screen-quoted Libor rates. This partly reflects the fact that the BBA quote includes a wider spectrum of banks, and therefore credit risk, than is quoted in typical screen-quoted rates.	6 basis points
Interbank deposits, on which Libor is quoted, are not as marketable as gilt repo. Gilt repo can be traded and it is eligible for use in the Bank's open market operations.	3 basis points
Interbank interest rates include a credit risk premium: the credit risk on private sector banks is likely to be higher than the credit risk on gilt repo, a government credit risk. Interbank rates therefore trade at a premium to repo rates.	6 basis points
A two-week rate of 7% is, after compounding, equivalent to a three-month rate of around 7.05%.	5 basis points
	20 basis points

Chart 4
US inflation expectations and short-term interest rate expectations



(a) Interest rates implied for December 1997 from three-month eurodollar futures contracts traded on the Chicago Mercantile Exchange.
(b) Inflation expectations measured by the US break-even inflation rate, derived by comparing ten-year conventional and index-linked bond yields.

supporting the continuation of non-inflationary growth. Chart 4 shows how the three-month eurodollar futures rate implied for December has been reasonably well correlated with changes in long-term inflation expectations, derived by comparing conventional and index-linked US bonds. (But US index-linked bonds are much less liquid than conventional bonds, so comparisons of yields—and hence inflation expectations—should be interpreted cautiously.)

Long-term interest rates

Long-term interest rates were stable in the United Kingdom for most of the third quarter, but fell sharply toward the end of September, apparently reflecting three factors. First, lower-than-expected inflation data in the United States helped to stimulate a global bond market rally. Second, lower-than-expected UK PSBR data drew attention to the improving fiscal position. Third, there was increased market interest in the possibility of early UK entry into EMU. Chart 5 compares UK bond yields with yields in other major countries. Implied forward short-term interest rates moved sharply during the quarter, with falls at short maturities (consistent with the fall in rates implied by short sterling futures prices). Chart 6 shows how the term structure of implied forward rates moved from being broadly flat to upward-sloping. (That movement has subsequently proved to be temporary.)

International background

US financial markets generally performed strongly during the quarter: the yield on the ten-year benchmark US Treasury fell by 40 basis points and the S&P 500 index rose by more than 7%. But

Chart 5
International ten-year bond yields

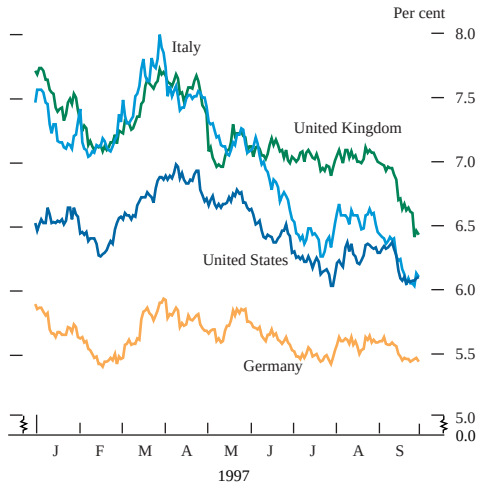
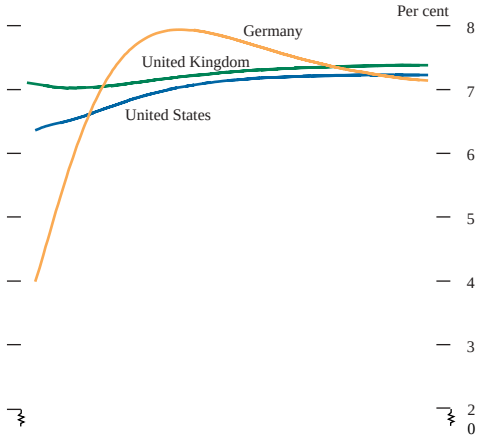
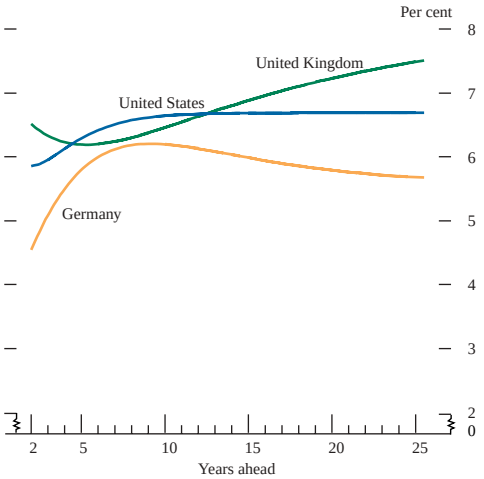


Chart 6
Term structure of six-month forward interest rates for Germany, the United Kingdom and the United States

30 June 1997(a)



30 September 1997(a)



Note: Beyond 15 years, data for Germany are indicative only, because there are fewer long-term bonds than in the United Kingdom or the United States.

(a) Implied six-month annualised rates derived from the zero coupon yield curve.

though US capital markets rose during the quarter, they were fairly volatile, because of changing expectations about US official interest rates. In July, economic data were interpreted by markets as generally supporting the Federal Open Market Committee's decision to leave interest rates unchanged at its meeting on 1–2 July, and Federal Reserve Chairman Greenspan's Humphrey Hawkins testimonies later in the month suggested that there were no excessive price pressures in the economy that would justify an increase in official rates. But market sentiment changed in early August, when the NAPM index and the non-farm employment data prompted one of the sharpest one-day falls in US long-bond prices for more than a year. In early September, bonds appreciated sharply and short-term interest rates fell, when price and retail sales data suggested that a tightening of US monetary policy was not needed as early as previously expected.

Global bond markets were also affected by market views about the immediate outlook for German official interest rates. Uncertainty about the future course of German monetary policy can be estimated by observing implied volatilities on 'at-the-money' options on the three-month euro-Deutsche Mark futures contract. So for example, the price of an option on the December contract (expressed in terms of implied volatility) increases with the level of uncertainty that financial market participants expect around the future level of interest rates in mid December. According to this measure, the level of uncertainty peaked at the beginning of August. This coincided with the peak in the dollar against the Deutsche Mark. The expected level of interest rates on three-month euro-Deutsche Mark deposits also peaked at around the same time.

The convergence in Italian and Spanish ten-year bond yields toward the equivalent yield on German bonds continued in the third quarter, albeit much more slowly than in previous quarters. Market commentators began to suggest that expectations of a wide EMU had strengthened. But there was also a growing recognition of emerging cyclical divergences in Spain and Italy, even though both countries were perceived as on track for meeting the criteria.(1)

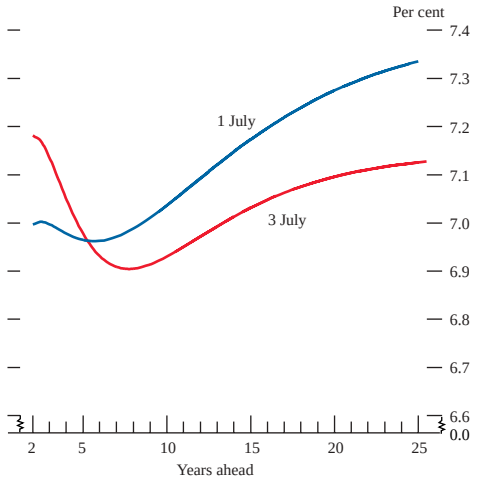
The gilt-edged market

At the beginning of the quarter, the gilt market—like other sterling markets—focused on the mix between monetary and fiscal policy ahead of the Budget on 2 July. In particular, attention was focused on the appropriate response to the strengthening of consumer demand. After the Budget, market expectations for official interest rates in the short term implied that further monetary tightening might be needed in the near term. But Chart 7 shows that expectations of short-term interest rates at longer maturities fell. This probably reflected the Budget's longer-term projections of an improving fiscal position.

Gilt yields were relatively stable until September and there were no significant changes in the shape of the yield curve up to then. UK economic data were generally stronger than the market expected, but any negative implications of such news for the gilt market may have been offset by expectations that the MPC would take action. Supporting this view, longer-term inflation expectations were broadly stable.

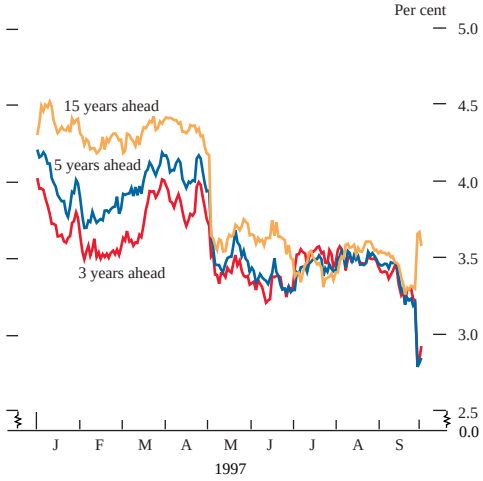
(1) This was underlined by EU official forecasts, published in early October, indicating that most countries would satisfy the deficit criterion.

Chart 7
UK six-month forward interest rates(a)



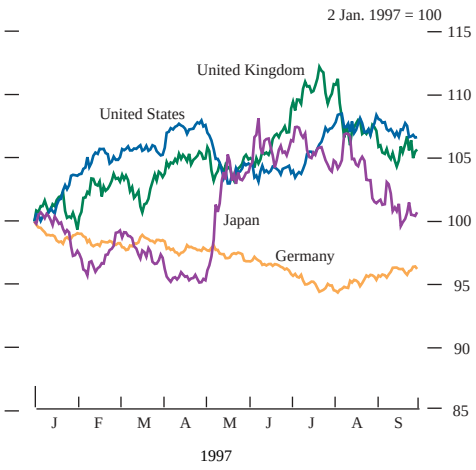
(a) Derived from the zero coupon yield curve.

Chart 8
Implied forward inflation expectations(a)



(a) The implied forward inflation rates are annualised six-month rates derived from the yields on conventional and index-linked gilts.

Chart 9
Effective exchange rate indices: Germany, Japan, the United Kingdom and the United States(a)



(a) Indices rebased to 100 at 2 January 1997.

Gilt yields then fell sharply in September. Three factors probably lie behind this fall: a global bond market rally, sparked by low inflationary pressures in the United States; increased market interest in the possibility of an early date for UK entry into EMU; and forecasts of low gilts supply as government finances appeared to be improving.

Gilt yields fell particularly sharply in the last week of September. A report on 26 September in the *Financial Times*, suggesting that the UK Government would soon make an announcement outlining its conditions for UK entry to EMU, was partly the trigger. The short end of the gilt yield curve rallied, with the long end little affected. The yield on ten-year gilts fell by more than 20 basis points, and that on five-year and two-year gilts fell by 32 basis points and 7 basis points respectively. The spread against Bunds narrowed by 33 basis points to 150 basis points at five years, and by 20 basis points to 95 basis points at ten years.

EMU-related convergence seems a likely explanation for the narrowing of the gilt-Bund yield gap, but Chart 6 shows that though UK and German forward rates converged closely in the short term, they were expected to diverge in the longer term. The term structure of inflation expectations also moved in a similarly puzzling way: Chart 8 shows that implied forward inflation rates fell at 3 and 5 years, but rose at 15 years. Why did short-term yields and implied inflation expectations fall by more than those at longer maturities at the end of September? Put another way, why did EMU-related convergence not affect all parts of the gilt yield curve similarly?

Part of the explanation may be to do with liquidity and institutional factors. Much of the shift occurred on 26 September, the day after the auction of £1.5 billion of 8% Treasury Stock 2021. On this day, gilt-edged market makers were, taken together, long of that stock and short of shorter-maturities and gilt futures contracts. The shift perhaps affected the short and medium part of the curve most because this coincided with potential likely EMU entry dates; it was the most liquid part of the curve (corresponding with the duration of highly liquid gilt futures); and it was the point in the curve where yields were most divergent because of the relative cyclical position of the United Kingdom. So market makers had to unwind their long positions in the longer maturities and buy the shorter part of the yield curve, where UK and other EU bond yields diverged most. This reinforced the momentum and led to a steepening of the yield curve as the short end of the curve rallied, with longer bonds, largely the domain of UK institutions, left broadly unaffected. Since the end of September, this ‘twisting’ of the yield curve has largely unwound.

Foreign exchange

International background

Chart 9 shows the sterling effective exchange rate and the major three international currencies—the Deutsche Mark, the US dollar, and the Japanese yen. During the third quarter, the yen fell as the likelihood of a tightening of monetary policy, which arose during the second quarter, decreased. The Deutsche Mark and US dollar appreciated modestly. In July, sterling reached its highest level for nine years, but ended the quarter 6% below its peak and 1.7% lower than at the start of the quarter.

Chart 10
Deutsche Mark/dollar exchange rate

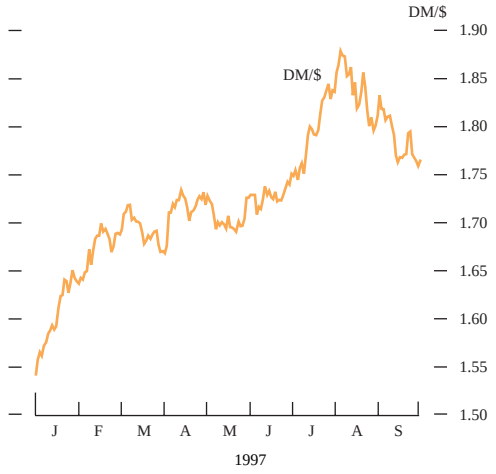


Chart 11
Indonesian rupiah/US dollar exchange rate

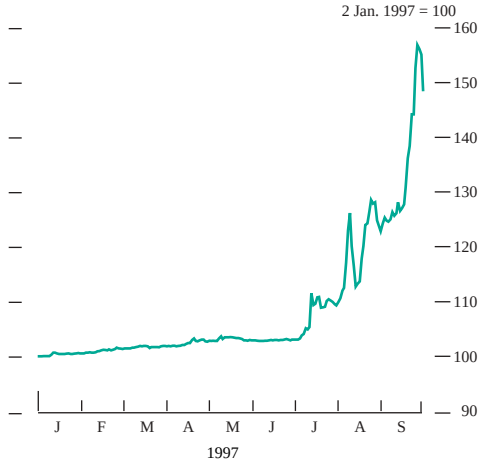


Table B
Selected emerging market currencies against the US dollar

	1 July	30 Sept.	Percentage change
Thai baht	24.4	36.2	-33
Indonesian rupiah	2432	3269	-26
Malaysian ringgit	2.53	3.43	-26
Philippine peso	26.4	34.0	-22
Singapore dollar	1.43	1.53	-6
Korean won	888	911	-3

Table C
Exchange rates

	15 Sept. 1992	1 Aug. 1996	31 Dec. 1996	30 June 1997	30 Sept. 1997
Sterling ERI	99.5	84.7	96.1	102.1	100.4
DM/£	2.7812	2.2946	2.6373	2.8990	2.8525
$/£	1.8875	1.5568	1.712	1.6636	1.6153
DM/$	1.4735	1.4739	1.5405	1.7426	1.7659
Yen/$	123.80	106.75	116.05	114.49	120.71

Chart 10 shows that the US dollar finished the third quarter unchanged against the Deutsche Mark, at DM 1.76. But it strengthened initially, peaking at DM 1.89 in August, which was a little surprising since interest rates implied by euro-Deutsche Mark contracts rose relative to eurodollar futures rates. The Deutsche Mark was eventually underpinned by the belief that a policy response would be triggered by further depreciation beyond DM 1.90. The Bundesbank's decision to return to setting its key official interest rate on a weekly basis on 21 August was regarded by some as indicative that official interest rates might rise (see section on short-term interest rates). During September, German economic data indicated that activity was strengthening, providing further support for the Deutsche Mark. Against the yen, the US dollar strengthened by more than 5% from ¥114½ to ¥121 during the third quarter. Earlier optimism about the prospects for the Japanese economy fell as consumer spending slowed in response to April's fiscal tightening, and the Bank of Japan's Tankan Survey underlined continuing weakness in manufacturing industry. The Japanese yen was supported to some extent by 'safe-haven' flows from neighbouring countries' currencies during July. But these proved short-lived as the markets focused on the likely consequences of the Asian currency crisis for Japanese financial institutions and exporters.

Asian currency markets were turbulent in the third quarter. On 2 July, the Bank of Thailand announced that the Thai baht's currency basket would be abandoned and that it would be allowed to float, subject to certain provisions. The Indonesian rupiah's fluctuation margins were widened on 11 July and they were suspended on 14 August (see Chart 11). The Philippine peso was floated on 11 July. All three currencies depreciated, as did the Malaysian ringgit and the Singapore dollar (see Table B and Chart 12).

In the ERM, currencies moved closer to their ERM central rates, as Chart 13 shows. Uncertainty faded about a possible realignment that might involve an upward revaluation of the central rates of the Irish pound and Finnish markka. The informal ECOFIN meeting on 13/14 September, which concluded that EMU entrants and bilateral conversion rates would be announced simultaneously in spring 1998, was influential in this regard. The divergence between the strongest and weakest currencies in the ERM (the Irish pound and French franc respectively), which reached 12% in July, narrowed to 6½% by the end of the third quarter (see Chart 13).

Sterling

Sterling fell by 1.7% to 100.4 on the effective exchange rate index (ERI) between the end of the second and third quarters. It weakened against the Deutsche Mark and US dollar from DM 2.90 to DM 2.85 and from $1.66 to $1.62 respectively (see Table C and Chart 14). Initially it strengthened during the quarter, to peaks of 106.7 on the ERI and DM 3.08¾ by 23 July, its highest since 1989 (see Chart 15). Sterling peaked against the US dollar at $1.6986 on 11 July, its highest since January 1997.

Early in July ahead of the MPC meeting, the interest rate implied by the December 1997 short sterling contract rose as markets began to expect a rise in the repo rate on 10 July. Following the Budget

Chart 12
Malaysian ringgit/US dollar exchange rate

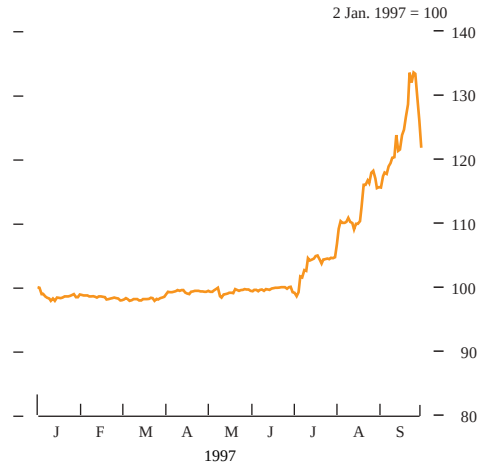


Chart 13
ERM exchange rates: divergence from the Deutsche Mark central rate

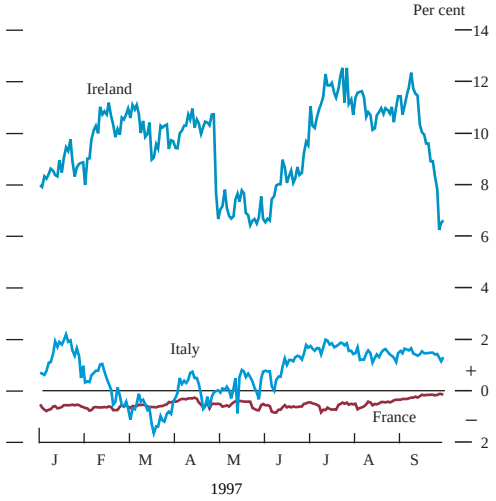
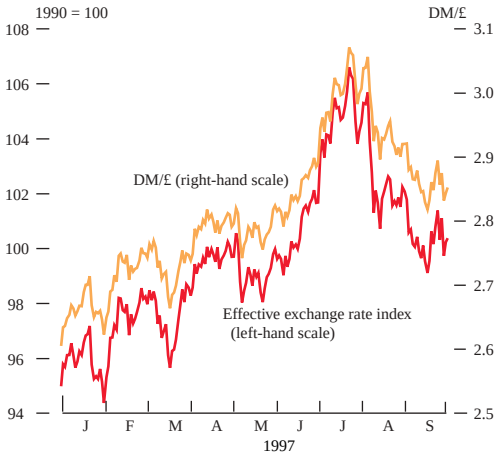


Chart 14
Sterling exchange rates



on 2 July, sterling strengthened by 2¼% to 104 on the ERI and from DM 2.88 to DM 2.96 between 2 July and 4 July. The exchange rate reacted little to the announcement that the Bank's repo rate was raised from 6½% to 6¾%: it closed at 103.8 on the ERI and DM 2.96½ on 10 July.

Sterling's subsequent rally during July to its third-quarter peaks was driven by a combination of news on EMU and strong UK economic data. On 11 July, the German government published its forecasts for the 1997 fiscal deficit. The Deutsche Mark fell sharply because of the belief that a wider EMU was more likely, and the Italian lira strengthened slightly to Lit 970, its highest against the Deutsche Mark since January 1997. Diversification flows from countries likely to participate in EMU appeared to boost sterling, which rose from DM 2.95 to DM 3. Further EMU optimism occurred after 21 July when the French authorities announced measures to reduce its deficit towards Maastricht's fiscal deficit criterion. Sterling reached DM 3.04 on 22 July and peaked at DM 3.08¾ on 23 July, following the publication of robust UK retail sales data.

Sterling subsequently traded in a narrow range between DM 2.98 and DM 3.06 ahead of the MPC meeting on 7 August. Sterling rallied briefly on the announcement that the Bank's repo rate was raised from 6¾% to 7%. The accompanying press release had a significant impact on sterling, which fell sharply from DM 3.02 to reach a low of DM 2.96½. It closed at DM 2.97 and ERI 102.8 on 7 August.

Sterling fell further following the publication of the *Inflation Report* on 13 August. The *Report's* conclusion was interpreted as confirming that monetary policy was unlikely to be tightened at the MPC's next meeting on 11 September. The exchange rate closed down 1% at 100.7 on the ERI. The foreign exchange market viewed UK monetary policy as 'on hold' for the time being, leaving sterling largely on the sidelines between the publication of the *Report* and the next MPC meeting. Sterling was broadly unchanged against the US dollar during this period, but it weakened by more than 4% against the Deutsche Mark, falling from DM 2.97 to DM 2.84½. The MPC's announcement on 11 September that interest rates were to be left unchanged had been widely anticipated and had no impact on the exchange rate. But the subsequent release of stronger-than-expected labour market and retail sales data supported sterling, which recovered to DM 2.87½ and ERI 101.1 by 25 September.

The *Financial Times* report on 26 September, referred to on page 333, suggested that sterling was likely to enter EMU at a lower exchange rate. Sterling fell sharply from DM 2.87½ to a low at DM 2.81 until reports that HM Treasury had described the story as speculation helped it to recover to DM 2.83¼. The expected future volatility of the sterling Deutsche Mark exchange rate, as derived from currency options, fell. This is consistent with a greater probability being placed on the United Kingdom joining EMU.(1)

(1) See the article 'Implied exchange rate correlations and market perceptions of European Monetary Union', by Creon Butler and Neil Cooper on page 413.

Chart 15
Sterling exchange rates

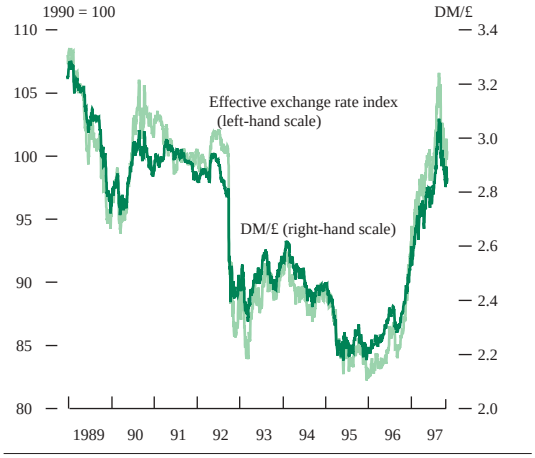
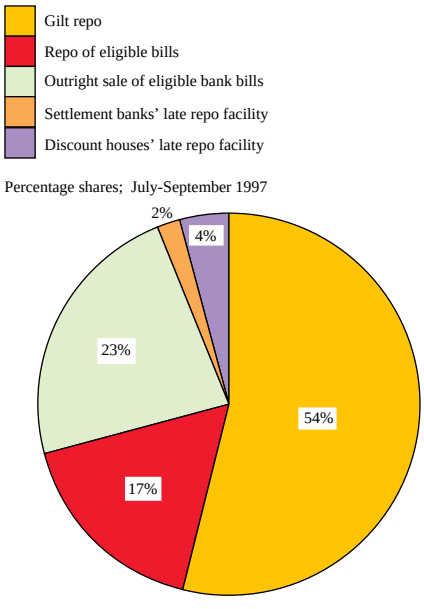


Chart 16
Equity indices

Chart 17
OMOs—instrument overview



Equity markets

UK and US equity markets continued to perform strongly in the third quarter, appearing unaffected by the turbulence in Asian equity markets. The FT-SE 100 index rose by nearly 14%, outperforming the S&P 500 index, which rose by 7% (see Chart 16). By comparison, the German DAX index rose by 10%. Price gains in the third quarter brought cumulative returns since the beginning of 1997 to 31% for the S&P 500 index, and to 27% for the FT-SE 100 index.

South East Asian equity markets, by contrast, fell sharply in the third quarter. The Malaysian and Indonesian stock market indices fell by more than 25%, and the Thai stock exchange index fell by about 10%. It is difficult to establish a causal link between equity market revaluation and the sharp falls in the value of some of these currencies against the US dollar. Two major concerns for both markets have been the extent of unhedged US dollar borrowing by domestic companies and the effect of rising domestic interest rates on national economies. There has also been uncertainty about the way national governments might tackle structural economic problems.

Open market operations and gilt repo

Operations in the sterling money market

This was the second quarter of the Bank's new arrangements for money-market operations.(1) Chart 17 shows how the Bank's daily refinancing with the market was provided during the quarter. About 70% of refinancing was by repo of gilts and eligible bills and most of the rest was provided by outright purchases of bills. The use of late facilities—through which the discount houses and settlement banks may obtain liquidity late in the day—was little changed compared with the previous quarter, despite a number of days at the end of September when there were late swings against the market. Table D shows the main influences on the cash position of the money market during the quarter.

The average daily shortage from July to September was £1.2 billion, compared with £1.1 billion in the same period last year. The new system seems to have coped well with large daily shortages; some large late swings in the money market position during September, however, occasionally put pressure on the overnight rate. For example, on 30 September, the overnight rate peaked at 9½% after the 2.30 pm round of open market operations (OMOs). The discount houses' late repo facility also failed to clear the shortage. The settlement banks' late repo facility was opened at 3.50 pm, as there was a further swing against the market, probably because of higher-than-expected corporation tax receipts.

In recent months, a relative shortage of eligible collateral for use in OMOs may have added to pressure on the overnight rate, particularly when shortages were large and occasionally revised up. The market for eligible bank bills—bills that may be sold to the Bank as part of the daily OMOs—increased during the quarter from £17.7 billion to £19.9 billion. The amount of outstanding gilt repo reported to the Bank fell between May and August, to £72 billion. Together, these probably indicate little change in the amount of

(1) For a fuller description of the changes to the money-market operations, see pages 204–7 of the May *Quarterly Bulletin*.

Table D
Influences on the cash position of the money market

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

	1997/98 Apr.-June	1997/98 July	Aug.	Sept.
CGBR (+)	9.1	-3.7	2.1	2.6
Net official sales of gilts (-) (a)	-8.6	-2.5	2.0	0.5
National Savings (-)	-0.3	-0.1	-0.1	-0.2
Currency circulation (-)	1.5	-0.5	-1.5	1.7
Other	-2.7	1.1	-0.6	-0.1
Total	**-1.1**	**-5.7**	**1.8**	**4.5**
Outright purchases of Treasury bills and Bank bills	0.4	-0.1	0.6	-1.3
Repos of Treasury bills, Bank bills, and British Government stock and non-sterling debt	-1.5	6.3	-1.3	-4.6
Late facilities (b)	0.5	-0.3	-0.2	0.3
Total refinancing	-0.7	5.8	-0.9	-5.5
Treasury bills: Market issues and redemptions (c)	-1.3	0.0	0.9	-0.8
Total offsetting operations	**0.6**	**5.9**	**-1.8**	**-4.8**
Settlement banks' operational balances at the Bank	-0.5	0.2	0.0	-0.2

(a) Excluding repurchase transactions with the Bank.
(b) Since 3 March 1997, when the Bank introduced reforms to its daily money-market operations, discount houses and settlement banks have been eligible to apply to use the late facilities.
(c) 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) and tap Treasury bills.

potential collateral that money-market counterparties could use in OMOs during the quarter. At the same time, the demand for eligible collateral remained high—both for use in OMOs and also as part of the sterling stock liquidity requirement for banks. (In the past year, the conversion of some building societies into retail banks has increased the number of institutions required to hold sterling stock liquidity.) As a result, some in the market have commented about a relative shortage of eligible collateral.

At the beginning of September, the money market coped well with a gilt maturity that generated a large cashflow to the market: the redemption of some £5½ billion of 8¾% Treasury Loan 1997 on 1 September. In anticipation of this, the Bank began issuing £300 million a week of one-month Treasury bills from 25 July, alongside the existing programme of £200 million a week of three-month bills. The use of one-month bills allowed the Bank to drain additional liquidity from the money market for a short, more closely targeted period. The market coped easily with the issuance of two maturities of bills simultaneously (the last time two different maturities were issued was in 1993, when three-month and six-month bills were issued). The one-month bills were in demand, with average cover of 5.5. Once the period of low refinancing was over, the one-month bill tender was withdrawn (on 19 September).

In addition to the introduction of the one-month Treasury bill programme, the Bank also adapted its regular money-market operations to help deal with the redemption. On 13 August, the Bank announced that it would adapt its operations in two ways from the following day:

- On appropriate days, the Bank would include invitations of repo to 1 September in its daily operations, in addition to its normal invitations of repos of approximately two weeks.

- From 14–20 August, the Bank would include holdings in CGO of 8¾% Treasury Loan 1997 in the instruments it was prepared to buy outright in its daily operations.

As a result of these adaptations, the Bank bought £240 million of the redeeming stock as part of its OMOs. This was in addition to buying £526 million through the normal facility, by which the Bank is ready to buy in stocks in the three months before they mature, at a price it posts each day on its gilts screens.

Interest rates quoted in the interbank market continued to trade above repo rates: the gap between two-week interbank and general collateral repo averaged 16 basis points during the quarter, for example. The gap between the two partly reflects the unsecured nature of interbank transactions relative to (collateralised) repo, but it could also reflect a continuing demand for eligible collateral. Any comparison of interbank and repo rates also raises a wider question about the potentially changing role of the interbank market in the past few years. Gilt repo was introduced at the beginning of 1996 and has grown into an important source of secured liquidity at the short end of the sterling money markets. The introduction of the Capital Adequacy Directive at the beginning of 1996 has meant that gilt repo receives more favourable capital treatment than traditional interbank lending. Both developments may mean that some of the liquidity and volume that would have occurred in the interbank market has been directed to the repo market.

Table E
Maturity breakdown of repo and reverse repo outstandings over time[a]

		On call and next day	2–8 days	9 days to 1 month	1–3 months	3–6 months	Over 6 months	Total Per cent	Total £ billions
Per cent									
Repos									
1996	May	20	34	23	15	7	1	100	*35*
	Aug.	19	33	33	11	4	1	100	*56*
	Nov.	19	36	22	19	2	2	100	*68*
1997	Feb.	20	29	33	15	3	0	100	*71*
	May	27	23	27	18	4	1	100	*79*
	Aug.	24	21	23	25	4	1	100	*71*
Reverse repos									
1996	May	20	30	20	23	6	2	100	*34*
	Aug.	22	29	29	14	5	1	100	*54*
	Nov.	21	34	21	20	3	2	100	*60*
1997	Feb.	18	32	26	21	3	0	100	*67*
	May	23	21	30	20	6	1	100	*71*
	Aug.	17	21	27	27	6	1	100	*67*

Note: rows may not sum to totals because of rounding.

(a) From the data reported under the voluntary quarterly arrangements.

Table F
Financing arithmetic 1997/98: progress to end September

£ billions	
CGBR forecast	12.4
Assumed increase in net official reserves	0.0
Gilt redemptions	19.6
Plus gilt sales residual from 1996/97	-3.9
Financing requirement	**28.1**
Less: expected net inflow from National Savings	3.0
expected net sales of Certificates of Tax Deposit (a)	-0.1
Gilt sales required	**25.1**
Less: gilt sales already made (to end Sept. 1997)	16.0
Further gilt sales required Oct. 1997–Mar. 1998	**9.1**

Note: figures may not sum to totals because of rounding.

(a) Certificates of tax deposit are deposits made by taxpayers with the Inland Revenue in advance of potential tax liabilities. Changes in the level of CTDs act as a financing item for central government.

Gilt repo market

The amount of gilt repo outstanding fell slightly between May and August from £79 billion to £71 billion, according to the Bank's quarterly survey. This follows rapid growth in 1996, the first year of the market. This consolidation in the market is also reflected in the gilt repo data reported to the Bank as part of the monetary statistics (gilt repo is in M4 and reverse repo in M4 lending).

The market was generally quiet during the summer period, both in general collateral and specials activity, with only a few of the well-known stocks, for example 6% Treasury 1999, trading special to any significant extent. But turnover in the quarter increased, averaging around £18 billion a day. Most turnover remained at the short end: 69% was on call or next day. The maturity of repo and reverse repo outstandings, shown in Table E, may be increasing. The percentage of outstanding transactions up to one month fell, compared with May, and the share at one to three months increased. This may be evidence that the market is maturing.

Conduct in the gilt repo market is guided by the *Gilt Repo Code of Best Practice*, which was finalised in November 1995. The *Code* has contributed to the smooth and orderly development of the market. When the repo market began, it was envisaged that the *Code* would be reviewed periodically in the light of market and other developments. A working party is now looking at all aspects of the *Code*, including areas such as penalties for failure to deliver, partial deliveries and the effect of the new CGOII system on the market.

Gilt financing

Gilt sales to the end of September amounted to £16 billion, about 60% of the revised sales target announced following the Budget (see Table F). About £12.7 billion was raised by conventional gilt sales, the rest by index-linked. Within conventionals, the distribution of sales has been skewed towards short and long-dated gilts, which account for about 40% each of total conventional issues, compared with 20% for mediums, against remit targets for the financial year as a whole of 35% each for shorts and longs and 30% for mediums. This reflects the fact that in the first six months of the financial year, three auctions each of shorts and longs were held, compared with only a single auction so far of a medium stock. Taps of conventional stocks are becoming increasingly rare and are only used for market-management purposes; there were no conventional taps during the quarter. Table G reports gilt issuance by auctions and taps.

Auctions

There were only two auctions during the second quarter of the financial year, a long auction in July and a dual short and long auction in September. The auction originally planned for August was cancelled in the alterations to the 1997/98 auction calendar following the Budget. The auction schedule for the second quarter was announced on 11 July, following the usual consultation with market participants.

The auction of £2 billion of 8% Treasury Stock 2021 in July was in line with the advice of market participants given at the Bank's quarterly meetings. This reflected strong demand for stock at the

Table G
Gilt issuance

Date	Stock	Amount issued (£ millions)	Price at issue (per £100 stock) (a)	Yield at non-competitive allotment price (b)	Yield at issue	Yield when exhausted (c)	Average yield (d)	Cover (e) at auctions	Tail (f) at auctions (basis points on yield)	Date exhausted
Auctions of Conventional stock										
23.4.97	7% Treasury Stock 2002	2,000	98.9688	7.24	n.a.	n.a.	n.a.	3.49	1	23.4.97
20.5.97	7% Treasury Stock 2002	1,500	100.2500	6.94	n.a.	n.a.	n.a.	3.03	0	20.5.97
22.5.97	8% Treasury Stock 2021	1,500	108.6250	7.24	n.a.	n.a.	n.a.	1.29	4	22.5.97
25.6.97	7¼% Treasury Stock 2007	2,000	100.8125	7.13	n.a.	n.a.	n.a.	2.71	1	25.6.97
23.7.97	8% Treasury Stock 2021	2,000	113.2813	6.86	n.a.	n.a.	n.a.	2.32	1	23.7.97
23.9.97	7% Treasury Stock 2002	1,500	101.1250	6.71	n.a.	n.a.	n.a.	2.30	1	23.9.97
25.9.97	8% Treasury Stock 2021	1,500	117.0313	6.57	n.a.	n.a.	n.a.	2.33	1	25.9.97
Tap Issues of Index-Linked Stock										
17.4.97	2½% Index-linked 2013	200	146.5625	n.a.	3.61	3.61	3.60	n.a.	n.a.	30.4.97
3.6.97	2½% Index-linked 2016	325	156.5000	n.a.	3.67	3.67	3.67	n.a.	n.a.	3.6.97
3.6.97	2½% Index-linked 2009	125	172.2500	n.a.	3.62	3.62	3.62	n.a.	n.a.	3.6.97
16.6.97	2½% Index-linked 2024	150	125.3750	n.a.	3.65	3.65	3.65	n.a.	n.a.	16.6.97
16.6.97	2½% Index-linked 2013	150	147.8750	n.a.	3.61	3.62	3.62	n.a.	n.a.	27.6.97
4.7.97	2½% Index-linked 2011	150	181.2500	n.a.	3.55	3.55	3.55	n.a.	n.a.	17.7.97
4.7.97	2½% Index-linked 2020	150	153.5625	n.a.	3.57	3.57	3.57	n.a.	n.a.	4.7.97
14.8.97	2½% Index-linked 2003	100	183.5625	n.a.	3.56	3.56	3.56	n.a.	n.a.	15.8.97
14.8.97	2½% Index-linked 2024	200	128.3125	n.a.	3.55	3.54	3.55	n.a.	n.a.	14.8.97
3.9.97	2½% Index-linked 2009	100	175.6875	n.a.	3.52	3.53	3.53	n.a.	n.a.	5.9.97
3.9.97	2½% Index-linked 2020	200	154.8125	n.a.	3.55	3.55	3.55	n.a.	n.a.	3.9.97
16.9.97	2½% Index-linked 2016	100	163.3750	n.a.	3.47	3.46	3.47	n.a.	n.a.	16.9.97
16.9.97	2½% Index-linked 2024	100	130.7500	n.a.	3.48	3.48	3.48	n.a.	n.a.	16.9.97

n.a. = not applicable.

(a) Non-competitive allotment price.
(b) Gross redemption yield per cent based on the weighted average price of successful competitive bids.
(c) Gross redemption yield or real rate of return (assuming 5% inflation) based on the price when the issue ceased to operate as a tap.
(d) Weighted average gross redemption yield or real rate of return (assuming 5% inflation), based on actual price at which issues were made.
(e) Total of bids divided by the amount on offer.
(f) Difference in gross redemption yield between the weighted average of successful competitive bids and the lowest accepted competitive bid.

long end (yields had just dipped below 7% for the first time since late 1993) and the desire to build up the outstanding amount of strippable long stock ahead of the start of the strips market later in the year. Expectations immediately ahead of the auction were that, despite prevailing strong demand, there might be a long tail—recalling the modest cover of the previous long auction in May—with some regarding long gilt yields below 7% as dear. But the result—2.3 times cover and a one-basis-point tail, with an average price (yielding 6.86%) only three ticks below the (10.30 am) when-issued price—was seen as good and the market rallied following the announcement.

Market participants' views on stocks for the September dual auction differed more, but many recognised that a combination of short and long would most readily achieve the remit targets for each maturity band, as well as appealing to a wide investor base and providing protection against any shift in the yield curve. Once again, the main factor in determining the choice of stocks was the aim of building up the amount outstanding of strippable stocks, and it was decided that the first leg should be the five-year benchmark, 7% Treasury Stock 2002, with the second leg a further tranche of 8% 2021. The identity of the short stock and the amounts to be auctioned—£1.5 billion in each leg, the minimum allowed under the remit—were both generally expected by the market (the long stock had already been specified in the quarterly auction announcement in July). Though retail interest in both stocks ahead of the dual auction appeared limited, both auctions went smoothly. Both stocks were covered 2.3 times, with a one-basis-point tail, the short stock from an average yield of 6.71% and the long from an average yield of 6.57%.

At the end of September, the quarterly announcement of the maturity ranges for the following quarter confirmed that the October auction would be a medium, the current ten-year

benchmark, 7¼% Treasury Stock 2007; and the November auction would be a new short conventional stock in the range 2003–4. The option to choose 2003 or 2004 for the maturity allows the authorities the opportunity to get further market feedback on the best choice of a new five-year benchmark, in an environment when the financing requirement is low. It was announced that the date of the November auction would be reviewed in light of the date of the Green Budget, and the auction was subsequently postponed to 10 December.

Outright sales of conventionals in the previous quarter had reduced the amount of stock in the Bank's shop window and, following further sales of £58 million as the market continued to rise, there was no stock available for sale or switching by the end of September. As a result, turnover in switches dropped sharply in the quarter, with nominal monthly turnover averaging only £30 million, compared with £547 million in the previous quarter.

Index-linked gilts

Index-linked gilts (IGs) generally performed strongly during the quarter, with yields falling sharply, especially at the long end, probably reflecting switching out of equities associated with the abolition of ACT tax credits in the Budget, as well as nervousness at signs of increasing volatility in equity markets. Index-linked real yields fell by 33 basis points during the quarter, with break-even inflation rates—the inflation rate needed to make holding index-linked bonds 'break even' with the equivalent conventional bonds—falling to around 3.2%, from around 3.4% in early July.(1) With demand generally buoyant during the quarter, especially in September, the Bank was able to tap the index-linked sector four times, with eight separate issues with a nominal value of between £100 million and £200 million each. Sales of index-linked gilts during the quarter raised £1.8 billion in cash terms, bringing the cumulative total for the first half of the financial year to £3.2 billion—nearly two thirds of the remit target. The box on page 341 reports briefly on recent developments in the US index-linked market and contrasts the fall in UK real yields with little change in US real yields.

Demand for longer-dated stock following the Budget prompted a tap package comprising £150 million each of 2½% 2011 and 2½% 2020. The latter was sold at a 1/16 premium in the initial tender. Small sales of the 2011s were made during the next fortnight, as GEMMs covered retail buying in the longer end by bidding for the outstanding tap, which was finally exhausted on 17 July.

With no supply for almost a month, and following a period of underperformance against conventionals and a stronger equity market, interest in index-linked stocks re-emerged, perhaps because some UK fund managers wanted to switch out of equities into longer-dated gilts. Short-dated index-linked stocks had also been performing strongly as the nominal and real yield curves disinverted, after the rise in UK interest rates on 7 August, and perhaps in anticipation of sales of the 1998 stock when it lost its index-linking, as it moved to having less than eight months to maturity. The Bank issued a tap package in response to this

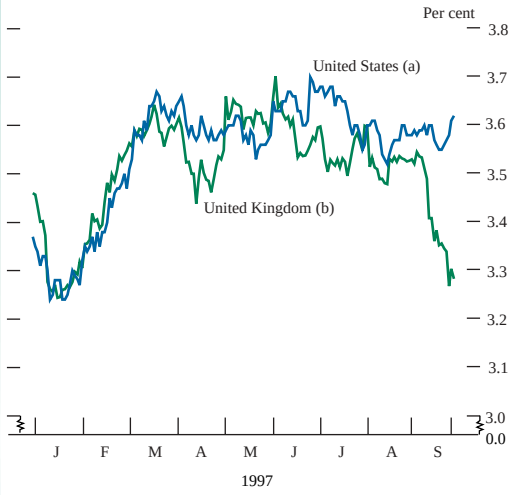
(1) IG yields were below equity dividend yields throughout the quarter, which is a reversal of their usual relationship.

United States: index-linked market and real interest rates

Global interest in inflation-indexed bonds has increased significantly during the year, following the US Treasury's introduction of inflation-indexed securities in January. Since the US launch, indexed bond markets have also been established in the Czech Republic and Greece. Issuance of the US securities is by quarterly single-price auction. The first two auctions were of a ten-year indexed note, and the July and October auctions were of a five-year note. Demand at the first auction was high; cover was lower at subsequent auctions, reflecting the combination of a favourable inflation outlook in the United States and uncertainty about possible revisions to the US CPI. Despite this, at $31 billion, the US indexed-bond market is already the second-largest such market in the world (after the United Kingdom) and is set to develop further in 1998 with the introduction of a new 30-year inflation-indexed bond. Liquidity of the market may be enhanced by the Chicago Board of Trade's introduction in July of futures and options on both the five and ten-year indexed notes, though so far few contracts have traded.

The chart compares the real yields on the US ten-year indexed note and the UK twelve-year index-linked gilt since the start of the US market. The levels of real yields are not directly comparable because of different tax regimes and the treatment of indexation lags. But the trends in yields are comparable, and the chart shows how UK real rates fell relative to US rates during September. Both UK and US-specific factors help to explain that. Three factors have underpinned demand for IGs. First, the structural influence of the Minimum Funding Requirement from April has boosted demand by UK pension funds. Second, the strength of equities has made IGs—often compared to equities as an inflation hedge—look 'cheap'. Third, there has reportedly been some demand for IGs from pension and insurance fund managers looking to buy longer-duration assets.

Real yields on index-linked bonds



(a) Real yields on 3⅜% index-linked 2007.
(b) Real yields on 2½% index-linked 2009.

In the United States, demand for index-linked bonds has been low. This may be because inflation has, on the whole, continued to be lower than expected, despite the strong labour market. Comments about a 'new economic paradigm' associated with high-technology sectors and implying a higher rate of non-inflationary growth have supported that view. With little perceived inflationary threat, conventional bonds may be preferred by US investors.

demand. The £200 million 2½% index-linked 2024s were exhausted on the day of issue, and sales of the £100 million 2½% index-linked 2003 were completed the following morning.

In response to continuing investor demand, a package of £300 million index-linked taps was issued on 3 September. The £200 million 2020s was immediately exhausted, but with demand concentrated at the longer end, only £10 million of the £100 million 2009s was sold at the initial tender. Following a strong market rally on the release of weaker-than-expected US employment data, the tap was exhausted on 5 September.

Following a further rally in the sector, a £200 million package was issued on 16 September and almost immediately exhausted: £100 million of 2½% 2024 was sold at a 3/16 premium in the initial tender, and £100 million of 2½% 2016 was exhausted shortly afterwards.

Sectoral investment activity

The latest ONS data, covering the period from April to June, show total net institutional investment in gilts, at £5.8 billion, returning

Table H
Official transactions in gilt-edged stocks

£ billions; *not seasonally adjusted*

	1997/98 Apr.-June	1997/98 July	Aug.	Sept.
Gross official sales (+) (a)	8.6	2.8	0.4	4.1
Redemptions and net official purchases of stock within a year of maturity (-)	0.0	-0.3	-2.4	-4.6
Net official sales (b)	8.6	2.5	-2.0	-0.5
of which net purchases by:				
Banks (b)	0.4	3.4	-1.2	-1.8
Building societies (b)	0.8	-0.1	0.1	-0.4
M4 Private sector (b)	7.3	0.4	-4.2	3.1
Overseas sector	0.2	-1.3	3.3	-1.5
LAs & PCs (c)	0.0	0.2	0.1	0.0

(a) Gross official sales of gilt-edged stocks are defined as official sales of stock with over one year to maturity net of official purchases of stock with over one year to maturity apart from transactions under purchase and resale agreements.
(b) Excluding repurchase transactions with the Bank.
(c) Local Authorities and Public Corporations.

to a level similar to those seen in each of the four quarters in 1996, after falling back to £2.3 billion in the first quarter of 1997 (probably reflecting the relatively large level of gilt redemptions—nearly £5 billion—falling in this period). Net investment in gilts by pension funds was a record £3.2 billion, an increase of £1.7 billion from the previous quarter, probably driven mainly by the effect of the Minimum Funding Requirement introduced in April under the Pensions Act 1995. It may also have reflected speculation about the likely Budget changes to ACT tax credits. Net investment in gilts by long-term insurers recovered in the second quarter, after an unusually low level in the first quarter, up from £0.3 billion to £2.5 billion.

Data compiled by the Bank for the most recent quarter, July to September, showed that net sectoral investment in gilts fell back to a virtually flat position, largely as a result of two large redemptions—totalling £7.5 billion—falling during the quarter (see Table H). The domestic non-monetary sector—which includes pension funds and life assurance companies—sharply reduced its net holdings of gilts in August, but made net purchases of £3.1 billion in September, with buoyant demand generally reflected in the sharp fall in yields during the second half of the month, and specific demand stimulated by the September dual gilt auction. The overseas sector made net purchases of £3.3 billion in August, but this was offset by equivalent net sales in July and September, perhaps reflecting profit-taking as gilt yield differentials against overseas bonds narrowed.

Technical developments

Gross payment of all gilt dividends from April 1998

It was announced on 2 July that with effect from 6 April 1998, all gilt interest will be payable without deduction of withholding tax, though investors who wish to continue to receive net dividends will be able to do so. The quarterly accounting arrangements for gross gilt interest received by UK taxable companies will remain in place for interest on those gilts to which quarterly accounting at present applies; but quarterly accounting will not apply to interest on future new gilt issues unless HM Treasury directs this at the time of issue.

This major simplification will enable the abolition of existing arrangements under which gilt interest is paid gross, such as the Central Gilts Office Star Account scheme, the CGO Gross scheme, the CGO Double Taxation Agreement scheme and the E arrangement. It will thus substantially reduce the tax compliance burdens of custodians and others, making the gilt market more accessible and attractive to investors, which will help to reduce the cost of future public borrowing.

CGO upgrade and Strips

On 1 August, the Bank announced the results of three dress rehearsals in July that trialled the upgraded Central Gilts Office system. The rehearsals demonstrated that the physical infrastructure of the upgraded system could handle the volumes likely to be experienced in live running, and that the system had the necessary settlement capability in place and was operating substantially as intended. There were, however, some areas where trialling had indicated the need for adjustments to the system; these

were being made, but it was important that they were rigorously trialled. It was therefore decided to hold a further dress rehearsal in September.

That rehearsal was conducted during the weekend of 27 and 28 September, and showed that the criteria for a successful implementation of the upgrade had been met. The Bank announced on 3 October that the upgraded CGO system would be inaugurated on 10 November 1997.

On the same day, the Bank announced that the planned start of the official gilt strips facility would be on 8 December, with trading in strips on a when-issued basis permitted from 1 December. On 8 October, the Bank issued a paper listing the decisions the authorities have made about the introduction of the strips market, following extensive consultation with gilt market participants and other parties.

Other issues

HM Government Ecu issues

The United Kingdom continued to hold regular monthly tenders of ECU 1 billion of Treasury bills during the third quarter, comprising ECU 200 million of one-month bills, ECU 500 million of three-month bills and ECU 300 million of six-month bills each month. The tenders continued to be several times oversubscribed, with issues covered by an average 3.4 times the amount on offer, compared with the average cover of slightly under 3.0 times during 1996 and the first half of 1997. During the quarter, bids were accepted at average yields of up to 5 basis points below the Ecu Libid rate of the appropriate maturity. By the end of the third quarter, there were ECU 3.5 billion of UK Government Treasury bills outstanding. Secondary market turnover in the third quarter averaged ECU 1.9 billion a month, slightly higher than in the first two quarters of 1997.

On 15 July, at the regular quarterly auction under the UK Government's three-year Ecu note programme, the Bank reopened the Ecu Treasury note maturing in January 2000 with a further tender for ECU 500 million, raising the amount outstanding with the public of this note to ECU 1.5 billion. There was good cover at the auction, of 2.4 times the amount on offer, and accepted bids were in a tight range of 4.40%–4.42%. The total of notes outstanding with the public under the UK note programme thus rose from ECU 5.0 billion to ECU 5.5 billion.

Sterling bond issues

With sterling continuing to appreciate because of expectations of higher short-term UK interest rates, and with the UK yield curve inverting, demand for sterling assets among overseas investors remained strong. As a result, there was heavy issuance in July and early August before the holiday season slowed the pace of new issues.

Fixed-rate issues in the quarter totalled £5.1 billion, with £1.2 billion in shorts, £2.4 billion in mediums and £1.5 billion in longs. Though lower than in the previous quarter, issuance was higher than in the same period for the previous three years and took

The single monetary policy in Stage 3 of EMU

In September the EMI published its 'General documentation on ESCB monetary policy instruments and procedures.'[1] The documentation is intended as a draft handbook for money-market counterparties of the European System of Central Banks (ESCB) in monetary union. Final decisions on the instruments and procedures will of course be taken by the European Central Bank (ECB) when it is established.

The proposed instruments and procedures are designed to allow the ECB to steer short-term interest rates in the euro money market, in pursuit of its ultimate aim—price stability in the euro area. Monetary policy decisions will be centralised in the ECB (but governors of national central banks will fill more than half of the seats on the ECB's Governing Council). Monetary policy implementation will be largely decentralised among the national central banks.

Each national central bank will deal with counterparties in its own country. The set of eligible counterparties is likely to be large. Though some details are yet to be settled, it is likely to include virtually all 'credit institutions' (in the United Kingdom, this would mean virtually all banks and building societies, including local branches of banks from outside the euro area).

The general shape of the instruments proposed for Stage 3 was published in January of this year[2] and is not much changed, but the General Documentation now gives details of the procedures and timetables, with worked examples of operations. The ESCB's main instrument will be two-week repo[3] operations, conducted every week. These operations will be conducted by tender, with bids submitted to local national central banks amalgamated at the ECB, where the allotment decisions will be taken.

The ESCB will also provide a limited amount of finance by three-month repos,[3] undertaken once a month. Two-week repos may be at fixed or variable rates, whereas the three-month repos will normally be at variable rates, because the ESCB will not attempt to set rates at the three-month maturity. All counterparties will be eligible to take part in two-week and three-month operations.

All counterparties will also have access to two standing facilities at their national central banks, allowing them to borrow against eligible assets or to place funds (in either case overnight), at rates that will normally form the upper and lower limits of a 'corridor' in which the market overnight rate will move. The ESCB will have a wide range of other instruments at its disposal. It may undertake fine-tuning operations between weekly repos, with a smaller group of counterparties; fine-tuning could take the form of repos, short fixed-term deposits with the national central banks or foreign exchange swaps. It may issue its own debt certificates to absorb liquidity and it may undertake outright transactions. The ESCB may also impose reserve requirements. The General Documentation gives some additional detail on the institutions that would be subject to reserve requirements, and liabilities that might be included in the calculation of these requirements.

The General Documentation breaks most new ground in the area of eligible paper. It indicates that in assessing paper, the ECB will take into account ratings by market agencies; it defines the links[4] between a counterparty and the issuer or guarantor of paper that would render the paper ineligible for use in operations; it sets out the characteristics[5] of mortgage bonds that would render them eligible, and it sets out special requirements that other bonds issued by credit institutions will have to meet to be eligible.

The General Documentation also contains new material on margining. For paper included on 'Tier 1'—the central list of eligible paper compiled by the ECB—initial margins will be set according to the maturity of the operation, with one margin for intraday and overnight operations and another for operations with a maturity of longer than one day. In addition, initial margins may be applied to individual debt instruments, according to their residual maturity. Depending on the law and operational systems in each country, paper provided by each counterparty to its national central bank may be pooled or may be earmarked against particular operations. Pooled assets will be revalued daily, and earmarked assets at least once a week. On valuation days, the national central banks will make margin calls, or return excess assets to counterparties, as necessary.

Counterparties will obtain liquidity from the national central bank of the country in which they are operating, but they will be able to make use of eligible paper located in other countries (usually within the euro area). The General Documentation sets out the ways in which eligible paper can be used across borders. The basic mechanism is the 'Correspondent Central Banking Model': the eligible paper, which is provided by the counterparty taking the liquidity, is delivered to the central bank of the country where the eligible paper is located, which will act as a securities custodian for the central bank that is providing liquidity.

(1) Copies are available from the Bank or the EMI.
(2) In *The single monetary policy in Stage Three: specification of the operational framework*.
(3) Strictly speaking a 'reverse transaction', which could take the form either of a repo or of a secured loan, depending on the legal system of the country where the transaction is undertaken.
(4) Taken from the First Banking Directive.
(5) Taken from the UCITS Directive (Undertakings for Collective Investment in Transferable Securities).

fixed-rate issues so far in 1997 to more than £26 billion, higher than the total for the whole of 1996.

Much of the issuance remained swap market driven, particularly at the ten-year maturity, though the fall in long yields and the curve inversion encouraged several UK financial companies (including Equitable Life, Lloyds, National Westminster and Robert Fleming) to raise longer-term capital. There were also three long-dated debentures for property companies.

Following the removal of certain tax credits on dividend payments in the July Budget, several large companies have announced share buy-backs as an alternative way of returning surplus cash to shareholders. With longer yields falling, gilt issuance declining and sterling bond markets becoming more liquid, there have been suggestions that companies may also be preparing to increase gearing, swapping equity for debt by refinancing share buy-backs in the debt market. But though there were a few UK corporate issuers in the quarter (including ICI, Tesco and Thorn), the expected increase in corporate issuance has not yet materialised.

The United Kingdom's EMU entry option generated some interest. Brazil became the second issuer, after the European Investment Bank, to incorporate a clause allowing the issuer to re-denominate sterling debt into euros if the United Kingdom joins EMU during the life of the bond. General Motors also issued Deutsche Mark and sterling issues together, allowing investors to switch easily between the two, either to benefit from convergence or to use the sterling bond as a safe haven should the euro prove weak and the United Kingdom remain outside EMU.

Floating-rate note issuance amounted to £3.4 billion in the quarter, mainly by UK and overseas financial issuers. The asset-backed market continues to grow, with more than £1 billion FRNs issued against credit card receivables, mortgages or other assets. These included the first securitisation of the Bank of Scotland's shared appreciation mortgages, in which homeowners surrender a share of any appreciation in the value of their property in return for a reduced borrowing rate.

The international environment

The main news[1] *since the previous* Quarterly Bulletin *is:*

- *US GDP continued to grow strongly in the second quarter of 1997, but GDP fell sharply in Japan.*
- *Output growth in the major European countries has strengthened, but in Italy it remains significantly weaker than elsewhere in Europe. Growth in Japan, France and Germany is being driven by net exports. In sharp contrast with the United States, the unemployment rate in Germany, France and Italy remains well above 10% of the labour force.*
- *Narrow money growth in the major industrialised economies has continued to increase, but broad money growth has remained stable.*
- *Equity prices in general continued to grow strongly, though in Japan they have continued to fall.*
- *Measured inflation remains low throughout the major six overseas economies. In Europe, consumer price inflation rates have largely converged at slightly above 1.5%.*
- *The Bundesbank increased its repo rate in October, leading to increases in several other European policy interest rates. But in the United States and Japan, official interest rates were unchanged.*

GDP grew in the major six overseas economies (M6)[2] *by 0.8% in the second quarter, up from 0.5% in the first quarter. US growth remained strong, but activity in Japan has slowed sharply since the end of the first quarter. Continental European growth is picking up, led by net exports, but domestic demand remains weak.*

US GDP grew by 0.8% in the second quarter, to a level 3.4% higher than a year earlier, well above the trend rate of growth for the US economy. This followed growth of 1.2% in the first quarter of 1997 and 1.1% in the fourth quarter of 1996. In the second quarter, unlike the first, private consumption grew slowly, as Table A shows. Business investment continued to grow strongly, but net exports once again fell, by the equivalent of 0.3% of GDP. This was the fifth fall in the past six quarters, reflecting continued appreciation in the dollar effective exchange rate and markedly stronger domestic demand than in most of the United States' major trading partners.

Data released so far for the third quarter suggest that the slowdown in private consumption in the second quarter may have been temporary. Private consumption grew by 0.8% in July and by 0.2% in August, so that the average level in those months was 1.2% higher than the average level in the second quarter. Consumer confidence remains higher than at any time since the late 1960s, partly reflecting the continued growth of employment and the associated low levels of unemployment. Non-farm payrolls, the key employment indicator in the United States, increased by an

Table A
Contributions to US GDP growth[(a)(b)]

Percentage points

	1996		1997	
	Q3	Q4	Q1	Q2
Private consumption	0.1	0.6	0.9	0.2
Investment	0.6	0.1	0.6	0.7
Government consumption	0.1	0.0	0.0	0.1
Stockbuilding	0.2	-0.1	0.4	0.2
Domestic demand	**0.6**	**0.6**	**1.5**	**1.0**
Net trade	**-0.4**	**0.5**	**-0.3**	**-0.1**
GDP	**0.3**	**1.1**	**1.2**	**0.8**

(a) The table shows the increase in each demand component expressed as a percentage of GDP.
(b) Contributions may not sum because of rounding.

(1) Up to 24 October 1997.
(2) UK trade-weighted. M6 comprises the G7 countries minus the United Kingdom, ie the United States, Japan, Germany, France, Italy and Canada.

Chart 1
US National Association of Purchasing Managers' Survey and industrial production growth

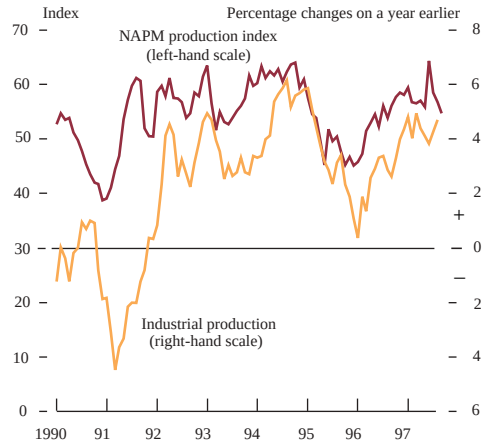


Chart 2
Japanese GDP growth

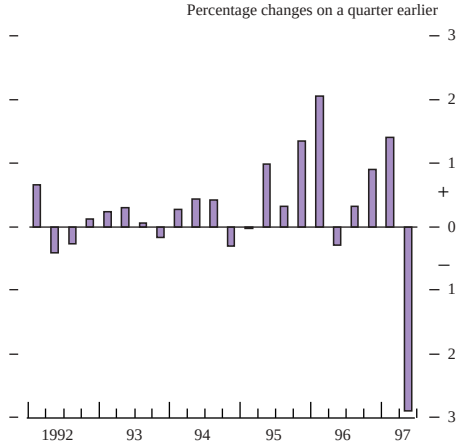


Table B
Contributions to Japanese GDP growth[a][b]

Percentage points

	1996		1997	
	Q3	Q4	Q1	Q2
Private consumption	-0.1	0.7	2.6	-3.5
Government consumption	0.1	0.1	0.0	-0.1
Investment	-0.2	-0.7	-1.1	0.3
Stockbuilding	0.0	-0.1	-0.1	0.2
Domestic demand	**0.1**	**0.5**	**1.4**	**-4.0**
Net trade	**0.2**	**0.4**	**0.0**	**1.0**
GDP	**0.3**	**0.9**	**1.4**	**-2.9**

(a) The table shows the increase in each demand component expressed as a percentage of GDP.
(b) Contributions may not sum because of rounding.

average of more than 210,000 per month in the third quarter, compared with the 25-year average monthly increase of slightly more than 160,000. This was the eighth consecutive quarter of above-trend employment growth, but employment growth slowed towards the end of the third quarter, especially when the upward bias produced by the end of the United Postal Service strike was taken into account (people on strike are treated in the statistics as being out of work). The unemployment rate was 4.9% of the labour force in September, below most estimates of its natural rate, which are typically close to 5.5%.

Industrial production in the United States also remained strong—it was 4.7% higher in August than a year before. And survey evidence points to continued buoyant output. The Federal Reserve's Beige Book for August suggested widespread increases in demand for non-defence goods, and the National Association of Purchasing Managers' index of business confidence was 54.2 in September (see Chart 1). A reading of more than 50 indicates expected business expansion.

By contrast with the United States, the Japanese recovery has been weak and erratic (see Chart 2 and Table B). The average quarterly GDP growth rate since the trough in 1993 Q3 has been 0.3%, compared with 0.7% in the United States. And the standard deviation of quarterly GDP growth since 1990 in Japan is nearly double that in the United States, though that could be partly because of seasonal adjustment problems. GDP fell by 2.9% in the second quarter, following 1.4% growth in the first quarter and 3.6% growth in 1996, the strongest of any G7 country. Spending patterns were distorted by the increase in the consumption tax from 3% to 5% in April 1997, giving consumers an incentive to bring forward their purchases. Private consumption fell by 5.7% in the second quarter.

This distortion to spending, plus possible seasonal adjustment difficulties,[1] make it difficult to assess the Japanese economic position. But the underlying picture appears to be that growth has slowed, though perhaps not by as much as the GDP data might suggest. The Bank of Japan's quarterly Tankan Survey, released in early October, suggested that the retail and construction sectors remained very weak. Other aspects of the survey were more optimistic: spare production capacity and employment indices were broadly stable, and investment intentions were revised upwards. As with some of the EU economies (see below), net export growth has been very important to the Japanese recovery during the past two years, and a major issue therefore is whether the recent currency crisis in South East Asia represents a real or nominal shock. A real shock—for instance if trend growth in South East Asia has fallen—would be more serious for the Japanese economy because of its implications for Japanese trade. A nominal shock would have less serious implications.

Output growth in the large continental European economies has been picking up, led primarily by net exports. Developments in Germany and France have continued to be broadly similar. In both countries, GDP grew by 1% in the second quarter. Italian growth is recovering, but remains significantly weaker than elsewhere in Europe.

(1) The Economic Planning Agency change their seasonal adjustment of Japanese GDP statistics on the release of Q3 data. Historically, the changes in back data have been significant. The changes made in December 1996 resulted in an average absolute change to estimated quarterly growth of 0.5 percentage points, compared with average quarterly growth of 0.7%, in the seven quarters to the second quarter of 1996.

The two sectors that contributed most to German GDP growth were net exports and private consumption, as Table C shows. But the strength in second-quarter growth in consumption is misleading: though it grew by 1.3% in the second quarter, consumption was only 1.4% higher than in the second quarter of 1996. Net exports were strengthened by the Deutsche Mark depreciation and by strong growth in several key export markets, most notably the United States. But investment remained weaker than is normal at this stage of a German recovery. Construction investment has been weak so far in 1997, following the end of the post-reunification boom and associated subsidies. Growth in machinery and equipment investment, which had been strong during the winter quarters, slowed to 0.3% in the second quarter. Given that German companies' profitability is high, share prices had risen by 42% from the beginning of 1997 to 24 October, and capacity utilisation is relatively high and rising, investment in plant and machinery might be expected to accelerate, so the weakness in the second quarter may prove to be temporary.

Table C
Contributions to German GDP growth[a][b]

Percentage points

	1996		1997	
	Q3	Q4	Q1	Q2
Private consumption	0.1	-0.3	0.1	0.7
Government consumption	0.2	-0.4	0.2	0.1
Investment	0.1	0.0	-0.5	0.1
Stockbuilding	-0.7	1.0	0.4	-0.8
Domestic demand	**-0.1**	**0.4**	**0.2**	**0.1**
Net trade	**0.6**	**-0.2**	**0.1**	**0.9**
GDP	**0.5**	**0.2**	**0.3**	**1.0**

(a) The table shows the increase in each demand component expressed as a percentage of GDP.
(b) Contributions may not sum because of rounding.

Unlike in the United States, the United Kingdom and Germany, French GDP data are not adjusted for the number of working days in each quarter. There were fewer in the first quarter, implying that growth of 0.2% on the previous quarter probably understated the underlying strength of the economy, and growth of 1% in the second quarter probably overstated it. As in Germany, net exports have been strong, helped by the depreciation of the franc (see Table D). The strength of net exports in both countries has been characterised by a combination of above-trend growth in both imports and exports. The average annual growth rate of French imports since 1970 measured on the national accounts basis is 4.6%, compared with growth in the year to 1997 Q2 of 7.4%. The corresponding figures for Germany are 4.2% and 6.4% respectively.

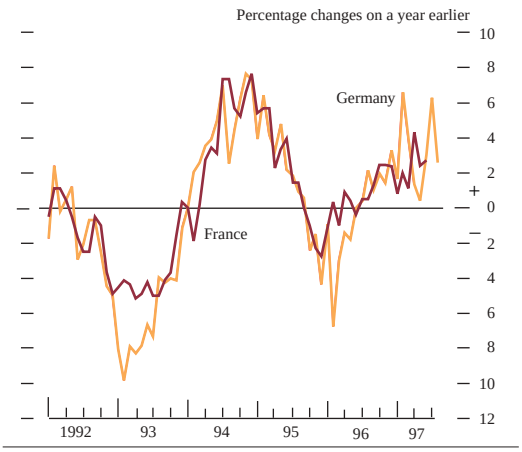
Table D
Contributions to French GDP growth[a][b]

	1996		1997	
	Q3	Q4	Q1	Q2
Private consumption	0.5	-0.3	0.1	0.0
Investment	0.3	0.0	-0.2	0.0
Government consumption	0.1	0.1	0.1	0.1
Stocks	-0.3	0.3	-0.4	0.4
Domestic demand	**0.6**	**0.1**	**-0.4**	**0.4**
Net trade	**0.2**	**0.2**	**0.6**	**0.6**
GDP	**0.8**	**0.2**	**0.3**	**1.0**

(a) The table shows the increase in each demand component expressed as a percentage of GDP.
(b) Contributions may not sum because of rounding.

French imports are strong despite the weakness of private demand. French consumers' expenditure has been even weaker than in Germany: it only grew by 0.6% in the year to the second quarter. The primary reason for the weakness in both countries is the mirror image of the case in the United States: the employment situation. In France, the unemployment rate has not risen in the last year, as it has in Germany, but it remains very high (12.5% in August). The German unemployment rate reached 11.7% in September. Wage growth in both countries has been muted because of the high levels of unemployment, which have held back growth in disposable income: for example, the Information und Forschung (IFO) Institute estimate that the average net real wage in Germany will be 1% lower in 1997 than in 1996. In France an additional distortion is caused by the car incentive scheme that ended in September 1996. Because car purchases are a major investment for consumers, car sales may still have been affected this year by the ending of the scheme—they have remained well below the levels seen in 1995 and 1996. But INSEE, the French statistical office, expects car sales to return to more usual levels in the third quarter.

Chart 3
French and German industrial production growth

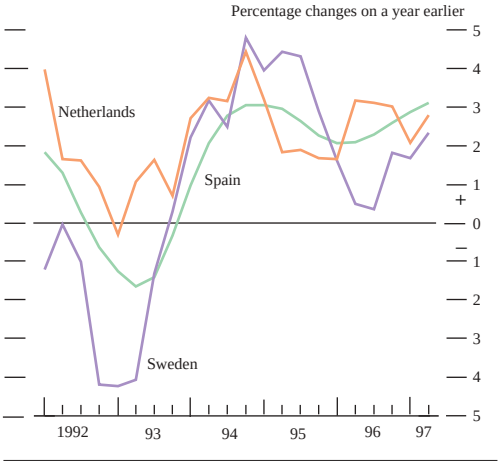


Monthly data released during the last quarter suggest that third-quarter growth in both Germany and France will be strong. German industrial production in July and August averaged 2.8% more than in the second quarter (see Chart 3). Business confidence is high, and external trade data are consistent with continued growth in net exports for both countries.

The situation in Italy is somewhat different from in Germany and France. GDP data, as in France, may be distorted by the absence of working-day adjustment, and by a car incentive scheme that started at the beginning of 1997. So though GDP grew by 1.6% in the second quarter, the underlying growth was much weaker—probably close to its quarterly trend rate of around 0.5%. In sharp contrast with Germany and France, net exports fell by the equivalent of 0.3% of GDP. This was largely because the depreciation of the Deutsche Mark and franc has not been matched by the lira: in the two years to August, the Deutsche Mark effective exchange rate depreciated by more than 8%, but the lira appreciated by more than 7%. In addition, underlying domestic demand in Italy is no stronger than in Germany and France.

Output elsewhere in Europe also strengthened in the second quarter (see Chart 4). The Spanish economy continued its strong growth, growing by 0.9% in the second quarter, the highest quarterly growth rate for two years, bringing annual GDP growth close to 3%. GDP in the Netherlands grew by 2.1% in the second quarter. This overstates the underlying rate of growth—the economy contracted in the first quarter—but with GDP 2.8% higher than a year before, activity continues to grow faster than trend. By contrast with Germany and France, growth in the other European economies is more broadly based, with strong domestic demand.

Chart 4
GDP growth in the Netherlands, Spain and Sweden

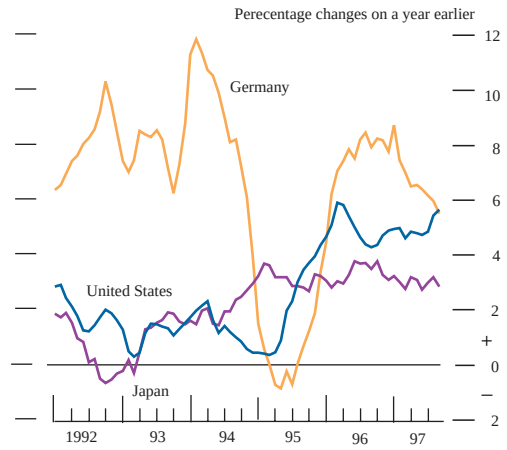


The OECD area as a whole is expected (by both the IMF and the OECD) to be a net exporter of goods and services in the next couple of years. In particular, Japan, Germany, France and Italy are expected to rely on net trade for GDP growth. This means that developing countries, notably in Asia and Eastern Europe, will need continued capital inflows to finance the resultant current account deficits. A key issue is the degree to which the currency crisis in Asia will hinder the cyclical recovery in the industrialised world. This could happen in several ways: lower demand for M6 exports; contagion for other developing economies, involving lower private capital flows; lower equity prices throughout the world; and moral hazard resulting from international 'bail-outs'. But calculations by the OECD suggest that the effects are likely to be limited. They estimated that if Asian growth was 1 percentage point lower in each of 1997 and 1998 than their baseline forecast, the cumulative effect would be to reduce GDP in Japan by 0.4%, and GDP in the European Union and the United States by 0.2%. The latest IMF forecast suggests that the effect of the currency crisis will be somewhat less than that.

Narrow money growth has continued to increase, but broad money growth has remained roughly constant in the last three months.

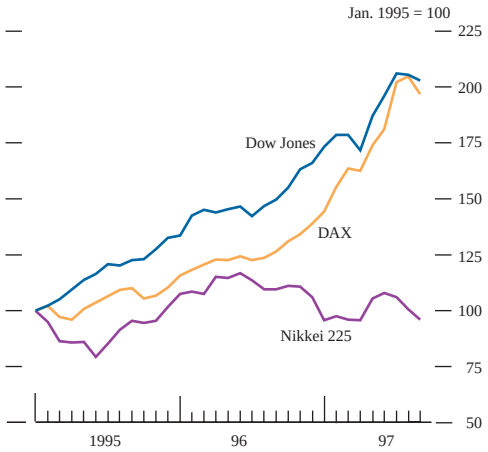
The GDP-weighted average of narrow money growth in the major six economies picked up slightly, to an annual rate of 3.3% in July. In real terms, average narrow money only grew at an annual rate of 0.6% in June (compared with 3.2% in March 1996). But the relative weakness in narrow money in the M6 was largely due to the decline in US M1 in the past two years, though its annual rate of decrease fell from 4.5% in March to 2.8% in August. Narrow money growth has increased in all M6 countries except Japan and the United States since the end of 1997 Q1. German M1 rose by 9.8% in July, mainly because of a strong increase in money held in current accounts.

Chart 5
Broad money[a] growth



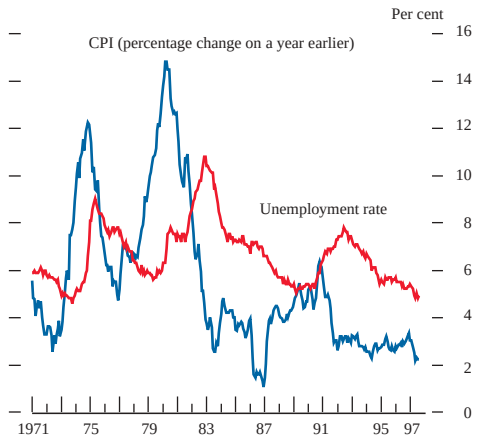
(a) M3 for Germany, M2 for the United States and M2 + CDs for Japan.

Chart 6
Equity prices[a]



(a) Measured in local currency.

Chart 7
US unemployment and CPI



Since 1996, the GDP-weighted averages of (nominal) broad money and nominal GDP in the M6 economies have been growing at similar rates of around 4% a year. Broad money growth in these countries reached a peak of 4.4% in July, the highest since 1992 Q1. US M2 picked up to an annual growth rate of 5.4% in August, exceeding its range (of 1%–5%) for the first time this year (see Chart 5). German M3 has weakened gradually this year and rose at an annual rate of 5.8% in August (relative to its average level in 1996 Q4—the base used by the Bundesbank for its M3 target). M3 growth has been within its target range of 3.5%–6.5% since June. Growth in Japanese broad money has been around 3% this year, and rose to 3.2% in August. Italian broad money has been increasing more quickly since March 1996, and increased by 11% in July. French broad money has been contracting for about a year now, but rose by 0.3% in the month to the end of July.

Equity prices increased strongly in most of the large industrialised countries in July, but fell somewhat thereafter. Nevertheless, they were considerably higher on 24 October than at the beginning of 1997. But Japanese equity prices have continued to fall.

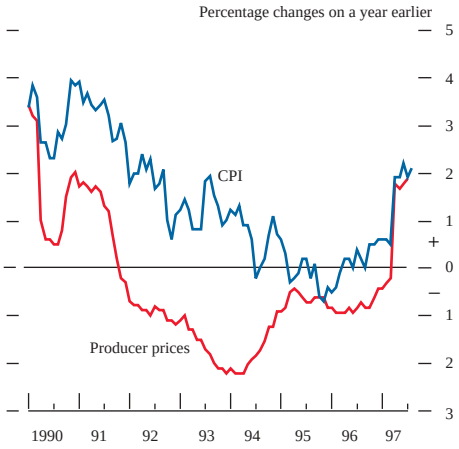
US equity prices rose sharply in July, following strong growth in May and June, but fell slightly in both August and September, and more sharply in October. On 24 October, the Dow Jones index was nearly 5% lower than three months previously, but still nearly 20% higher than at the start of 1997 (see Chart 6). Price:earnings ratios in the United States remain high, at around 23 compared with a 40-year average of 15, suggesting strong expected future profitability growth. A further reason, mentioned by Alan Greenspan, the Chairman of the Federal Reserve Board, in his testimony to the House of Representatives, might be that the amount of risk firms face has lessened, so that the risk premium in equity yields has fallen. German equity prices rose very quickly (the DAX index increased by more than 11%) in July, but have since fallen slightly. The position was very similar in France: the CAC 40 share index increased by more than 7% in July, but fell slightly thereafter. In contrast with the other G7 equity markets, Japanese equities continued to fall—by nearly 10% in July and August. Yen weakness boosted the share price of export-oriented industries. But continued weakness in financial sector companies, reflecting prolonged uncertainties about financial fragility, kept the Nikkei 225 depressed.

Despite the continued strengthening of activity, inflation remains low throughout the M6 and the European Union. Though EU inflation as a whole has picked up slightly, convergence of EU consumer price inflation has largely been achieved, at least temporarily.

Despite low unemployment, inflation has remained low in the United States, and, whether measured by the GDP deflator or consumer prices, was only 2.2% on the latest reading (see Chart 7). In the year to the second quarter, the employment costs index and unit labour costs, measured on the national accounts basis, both increased by less than 3%; the quarterly growth of unit labour costs was the lowest for three years. Prices throughout the supply chain have also remained subdued. Producer price inflation was zero in the year to September, with prices falling in the first seven months of 1997.

Some of the reasons for the small price rises seen recently may be temporary. Following their sharp rise in 1996, dollar oil prices fell quickly in the first quarter of 1997, placing downward pressure on producer prices. But oil prices rose in August and September. The dollar effective exchange rate appreciated by more than 10% in the year to August, lowering imported goods prices relative to what they would otherwise have been. But since the end of August, the dollar has depreciated slightly. Reforms of the US health care system allowed companies to limit increases in the benefit payments part of employment costs—benefits have grown by less than wages in the past two years, which is unusual (in the last ten years, annual benefits payment inflation has exceeded wages inflation on average by more than 1 percentage point). And computer prices fell by 22% in 1996, driven by sharp falls in semi-conductor prices. Given the strength of investment in information technology in the United States in the last two years, this has reduced the investment deflator and so the GDP deflator.

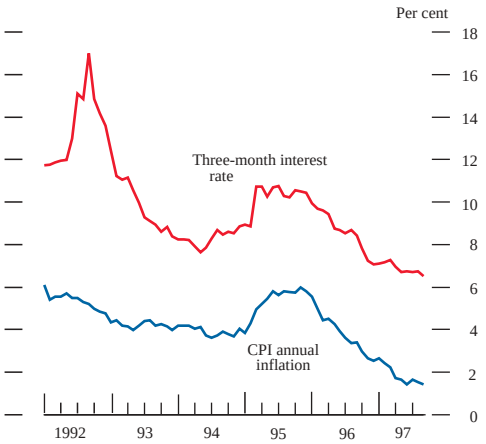
Chart 8
Japanese CPI and producer prices



Adjusting for the consumption tax rise in April, Japanese inflation remains negligible. Consumer and producer price inflation have remained close to 2% (see Chart 8), even though the consumption tax meant a step change in prices (other things being equal) of 1.9%. This reflects subdued domestic demand, which has constrained the degree to which producers and retailers are able to pass on the tax rises. Following the fall in retail sales and inventory build-up after April, margins have narrowed. Indeed, allowing for possible upward bias in the measurement of the CPI, it seems likely that the true cost of living is still falling.

In Germany, annual consumer price inflation increased to 2.1% in August from 1.6% in May, but fell back to 1.9% in September. Producer price inflation rose to 1.5% in August from 1.1% in May. But the size of these increases may be misleading. An important contributory factor was the depreciation of the Deutsche Mark, which led to annual import price inflation rising to 5.4% in August, its highest since 1989, from 2.8% in May. Administered prices were also influential, rising by 4.3% in the year to August. Excluding these, the inflation rate in August was 1.5%. The whole-economy inflation rate, as measured by the GDP deflator, was only 0.8% in the year to the second quarter.

Chart 9
Italian CPI inflation and three-month interest rates



Consumer price inflation has consistently been lower in France than in Germany since the beginning of 1997, and producer price inflation has been lower since the beginning of 1996, though this is partly because of differences in the national definitions of the producer prices series—the French series is intermediate goods prices, whereas the German series refers to output prices. As in Germany, consumer and producer price inflation have both increased in the last quarter, though the August consumer price inflation rate of 1.5% may be overstated because the pattern of discounting in the summer sales in 1997 was different from that in 1996. With annual producer price inflation at 0.3% and underlying consumer price inflation close to 1%, measured inflation remains extremely low in France.

In Italy, annual CPI inflation was only 1.4% in the year to September, maintaining the historically low rates of inflation seen in the summer (see Chart 9). Italian inflation has been restrained by a combination of tight monetary policy—real interest rates have

Table E
Harmonised index of consumer prices

Percentage changes on a year earlier

	1997		
	Feb.	May	Aug.
Austria	1.4	1.2	1.3
Belgium	2.0	1.3	1.7
Denmark	2.0	1.5	2.4
Finland	1.7	1.1	1.6
Germany	1.5	1.3	1.7
Greece	6.5	5.9	5.6
Ireland	1.7	1.3	0.6
Italy	2.3	2.2	1.6
Luxembourg	1.5	1.3	1.4
Netherlands	1.6	1.3	2.5
Portugal	2.4	2.3	1.6
Spain	2.5	2.2	1.7
Sweden	1.1	1.0	2.2
United Kingdom	2.0	1.8	2.0

Table F
Forecast of 1997 fiscal deficits(a)(b)

	EC	OECD	IMF
Austria	-3.0	-3.0	-2.5
Belgium	-2.7	-2.8	-2.8
Denmark	0.3	0.0	0.5
Finland	-1.9	-2.0	-1.9
France	-3.0	-3.2	-3.2
Germany	-3.0	-3.2	-3.1
Greece	-4.9	-5.2	-4.7
Ireland	-1.0	-1.2	-1.6
Italy	-3.2	-3.2	-3.1
Luxembourg	1.1	n.a.	-0.1
Netherlands	-2.3	-2.3	-2.1
Portugal	-3.0	-2.9	-2.9
Spain	-3.0	-3.0	-3.0
Sweden	-2.6	-2.1	-0.8
United Kingdom	-2.9	-2.8	-2.1

n.a. = not available.

(a) Percentage of GDP.
(b) General government (Maastricht definition).

remained well above those in Germany and France—and the associated strength of the lira. In all three countries, the weakness of domestic demand has meant that it has been difficult for retailers to pass on higher costs. And falling commodity prices in the last two years have limited inflation.

Inflation across the European Union is low and at similar rates. According to the harmonised price data for July, all countries other than Greece were within 1.5 percentage points of the countries with the three lowest inflation rates, whether using the mean, the highest or the lowest rate of the three countries (see Table E). The standard deviation of these 14 countries' inflation rates was only 0.4%. But in common with developments in the larger countries, EU-wide inflation increased in the three months to July. The average inflation rate (excluding Greece) increased to 1.6% from 1.3%.

The prospects for meeting the Maastricht fiscal deficit convergence criterion have improved, but most countries are still expected to fail to meet the debt criterion.

The German statistical office revised down their estimate of the German fiscal deficit for 1996 from 3.8% to 3.5%. The reasons for the change include the assimilation of new data, but also the adoption of the new European national accounting scheme (ESA 95). The biggest difference this makes to the German public sector deficit is that it classifies public sector hospitals as belonging to the corporate sector. This reduced the estimated German fiscal deficit by an average of nearly 0.2 percentage points in the three years to 1996. The deficit in the first half of 1997 was estimated to be DM 79.2 billion, DM 1.6 billion less than in 1996 (both numbers are calculated using the old scheme, and are therefore possibly overstated). The fall was due to an improvement in the social security account: the federal and Länder deficits increased, and the local authority deficit narrowed only very slightly. The German authorities agreed to reduce the solidarity surcharge—a tax intended to provide funds to assist the assimilation of eastern Germany—by 2 percentage points to 5.5% in January 1998. But they were unable to agree on more wide-ranging tax reforms. Discussion on these has been postponed for at least a year.

The French authorities announced both a supplementary budget for 1997 and their budget for 1998. The most important features were a 5 percentage point increase in the corporation tax rate to 41.6%, a reduction of the payroll tax (the RDS) by 4.75 percentage points and an increase in the CSG (a broad-based income tax that goes to the social security account) of 4.1 percentage points. With high corporate profits in France at present, and the CSG considered to have a higher marginal revenue rate than the RDS, both of these measures are likely to increase revenues.

The prospect of EU countries meeting the fiscal reference values set out in the Maastricht criteria has improved. According to the latest IMF forecasts, eleven out of the fifteen countries will meet the 3% target for the fiscal deficit as a proportion of GDP, and three out of the other four are forecast to have deficits of 3.2% or less (see Table F). Since the previous *World Economic Outlook (WEO)*, nine countries' deficit forecasts have been revised down, and only one has been revised up (Sweden, which is still expected to meet the criterion comfortably). The EU autumn forecast was

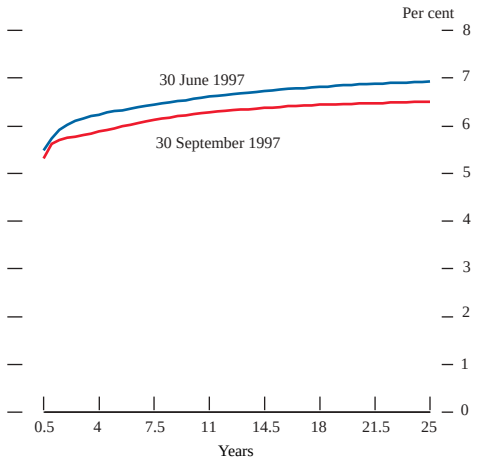
even more upbeat, with only France and Greece missing the deficit criterion, France by just 0.1 percentage point.

The debt levels remain problematic. The IMF forecast that only four countries will have debt/GDP ratios of 60% or less, and since the previous *WEO* they have revised up their forecasts of the debt/GDP ratio for nine EU countries. The position is expected to improve in 1998. The IMF expect 13 EU countries to lessen their debt/GDP ratio, with only the ratios of Germany and Portugal forecast to increase. But in 1998, only France, Luxembourg and the United Kingdom are forecast to have a debt/GDP ratio under 60%. For Italy, Belgium and Greece, debt is expected to remain more than 100% of GDP.

Most industrialised countries' official interest rates remained stable, though the rise in Germany's repo rate in October led to similar moves elsewhere in Europe.

US official interest rates were left unchanged by the Federal Open Markets Committee during the past quarter, as the lack of clear indications of increasing inflationary pressures continued despite the strength of activity data. The long end of the US yield curve fell during the past three months but short-run rates were little changed, as Chart 10 shows, suggesting that concerns about rising inflationary pressure are limited. Japanese official interest rates also remained unchanged, at 0.5%. But, reflecting increasing pessimism about economic conditions and diminishing expectations of a near-term rise in short-term interest rates, the benchmark bond yield fell to 1.7%, the lowest in history for an industrialised country.

Chart 10
US yield curves



Following 14 months of stable short-term official rates, the Bundesbank increased its repo rate by 30 basis points to 3.3% on 9 October. The move was immediately followed by several other European countries, most notably France, where the Banque de France raised the intervention rate by 20 basis points, bringing it into line with the German repo rate. The Bundesbank stated that the move was to stem increasing inflationary pressures, as evidenced by rising consumer, producer and import price inflation. Before the move, German money-market rates rose in anticipation of the Bundesbank's rate rise. Between the end of June and the beginning of October, three-month Deutsche Mark euromarket rates increased by 30 basis points. By contrast, French short-term euromarket rates had only increased very slightly.

Italian official interest rates were unchanged during the quarter, but short-term market rates fell by roughly 30 basis points. At close to 6.5%, Italian short-term nominal interest rates are at historically low levels. But this is largely a function of the lower inflation rate in Italy. Real interest rates, as measured by the nominal interest rate minus the current level of CPI inflation, were slightly above 5% in September, compared with an average of 4.3% since 1977. A better measure of real interest rates uses forward-looking inflation expectations. Inflation expectations for the next three months are lower than in June—the market consensus (as measured by the poll published in the September issue of *Consensus Forecasts*) for quarter-on-quarter consumer price inflation in the fourth quarter was roughly 0.8%, compared with quarterly inflation of 0.2% in the third quarter. The fall in short-term nominal rates in Italy therefore understates the fall in real rates.

Spanish interest rates have continued to fall. The Spanish ten-day repo rate was lowered to 5% in early October, from 6.25% at the beginning of the year. Spanish activity is at least as strong as that of most of the northern European countries; these moves have reflected the relative strength of the peseta (though it has depreciated in real terms this year, it has appreciated by more than 1.5% against the Ecu), the rapid fall of Spanish consumer price inflation and fiscal tightening. The situation in Portugal has been similar. Dutch, Belgian and Austrian interest rates typically follow German rates closely; this has continued to be the case during the past three months.

Public sector debt: end March 1997

This article[1] continues the annual series of articles in the Quarterly Bulletin *analysing the debt position of the public sector. It considers developments in the net and gross debt of the public sector in the financial year to end March 1997 and analyses the composition and distribution of the national debt.*

- *In 1996/97, the nominal value of the public sector's net debt rose by £28 billion to £350 billion, an increase of 1 percentage point to 45% of GDP.[2] The increase was largely because of a £27 billion rise in public sector gross debt; public sector holdings of liquid assets were virtually unchanged.*

- *Central government gross debt rose by £29 billion to £401 billion. Market holdings of gilts and National Savings products rose by £28 billion and £5 billion respectively; holdings of Treasury bills fell by £6 billion.*

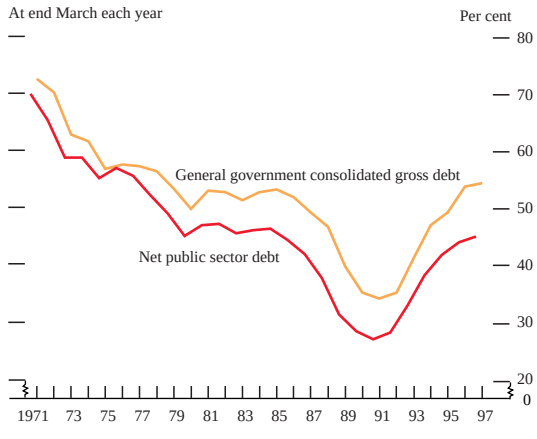
- *The ratio of general government consolidated gross debt to GDP increased slightly to 54.5% at end March 1997, remaining well within the reference value of 60% laid down by the Maastricht Treaty. The general government financial deficit fell further to 4.2%, but remained above the 3% ceiling. The box on pages 358–59 looks at the procedures followed by the Statistical Office of the European Union (EUROSTAT) when interpreting the Maastricht convergence criteria relating to debt and deficit.*

Public sector debt

At end March 1997, net public sector debt was £350 billion, 9% higher than a year earlier (see Table A). Within this, central government gross debt increased by 8% to £401 billion (52% of GDP). The gross debt of local authorities and public corporations increased slightly to £51 billion and £27 billion respectively; these increases were mostly taken up elsewhere in the public sector and so are not reflected in the consolidated total. Public sector holdings of liquid assets fell by £0.5 billion in 1996/97 (Table B). Falls in central government and public corporations holdings (of £0.7 billion and £1.3 billion respectively) were partly offset by local authorities building up their liquid assets by £1.5 billion.

Net public sector debt as a percentage of GDP has climbed sharply from a low of 27% at end March 1991 to 45% at end March 1997, its highest for twelve years (see Chart 1). By historical standards, current debt ratios are low (see Chart 2); though at its highest for more than two decades, the ratio of national debt[3] to GDP is still lower than at any time between 1914 and 1972.

Chart 1
Measures of public sector debt relative to GDP



It is useful to consider public sector debt as a proportion of nominal GDP because nominal GDP is closely related to the tax base of the economy, and so to the economy's theoretical ability to service the debt. Expressing public sector debt in this way, however, masks the impact of inflation. Since public sector debt is largely denominated

(1) Prepared by Liz Dixon of the Bank's Monetary and Financial Statistics Division.
(2) The percentage data shown here (with the exception of the memo item) are based on the average measure of GDP, at current market prices, for four quarters centred on 31 March.
(3) The differences between the national debt and net public sector debt are explained in the notes and definitions at the end of this article.

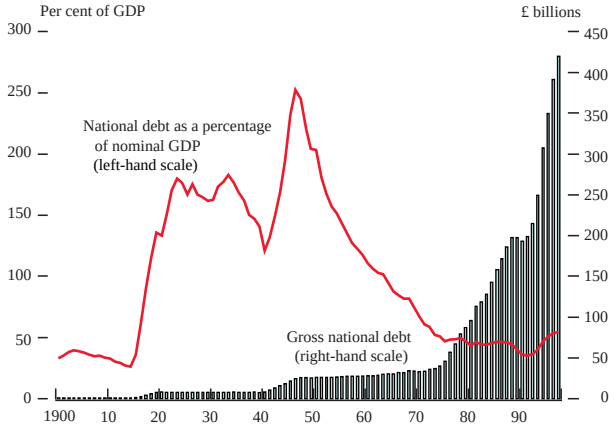
Table A
Public sector net debt

£ millions, nominal values (a)

31 March (b)	1996	1997	Changes 1996–97
Central government			
Market holdings of national debt (Table C)	343,977	369,332	25,356
as a percentage of GDP	*47.0*	*47.6*	*0.6*
Net indebtedness to Bank of England Banking Department	0	1,149	1,149
Savings banks	1,432	1,417	-15
Accrued interest and indexing on National Savings	3,517	3,422	-95
Notes and coin in circulation	23,427	25,638	2,212
Other	359	419	61
Total central government gross debt	372,711	401,377	28,667
as a percentage of GDP	*51.0*	*51.8*	*0.8*
Local authorities			
Total gross debt	50,252	51,276	1,024
less holdings of other public sector debt:			
Central government holdings of local authority debt	41,266	42,556	1,290
Local authority holdings of central government debt	153	156	3
General government consolidated gross debt	**381,544**	**409,941**	**28,398**
as a percentage of GDP	*52.2*	*52.9*	*0.7*
Public corporations			
Total gross debt	26,595	26,789	194
less holdings of other public sector debt:			
Central government holdings of public corporation debt	25,980	26,295	315
Local authority holdings of public corporation debt	0	1	1
Public corporation holdings of central government debt	6,570	7,788	1,217
Public corporation holdings of local authority debt	890	805	-85
Public sector consolidated gross debt	**374,698**	**401,841**	**27,143**
as a percentage of GDP	*51.2*	*51.8*	*0.6*
Total public sector liquid assets (Table B)	**52,636**	**52,088**	**-549**
as a percentage of GDP	*7.2*	*6.7*	*-0.5*
Net public sector debt	**322,062**	**349,754**	**27,692**
as a percentage of GDP	*44.0*	*45.1*	*1.1*
Memo item:			
General government consolidated gross debt (Maastricht basis) (1)	**380,164**	**408,534**	**28,370**
as a percentage of GDP (ESA)	*53.9*	*54.5*	*0.6*

(a) Figures may not sum to totals because of rounding.
(b) Data from 1970–97 are published in the *Bank of England Statistical Abstract 1997*, Part 1, Table 13.1.

Chart 2
Gross national debt: 1990–97



Source: HM Treasury.

in nominal terms, inflation erodes its real value. During the 1970s, the nominal debt stock increased substantially, but the debt ratio fell by some 24 percentage points. High inflation throughout the period led to increases in nominal GDP that outpaced the rise in the debt stock. As inflation has been brought under control, the rate of growth of nominal GDP has slowed. Because of this, the increases in the nominal debt stock due to large financial deficits in recent years have not been matched by nominal GDP growth and have led to a higher debt ratio.

The Treasury's forecasts in the July 1997 Financial Statement and Budget Report suggest that the public sector net debt ratio has peaked and will decline steadily in the coming years, in line with the Government's plans to reduce the deficit.

Table B
Public sector liquid assets

£ millions, nominal values

31 March (a)	1996	1997	Changes 1996/97
Central government			
Gold and foreign exchange reserves	30,463	25,547	-4,916
Commercial bills (including those held under repo)	1,093	1,790	697
British government stock held under repo (b)	2,465	6,081	3,616
Treasury bills held under repo	0	41	41
Loans against export credit and shipbuilding paper	286	0	-286
Net claim on Bank of England Banking Department	135	0	-135
Bank and building society deposits	1,802	2,062	260
Total central government liquid assets	**36,243**	**35,521**	**-722**
Local authorities:			
Bank deposits	6,024	6,496	472
Building society deposits	4,205	4,780	575
Other short-term assets	2,826	3,256	430
Total local authority liquid assets	**13,055**	**14,532**	**1,477**
Public corporations			
Bank deposits	3,088	1,773	-1,315
Other short-term assets	250	262	12
Total public corporation liquid assets	**3,338**	**2,035**	**-1,303**
Total public sector liquid assets	**52,636**	**52,088**	**-549**

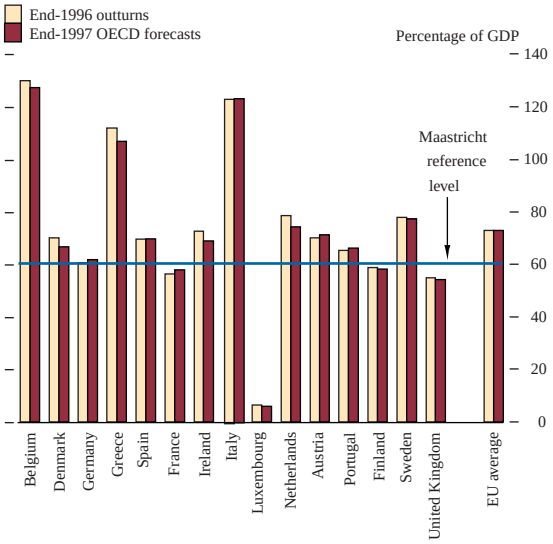
(a) Data from 1970–97 are published in the *Bank of England Statistical Abstract 1997*, Part 1, Table 13.1.
(b) Excludes repos between public sector bodies. Claims arise in connection with the Bank of England's provision of liquidity to the money markets through its gilt repo facility. Take-up of liquidity is variable, depending on the prevailing and expected level of interest rates and forecasts of money-market liquidity.

General government debt (Maastricht basis)

The Maastricht measure of debt is general government consolidated gross debt (GGCGD) on the European System of Accounts (ESA) basis.(1) GGCGD is thought to have peaked in 1996/97 at 54.5% of GDP (a sharp increase from 34% of GDP in 1990/91), comfortably below the Maastricht reference value of 60%. This compares favourably with figures for the European Union as a whole, where the weighted average debt burden at end 1996 was 73% (see Chart 3). At end 1996, only four Member States (Finland, France, Luxembourg and the United Kingdom) had debt ratios of under 60% of GDP, though the ECOFIN Council has already ruled that Ireland and Denmark do not have

(1) See the notes and definitions on page 366 for a description of how this differs from the UK definition of GGCGD.

Chart 3
General government consolidated gross debt



Sources: Eurostat, OECD.

'excessive' deficits. OECD forecasts for end 1997 show the debts of a number of other Member States falling towards the reference value (see the box on pages 358–59 for more detail on the Maastricht debt and deficit criteria).

Public sector borrowing requirement

The net debt of the public sector is the approximate stock counterpart to the public sector borrowing requirement (PSBR). The box opposite explains why the change in debt is not exactly the same as the PSBR, though the two are closely related.

The PSBR fell sharply in 1996/97 to £22.7 billion (£27.2 billion excluding privatisation proceeds), from £31.7 billion in 1995/96 (see Table C). The PSBR is projected to continue falling, to approximate balance in 1999/2000 and to a surplus in 2000/01. The PSBR will be temporarily reduced by windfall tax payments of around £2.6 billion in both 1997/98 and 1998/99. This effect will be unwound during the period to 2001/02 by associated spending on the Welfare-to-Work scheme.

Table C
Composition of the PSBR(a)

£ millions

	1995/96	1996/97
Central government borrowing requirement (CGBR)	**35,519**	**25,041**
Memo item: CGBR on own account	35,832	24,880
Local authority borrowing requirement (LABR)	-1,141	-760
less borrowing from central government	*473*	*1,517*
General government borrowing requirement (GGBR)	**33,905**	**22,764**
Public corporations' borrowing requirement (PCBR)	-3,006	-1,451
less borrowing from central government	*-786*	*-1,356*
Public sector borrowing requirement (PSBR)	**31,685**	**22,669**
As a percentage of GDP	*4.5*	*3.0*

(a) Source: *Financial Statistics*, September 1997.

The PSBR and public sector net debt: reconciliation

The PSBR is financed by transactions in assets and liabilities and is calculated on a cash-flow basis. Public sector net debt is a stock and its change is calculated on a nominal, accrued basis. Slight differences arise between the change in public sector net debt and the PSBR, largely because of the following:

- The value of foreign currency liabilities and assets changes with fluctuations in exchange rates, independently of any transactions. The 17% rise in sterling's effective exchange rate in 1996/97 meant that this was particularly significant in this year; the fall in the sterling value of the foreign exchange reserves was only partly offset by a corresponding fall in the value of foreign currency debt.
- Capital uplift on index-linked gilts is only recorded in the borrowing requirement when it is paid out (when the stock is redeemed), but accrues in the debt during the life of the stock. In 1996/97, the redemption of an index-linked stock meant that the increase in debt due to accrued uplift on outstanding stocks was partly offset in the PSBR by the capital uplift paid on the maturing stock.
- When gilts are issued (or bought in ahead of their redemption date) at a discount or premium, the borrowing requirement is financed by the actual cash amount received (or paid out), but the level of debt is deemed to have changed by the nominal value of gilts issued (or redeemed). Current practice is to issue gilts with coupons close to the prevailing market rate and so discounts/premia tend not to be large.

£ billions (a)	Year ending March 1997
PSBR	22.7
plus	
Revaluation of foreign currency assets/liabilities	2.3
Capital uplift on index-linked gilts	1.1
Discount/premium on gilt issues	0.7
Other	1.0
equals	
Change in public sector net debt	**27.7**

(a) Figures may not sum to total because of rounding.

Within the PSBR, interest payments on public sector debt in 1996/97 rose for the fifth consecutive year, to £26.6 billion. Interest payments represent a current payment for previous expenditure and can influence fiscal policy: to meet a given target for the PSBR, other government spending net of receipts—the primary deficit—must fall when interest payments rise. Despite the recent increase, debt interest payments as a proportion of spending are still relatively low by recent historical standards (see Chart 4), and are expected to remain broadly stable at 8.5% of public sector current and capital expenditure in the short term.

Decisions on Maastricht debt and deficit accounting rules

The position of each EU Member State in relation to the convergence criteria on public deficit and debt will be taken into account in considering admission to economic and monetary union. Member States are therefore required to report their annual debt and deficit levels biannually to the European Commission for assessment of their budgetary situation.

The Maastricht Treaty[1] sets out the procedure for determining whether a Member State has an excessive deficit. Though the treaty does not specify what constitutes 'excessive', a protocol to the treaty[2] establishes the reference values of 3% and 60% of GDP for deficit and debt respectively. The ratio of the planned or actual government deficits should not exceed the reference value unless '*either* the ratio has declined substantially and continuously and reaches a level that comes close to the reference value *or* the excess over the reference value is only exceptional and temporary and the ratio remains close to the reference value'. The ratio of government debt to GDP should not exceed the reference value 'unless the ratio is sufficiently diminishing and approaching the reference value at a satisfactory pace'.

EUROSTAT framework for accounting decisions

To ensure comparability of Member States' statistics, general government deficit and debt are calculated according to the European System of Integrated Accounts, second edition 1979 (ESA79). A new edition (ESA95) will come into force in 1999. The Statistical Office of the European Communities (EUROSTAT) in Luxembourg checks Member States' compliance with ESA79. Certain financial and economic transactions are not clearly defined in ESA79 and problems have arisen in trying to ensure a consistent treatment in all Member States. EUROSTAT has therefore developed a framework for consultations with Member States and taken a number of decisions to clarify the accounting treatment of certain transactions.

EUROSTAT aims to identify the most appropriate technical solution for which there is large support from Member States, based on three criteria:

- the solution must conform with ESA79;
- when ESA79 cannot provide a solution, reference should be made to ESA95; and
- where there are two or more viable solutions, reference should be made to the guiding principles of economic accounts as outlined by the Worldwide System of National Accounts 1993.

EUROSTAT's decision takes account of the opinions expressed by the Committee on Monetary, Financial and Balance of Payments Statistics (CMFB), which comprises senior representatives of the central banks, national statistical institutes, the European Monetary Institute and EUROSTAT. The CMFB's advice is formulated following discussions of the methodological issues by two groups of experts: the National Accounts and Financial Accounts Working Parties. The decision, backed up by its methodological reasoning, and the outcome of the CMFB consultation are made publicly available. Every decision applies automatically to all Member States rather than focusing on specific instances.

Recent decisions taken by EUROSTAT

Among the rulings made this year were the treatments of certain non-conventional bonds: bonds with capitalised interest (such as Italian Postal Bonds, though some National Savings products have similar characteristics); zero coupon bonds and deep discount bonds (defined as those whose nominal coupon is less than 50% of the yield to maturity at issue); and index-linked bonds where the capital uplift is related to changes in a consumer price index. In all of these cases, it was agreed that the capitalised interest, discount or capital uplift should be recorded in the deficit as an interest payment at the redemption of the bond. Where an index-linked bond is linked to the value of a financial asset, such as foreign currency or gold, EUROSTAT decided that the capital uplift should be regarded as a holding gain/loss (as is the case for foreign currency bonds).

For 'linear bonds' (fungible tranches of bonds issued more than twelve months after the original bond issue), it was agreed that the discount or premium could be accrued over the life of the stock. Countries with small illiquid bond markets issue linear bonds in order to build up a few relatively liquid stocks. This restricts the choice of coupon and, because of changes in prevailing market yields, the bonds may be issued at large discounts/premia. EUROSTAT decided that an accruals accounting method would allow a more

(1) Article 104c of the Treaty on European Union.
(2) Protocol on the Excessive Deficit Procedure.

accurate reflection of the actual interest rate being paid on these bonds. Where any fungible tranche of a bond is issued, the increase in issue price reflecting the accrued interest should be treated as a short-term advance to the government, which is reimbursed when the coupon becomes payable.

Various case studies relating to the financing and exploiting of public infrastructure by the private sector were discussed. Specific examples of this were the United Kingdom's Private Finance Initiative, the 'Vasco-da-Gama' bridge being built over the River Tagus in Portugal and a high-speed rail-link in Spain. A number of classification issues were also considered including: certain types of pension fund, bodies implementing the Common Agricultural Policy and export credit insurance guarantees. The accounting treatments agreed were generally in line with those already being applied by the relevant governments.

EUROSTAT had to make rulings on some potentially controversial cases. France Télécom made a payment of FFr 37.5 billion (around 0.4% of GDP) to the French government in return for the government assuming its future pension liabilities. The CMFB was split over whether this payment should be recorded as a capital transfer (thereby reducing the 1997 deficit) or as a financial transaction (for example, the pre-payment of a future stream of liabilities or the sale of a government financial asset). EUROSTAT ruled that recording this exceptional payment as a capital transfer was in conformity with a strict interpretation of ESA79. EUROSTAT agreed that though there could be other treatments as financial transactions that were also in conformity with ESA79, these would require additional economic interpretation and so were less close to the letter of ESA79. Following EUROSTAT's decision on the France Télécom case, several other countries have announced similar schemes to take over pension liabilities in return for a one-off payment.

EUROSTAT and the CMFB agreed that the Italian tax on wage funds (part of the 'Euro-tax', the remainder being an income tax surcharge) would be allowed to reduce the deficit. Employees are normally obliged to pay a tax on these statutory savings at the time of their withdrawal. In 1996, the Italian government introduced a law under which 2% of the amounts accumulated (Lit 3.5 trillion) was required to be paid by enterprises in 1997, with the rest due from the employee at withdrawal. This was subsequently increased to Lit 8.5 trillion (0.45% of GDP) with a further part-payment due in 1998. EUROSTAT ruled that as the government had, by law, changed the due date for payment, the taxpayer and the tax rate, this had to be regarded as a new tax and not as a financial advance (which would not reduce the deficit until the tax receipts became due under the original rules).

Following the sale of gold reserves by the Belgian National Bank (and planned sales of gold and foreign currency reserves by other central banks), EUROSTAT ruled that the transfer to the government of the profits of the sale could not be recorded as a receipt reducing the deficit but could be used to reduce government debt (consistent with the treatment of privatisation proceeds).

Impact of decisions on UK accounts

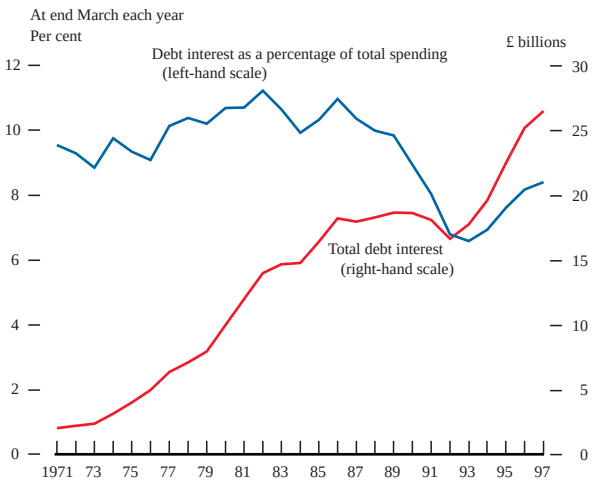
The EUROSTAT decisions have been mostly in line with current UK national accounts practice and so have had little impact on the Maastricht debt figure.

In calculating the general government financial deficit, the treatment of capital uplift on index-linked gilts has been changed to reflect the EUROSTAT decision to record it when it is paid (consistent with the PSBR treatment) rather than accruing it over the life of the bond. This will reduce the UK deficit in years when no index-linked stocks mature, offset by increases in years where there are redemptions. As there are no redemptions of index-linked stocks in 1997, the deficit is expected to be reduced by around £1 billion.

Though the UK authorities do issue fungible tranches of bonds more than twelve months after their original issue, EUROSTAT has agreed that these should not be treated as linear bonds. The size of the UK gilts market means that the authorities can pursue their policy of only issuing bonds whose coupons are close to market yields, and hence large discounts/premia do not arise. EUROSTAT have also agreed that the UK treatment of accrued interest on fungible tranches as negative interest payments is satisfactory, provided that its impact on the deficit is not too different from their preferred treatment.

EUROSTAT has asked for the treatment of certain unfunded public sector pension schemes (such as those paid to teachers) to be changed to reflect the actual cash flows more fully. The surplus of pensions paid over contributions received will now be treated as a non-financial transaction, rather than a reduction in the government's liability to pensioners. This is expected to increase the 1997 deficit by around £1 billion.

Chart 4
Public sector debt interest



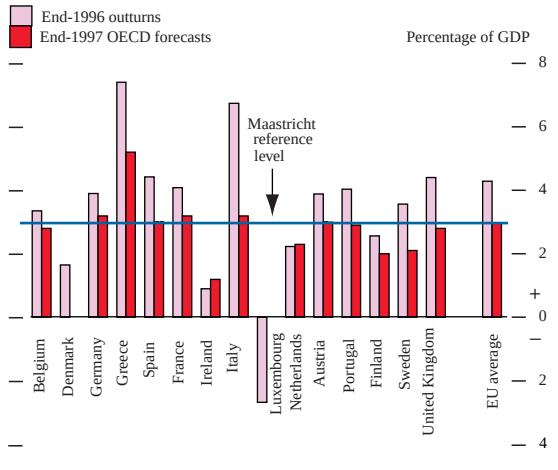
Source: ONS.

General government financial deficit (Maastricht basis)

The Maastricht deficit measure, the general government financial deficit (GGFD), fell to £31.4 billion (4.2% of GDP) in 1996/97. The GGFD, which excludes privatisation proceeds and the surpluses posted by public corporations, has been slightly higher than the PSBR in recent years. Treasury forecasts suggest that the GGFD will move broadly in line with the PSBR in the next few years, as both of these factors are forecast to fall close to zero.

Though the GGFD remains above the Maastricht reference value of 3%, it has fallen continually and substantially from a peak of 7.8% of GDP in 1993, and is forecast by the Treasury to be 2% in 1997. Five Member States had deficits below the reference value at end December 1996: Belgium, Denmark, Luxembourg, Ireland and Finland. The average deficit for the EU area was 4.3% of GDP. The latest OECD forecasts for 1997 (see Chart 5) suggest that most countries will be close to the 3% reference value, though some countries may overshoot slightly. The projected weighted average EU deficit for 1997 is 3% of GDP.

Chart 5
General government financial deficit



Sources: Eurostat, OECD.

Analysis of central government debt by instrument

Central government gross debt is composed almost entirely of market holdings of national debt. The national debt represents the total liabilities of the National Loans Fund(1) and is dominated by six types of instrument (see Table D): gilt-edged stocks, Treasury bills, National Savings, interest-free notes due to the IMF, certificates of tax deposit and foreign currency debt.

Table D
Market and official holdings of national debt

£ millions, nominal values; *percentage of market holdings in italics*

Amounts outstanding at 31 March (a)	1996		1997	
Market holdings				
British government stocks	253,567	*73.7*	281,780	*76.3*
of which: index-linked	46,127	*13.4*	51,534	*14.0*
other	207,439	*60.3*	230,246	*62.3*
Treasury bills	10,781	*3.1*	4,952	*1.3*
National Savings	52,015	*15.1*	56,915	*15.4*
of which: index-linked	7,638	*2.2*	8,076	*2.2*
other	44,377	*12.9*	48,839	*13.2*
Interest-free notes due to the IMF	5,544	*1.6*	5,638	*1.5*
Certificates of tax deposits	1,222	*0.4*	852	*0.2*
Other	4,059	*1.2*	4,855	*1.3*
Market holdings of sterling debt	**327,187**	***95.1***	**354,992**	***96.1***
North American government loans	788	*0.2*	644	*0.2*
US$ floating-rate note	2,559	*0.7*	1,227	*0.3*
US$ bonds	1,966	*0.6*	3,067	*0.8*
Ecu Treasury bills	2,883	*0.8*	2,488	*0.7*
Ecu 9⅛% 2001 bond	2,059	*0.6*	1,777	*0.5*
Ecu Treasury notes	4,118	*1.2*	3,199	*0.9*
DM 7⅛% 1997 bond	2,219	*0.6*	1,828	0.5
Debt assigned to the government	198	*0.1*	111	0.0
Market holdings of foreign currency debt (b)	**16,789**	***4.9***	**14,341**	***3.9***
Total market holdings of national debt	**343,977**	***100.0***	**369,332**	***100.0***
Official holdings	47,194		50,577	
Total national debt	**391,171**		**419,909**	

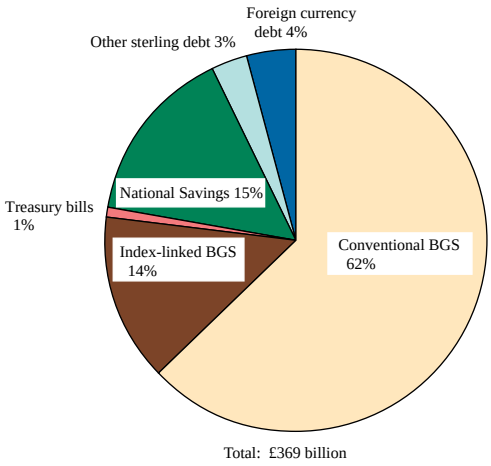
(a) Data from 1970–97 are published in the *Bank of England Statistical Abstract 1997*, Part 1, Table 13.2.
(b) Sterling valuation rates:
31 March 1996: £1 = US$ 1.5262, Can$ 2.0798, ECU 1.2142, DM 2.2531.
31 March 1997: £1 = US$ 1.6303, Can$ 2.2448, ECU 1.4068, DM 2.7345.

The total nominal value of the national debt rose by £29 billion to £419 billion (54% of GDP) in 1996/97. Holdings by other central government bodies and the Banking Department of the Bank of England(2) (together known as official holders) accounted for £3.4 billion of this rise; official holdings of Treasury bills increased by £1.8 billion.

Market holdings of national debt (which include holdings by local authorities and public corporations) rose to £369 billion (48% of GDP). The proportion of debt in market hands that is marketable (instruments that can be

(1) Stocks of nationalised industries guaranteed by the government are not strictly part of the national debt, but would be included here since the market does not generally distinguish them from government stocks. No such stocks are currently outstanding.
(2) The Issue Department of the Bank of England is part of central government.

Chart 6
Composition of market holdings of national debt by instrument: at end March 1997



traded in a secondary market: gilts, Treasury bills and some foreign currency instruments) remained unchanged at 81%. There were few significant changes in the share of individual instruments; Chart 6 provides a breakdown of the market holdings of national debt by instrument.

Other central government gross debt includes net indebtedness to the Banking Department of the Bank of England, notes and coin in circulation, deposits in the National Savings Bank, and accrued interest and indexing on other National Savings products. The note issue is backed by assets held by the Issue Department (some of which are national debt instruments), and net indebtedness reflects the Banking Department's holdings of central government debt. The inclusion of these items in central government gross debt therefore partly offsets the effect of subtracting official holdings of national debt. Hence central government gross debt and national debt are very closely related.

Central government net debt is gross debt less the central government sector's holdings of liquid assets (see Table B). Liquid assets fell by £0.7 billion in 1996/97, largely because of two significant, but offsetting, factors: gold and foreign exchange reserves fell by £4.9 billion, partly as a result of the appreciation of sterling, and the Issue Department's claims on the market under gilt repo increased by £3.6 billion.

British government stocks

Gilt-edged stocks are by far the largest single component of the national debt by instrument, accounting for 76% of market holdings of national debt, with £282 billion outstanding in market hands at the end of March 1997.(1)

Total gilt issuance in 1996/97 was £32.7 billion in nominal terms, of which £5.5 billion (including £2.4 billion of accrued uplift) was index-linked. The Government's remit to the Bank of England for 1996/97 specified that approximately 15% of the gilt sales should be index-linked, with the remainder split broadly evenly between short, medium and long-dated conventional gilts. The actual distribution of gilt sales was very close to this target.

Building up large benchmark stocks has proved attractive to market participants, who value the liquidity such bonds typically enjoy. Continuing this policy, 11 of the 14 auction sales in 1996/97 added to existing benchmarks. Three new stocks were created via auction in 1996/97: new five and ten-year benchmarks (7% Treasury 2002 and 7¼% Treasury 2007) and a floating-rate gilt (Floating Rate Treasury Stock 2001). The conventional stocks will both be strippable when the official gilts strips facility is introduced (expected to be on 8 December 1997). Current practice is to issue new gilts with coupons close to the gross redemption yields available in the market for the relevant maturity. All conventional stocks issued via auction in 1996/97 had a coupon of between 7% and 8% (with a weighted average coupon of 7.6%).

Taps of conventional stock are only issued for market management purposes in situations of temporary excess demand in a particular stock or sector. £0.6 billion of conventional stock was issued via tap in 1996/97, less than 2% of total gilt issuance. Primary issuance of index-linked gilts continued to be via the tap mechanism; the authorities are keeping the possibility of index-linked auctions under review.

Seven stocks with a total nominal value of £13 billion were redeemed in 1996/97. These included the early redemption of 6¾% Treasury 1995/98 (following the fall in market yields, the authorities decided to exercise their right to redeem the stock) and Index-Linked 2% 1996, which included £1.5 billion of indexation on the capital repayment.

There were two conversion offers in 1996/97: from 13½% Treasury 2004–08 into 8½% Treasury 2005 and from 12% Exchequer 2013–17 into 8% Treasury 2015. The offers were primarily made to build up the stock of strippable gilts.

Stock of gilts outstanding

The maturity structure of the gilts portfolio at end March 1997 was virtually unchanged from that at end March 1996. The average maturity of gilts in market hands was 10.1 years and the average maturity of all stocks excluding index-linked gilts remained at 8.8 years (see Table E and Chart 7).

Chart 8 shows how market holdings of gilts split between different types of instrument have varied during the last decade. The proportion of index-linked gilts has risen from 10% in 1987 to 18% in 1997, partly because of the substantial issuance programme, but also reflecting the accrual of inflation indexation and relatively fewer redemptions than of conventional gilts. Floating-rate gilts,

(1) Unless otherwise stated, all figures are in nominal terms and include capital uplift accrued on index-linked stock.

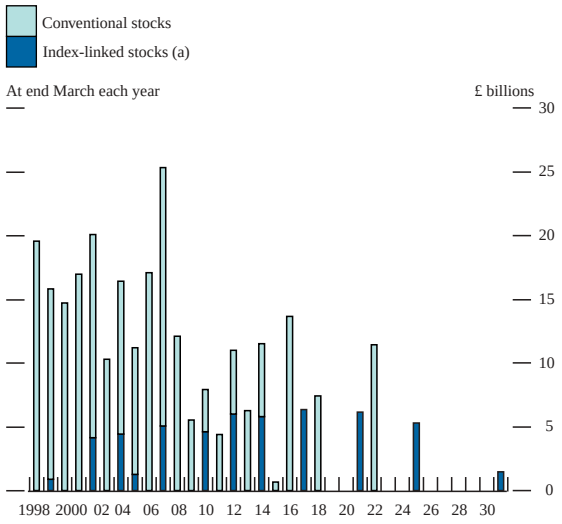
Table E
Average remaining life of dated stocks in market hands

Years to maturity at 31 March

	1991	1992	1993	1994	1995	1996	1997
Latest possible redemption: (a)							
All dated stocks (b)	9.9	10.0	10.8	10.6	10.4	10.1	10.1
Excluding index-linked stocks	8.0	8.4	9.4	9.1	9.1	8.8	8.8
Earliest possible redemption date: (a)							
All dated stocks	9.6	9.8	10.5	10.4	10.2	9.9	9.9
Excluding index-linked stocks	7.7	8.1	9.0	8.9	9.1	8.8	8.7

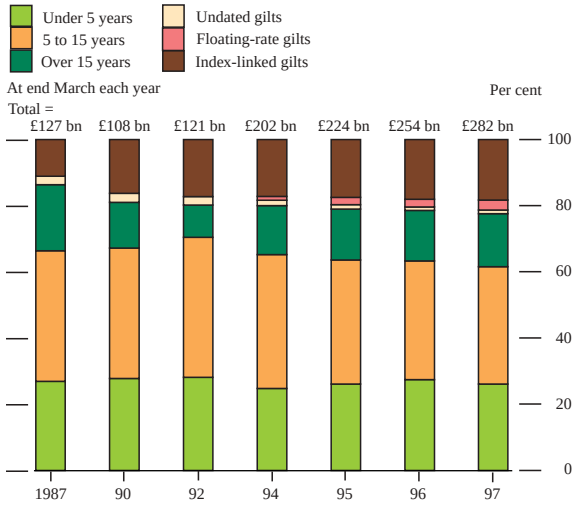
(a) Assumes no conversions (no conversion options were available between 1990 and 1994).
(b) Index-linked stocks are given a weight reflecting capital uplift accrued to 31 March.

Chart 7
Maturities of dated stocks in market hands



(a) Figures include accrued capital uplift to 31 March 1997.

Chart 8
Breakdown of market holdings of gilts



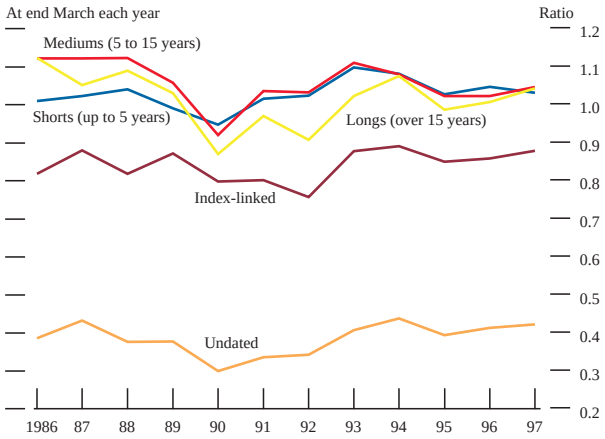
which were introduced in 1994, now account for around 3% of the gilts portfolio. By end March 1997 there were seven strippable stocks outstanding, with a total nominal value of £66 billion (23% of total outstanding gilts). The proportion of short, medium and long-dated gilts in market hands has remained broadly unchanged during the last ten years. Any fluctuations have largely reflected the natural ageing of the gilt portfolio; for example, the budget surpluses in the late 1980s meant that very few gilts were issued during that period. As the gilt portfolio aged, the average residual maturity of the portfolio fell and the proportion of long-dated stocks relative to other maturities fell sharply.

The gilt market in 1996/97(1)

Gilt yields at all maturities fell in 1996/97; the yield on the ten-year benchmark fell by around 50 basis points from 8.2% at end March 1996 to 7.6% at end March 1997. The yield curve became flatter, reversing the steepening seen in 1995/96. Five-year benchmark yields fell by 30 basis points to 7.4%, but the yield on 20-year bonds fell by some 60 basis points, giving a differential over five-year bonds of around 30 basis points.

The market value of gilts in market hands at end March 1997 was very close to the nominal outstanding, at £282 billion, compared with a discount of 1.3% at end March 1996. The changes in market:nominal value ratios of conventional gilts are shown in Chart 9. The premium on

Chart 9
Ratios of market to nominal values of stocks in market hands



short-dated gilts fell from 4.5% to 2.8%. The market:nominal value ratios of medium and long-dated gilts increased by 2.4 and 3.6 percentage points respectively to 4.2% and 4.3%. These premia were mostly offset by discounts on undated stocks and index-linked gilts. Undated stocks, such as the 3½% War Loan, only make up 1% of outstanding stocks by nominal value, but have a disproportionate effect on the overall market:nominal value ratio as they generally trade at less than half their nominal value.

The structure of the gilt market developed further in 1996/97 following the extensive changes introduced in the previous year. The average size of individual auctions was reduced by the introduction of periodic dual auctions. Dual auctions allow the issue of two stocks of different maturities in the same month without the inconvenience of having two

(1) For a full review of gilt market developments in 1996/97, please refer to *Gilts and the Gilt Market, Review 1996/97*, available from the Bank of England, PO Box 96, Gloucester, GL1 1YB.

auction weeks within a month (which may clash with the monetary policy round or important data releases). This has the advantage of moderating the supply in any one maturity at a particular time, and may attract a wider range of investors. There were also a number of incremental changes to the auction process, designed to encourage participation in auctions and reduce risks for both the Government and the market.

The remit for 1997/98 and gilt issuance

The target for gilts sales in 1997/98 specified in the Government's remit to the Bank of England was £36.5 billion. This was reduced to £25.1 billion following the July 1997 Budget. The Central Government Borrowing Requirement (CGBR) is forecast to be much lower than in 1996/97, at £12.4 billion, but this is partly offset by a much higher level of gilt redemptions (£19.6 billion). The target has also been reduced by the carry-forward of the £3.9 billion over-financing in 1996/97. The target for index-linked sales has been increased to 20% of total gilt sales, reflecting expected demand for index-linked gilts and the authorities' assessment that index-linked gilts have cost and risk advantages for the Government. Conventional issuance is still to be spread broadly evenly across the three maturity bands, but with slight skews towards the short and long ends. This reflects a number of factors: the pattern of refinancing; greater expected demand for gilt strips at short and long maturities; and maturities that fit more readily into the dual auction format.

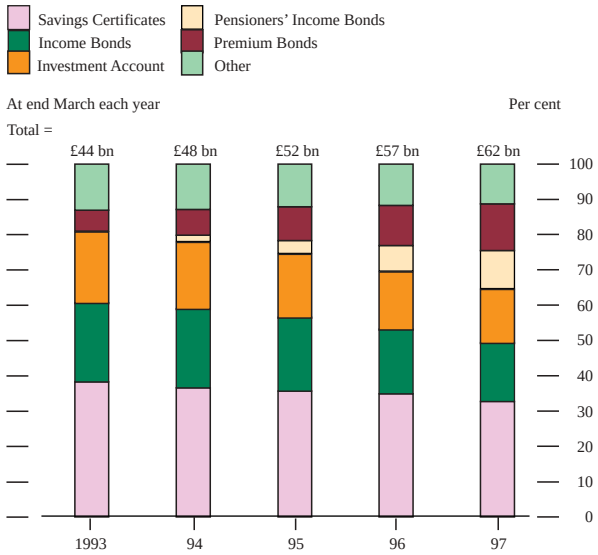
National Savings

Total holdings of National Savings instruments increased by £4.8 billion in 1996/97 to £61.7 billion, compared with an initial assumption in the 1996/97 financing requirement of £3 billion. The largest contributors were Pensioners' Income Bonds (at £2.5 billion) and Premium Bonds (at £2.1 billion). Gross sales of National Savings products in 1996/97 were around £13 billion and benefited from a high-profile marketing campaign.

The total outstanding includes around £4.8 billion of deposits with the National Savings Bank and accrued interest and index-linked increments on other national savings products, which are not included in the national debt (though they are included in central government debt). National Savings (which are all assumed to be in market hands) accounted for 15% of market holdings of national debt.

Chart 10 shows the change in composition of outstanding products during the last five years. Since their introduction in January 1994, amounts outstanding of Pensioners' Income Bonds, which pay a guaranteed monthly interest rate, have grown rapidly and now account for 11% of National Savings holdings. The proportion of National Savings held in Premium Bonds has also more than doubled, from 6% in 1993 to 13% in 1997. This reflects the introduction of a monthly

Chart 10
Composition of national savings by product



Source: Department for National Savings.

£1 million jackpot in 1995 and structural changes to the prize fund.

These increases have come largely at the expense of holdings of Income Bonds (which may reflect product switching) and Investment Account deposits (possibly because of the speculation about building society conversions). A new product, the Treasurers' Account, aimed at non profit making bodies, was introduced in September 1996.

In the 1997/98 financing requirement, National Savings products are assumed to contribute £3 billion.

Sterling Treasury bills

As the Government has decided not to issue any marketable debt of less than three years' maturity to finance the CGBR, the Treasury bill stock is largely determined by the Bank of England's sterling money-market operations.

Market holdings of sterling Treasury bills more than halved in 1996/97, from £10.8 billion to £5 billion (a fall from 3% to 1% of market holdings of national debt). This reflected the reduction in the size of weekly Treasury bill tender to relieve the pressure on the daily money-market shortages. The Treasury bill tender was £400 million at end March 1997 and reached a low of £200 million between 11 October and 31 January; it was £800 million at the start of the financial year and averaged £1.2 billion in 1995/96.

Foreign currency debt

The sterling value of debt denominated in foreign currency fell by some 15% in 1996/97, from £16.8 billion to £14.3 billion (a fall from 5% to 4% of total market holdings of national debt).

The fall was almost entirely attributable to the sharp appreciation in the value of sterling, as the nominal value of foreign currency debt was broadly unchanged. The only significant change in nominal terms was a ECU500 million fall in the nominal amount outstanding of Ecu Treasury Notes. The redemption of the US$3.9 billion Floating Rate Note in September 1996 was fully offset by issues of US$2 billion each of Floating Rate 2001 and 6$^{3}/_{4}$% 2001. The 21% appreciation in sterling against the Deutsche Mark in 1996/97 led to a significant reduction in the sterling value of the 7$^{1}/_{8}$% Deutsche Mark bond (which matured on 28 October 1997).

Sterling national debt: analysis by holder (Tables F and G)[1]

Total sterling national debt at end March 1997 was £404 billion, of which £355 billion (88%) was in market hands. Gilts accounted for £290 billion (72%) of the total sterling debt, and £282 billion (79%) of market holdings.

Institutional investors remain by far the largest holders of government debt. Their holdings increased by £18.1 billion during the year and account for 49% of total market holdings of sterling national debt (and some 61% of gilts in market hands). The requirement of such institutions to match their long-term liabilities with assets of similar duration inclines them towards medium and long-dated gilts and away from such instruments as Treasury bills. Insurance companies increased their holdings of gilts by £12 billion to £108 billion, of which about 85% were held by life assurers. Pension funds increased their holdings of gilts by £5 billion to £61 billion, with index-linked gilts accounting for around one half. Pension funds have significantly increased their holdings of gilts in the past few years. In 1993/94, pension funds accounted for 17% of total gilts in market hands; by 1996/97 this had increased to

Table F
Distribution of the sterling national debt: summary[a]

£ billions; *percentage of market holdings in italics*

Amounts outstanding at 31 March [b]	1996		1997		Change in 1996/97
Market holdings					
Public corporations and local authorities	5.3	*1.6*	7.0	*2.0*	1.7
Banks	26.8	*8.2*	20.4	*5.7*	-6.4
Building societies	7.8	*2.4*	6.9	*2.0*	-0.9
Other financial institutions	155.2	*47.4*	173.3	*48.8*	18.1
Overseas residents	43.3	*13.2*	48.4	*13.6*	5.1
Individuals and private trusts	57.9	*17.7*	68.6	*19.3*	10.7
Other (including residual)	30.9	*9.4*	30.2	*8.5*	-0.7
Total market holdings	**327.2**	***100.0***	**355.0**	***100.0***	**27.6**
Official holdings	45.7		49.3		3.6
Total sterling debt	**372.8**		**404.3**		**31.5**

(a) See Table G for more detailed analysis. Data for 1970–97 are published in the *Bank of England Statistical Abstract 1997*, Part 1, Table 13.3.
(b) Figures shown may not sum to totals because of rounding.

Table G
Estimated distribution of the sterling national debt: 31 March 1997

£ billions, nominal value (a) (b)

	Total holdings of sterling debt	British government stocks (c) *Total*	Up to 5 years to maturity	Over 5 years and up to 15 years	Over 15 years and undated	Treasury bills	Non-marketable debt
Market holdings							
Other public sector:							
Local authorities	0.2	*0.2*	0.0	0.1	0.0	0.0	0.0
Public corporation	6.8	*1.9*	0.2	0.3	1.4	0.0	5.0
Total public sector	**7.0**	***2.0***	**0.2**	**0.4**	**1.4**	**0.0**	**5.0**
Banks	20.4	*17.6*	9.4	7.2	1.0	2.7	0.1
Building societies	6.9	*6.3*	5.4	0.9	0.0	0.6	0.0
Institutional investors:							
Insurance companies	107.9	*107.9*	19.6	45.3	43.0	0.0	0.0
Pension funds	61.3	*60.8*	9.6	37.5	13.7	0.5	0.0
Investment and unit trusts	4.1	*4.1*	1.3	2.1	0.7	0.0	0.0
Total institutional investors	**173.3**	***172.8***	**30.5**	**84.8**	**57.4**	**0.5**	**0.0**
Overseas holders:							
International organisations	6.8	*1.2*	0.6	0.4	0.2	0.0	5.6
Central monetary institutions	15.1	*14.4*	6.7	4.8	2.8	0.7	0.0
Other	26.5	*26.2*	7.5	13.0	5.7	0.3	0.0
Total overseas holders	**48.4**	***41.8***	**14.8**	**18.2**	**8.7**	**1.0**	**5.6**
Other holders:							
Individuals and private trusts	68.6	*11.6*	3.8	5.6	2.2	0.0	57.1
Industrial and commercial companies	1.8	*1.3*	0.6	0.4	0.3	0.0	0.5
Other (residual)	28.4	*28.4*	22.5	3.8	2.1	0.0	0.0
Total market holdings	**355.0**	***281.8***	**87.2**	**121.3**	**73.3**	**5.0**	**68.2**
Official holdings (d)	49.3	*8.5*	3.2	4.1	1.2	2.6	38.2
Total sterling national debt	**404.3**	***290.3***	**90.4**	**125.4**	**74.5**	**7.6**	**106.4**

Figures shown may not sum to totals because of rounding.

(a) For explanations, see the notes to similar tables on pages 439–40 of the November 1992 *Bulletin*.
(b) Some of these estimates are based on reported market values; certain others rely on broad nominal/market value ratios.
(c) A sectoral analysis of gilt holdings from 1970–97 is published in the *Bank of England Statistical Abstract 1997* Part 1, Table 13.4.
(d) Official holders include the Issue and Banking Departments of the Bank of England.

(1) Compiled from a variety of sources, though the majority of the data are taken from the ONS' quarterly and annual survey data of various financial and non-financial companies.

22%. The increasing involvement of pension funds in the gilt market may have been encouraged by the minimum funding requirement of the Pensions Act, which came into force in April 1997.

Though banks continued to be the largest holders of Treasury bills, their holdings fell sharply both in nominal terms and as a proportion of total Treasury bills in market hands. The reduction in the Treasury bill stock was almost entirely reflected in banks' holdings, with other sectors keeping their Treasury bill investment broadly unchanged in nominal terms. Banks also reduced their holdings of gilts in 1996/97 (from £19.3 billion to £17.6 billion) and there was some switching from medium-dated into short-dated stocks. Building societies' holdings of gilts remained virtually unchanged at £6.3 billion.

Total sterling debt held by individuals and private trusts increased by £10.7 billion, largely as a result of increased holdings of National Savings. The proportion of gilts held by individuals and private trusts fell slightly in 1996/97, partly reflecting the transfer of funds from the personal sector to Equitas, the reinsurance company that took over some of the old liabilities of Lloyd's of London in September 1996.

Overseas holdings of sterling national debt rose by £5.1 billion in 1996/97. This was almost entirely because of increased investment in gilts, most of which was concentrated in the short to medium term; the proportion of gilts held by the overseas sector rose slightly to 15%. Gilts may have become more attractive to overseas investors because of the appreciation of sterling, the relatively high yields available in UK markets compared with the rest of Europe and Japan, and possibly the perception of sterling as a safe haven from EMU uncertainty. Gilt market developments in 1996/97 and the introduction of gilt repo may also have boosted overseas interest.

Notes and definitions

The national debt

The *national debt* represents the total liabilities of the National Loans Fund (NLF). *Market holdings* include holdings by local authorities and public corporations, but exclude holdings by other central government bodies (principally the funds of the National Investment and Loans Office, the Exchange Equalisation Account, government departments and the Issue Department of the Bank of England) and by the Banking Department of the Bank of England (together called 'official holders').

The national debt comprises:

British Government Stocks (BGS): Sterling, marketable, interest-bearing securities issued by the UK Government. The nominal value of index-linked gilt-edged stocks is increased by the amount of accrued capital uplift. The whole nominal value of all issued stocks is recorded, even where outstanding instalments are due from market holders (where this is the case, the outstanding instalments are recorded as holdings of liquid assets). This article uses the same definition of short and medium-dated gilts as the National Loans Fund accounts (under five years and five to ten years respectively). In the financing requirement, however, short-dated gilts are defined as three to seven years and medium-dated as seven to fifteen years.

Treasury bills: Short-term instruments, generally with a maturity of 91 days. The bills, which can be traded on the secondary market, are sold at a discount and redeemed at par. The amount of discount depends on the price accepted by the Bank at the tender.

National Savings securities: Non-marketable debt comprising a variety of products available to the public. The national debt excludes deposits in ordinary accounts of the National Savings Bank as well as accrued interest and indexing on National Savings products.

IMF interest-free notes: Non-marketable non interest bearing Treasury notes, issued by the Bank on the authority of warrants from HM Treasury. The warrants authorise various sums to be placed at the disposal of the International Monetary Fund (IMF) as a reciprocal facility for loans received by the United Kingdom. All transactions are initiated by the IMF.

Certificates of tax deposit: Non-marketable debt available to taxpayers generally, which may be used in payment of most taxes.

Other sterling debt: Includes ways and means advances (the method by which government departments etc lend overnight to the NLF), NILO stocks (non-marketable stocks, issued directly to the National Debt Commissioners, whose terms reflect those on existing BGS), and the temporary deposit facility (deposits by central government bodies and public corporations with the NLF).

Foreign currency debt: Foreign currency bonds (denominated in US$, DM and Ecu), Ecu Treasury Notes and bills, long-term post-war loans from the governments of the United States and Canada and assigned debt (debt originally drawn under the Exchange Cover Scheme and transferred to the government following privatisations of public corporations). Converted to sterling at end-period middle-market closing rates of exchange.

Central government gross debt

Includes market holdings of national debt and also any market holdings of other central government gross debt, which comprises:

Net indebtedness to the Bank of England Banking Department: The Banking Department's holdings of central government debt (principally sterling Treasury bills and British government stocks) less its deposit liabilities to the National Loans Fund and Paymaster General. Where this is a net claim, it is recorded in the accounts as a liquid asset (and so does not contribute towards gross debt).

National Savings ordinary account, accrued interest and indexing on National Savings: Excluded from market holdings of national debt.

Notes and coin in circulation: Excludes holdings by the Banking Department of the Bank of England, which are subsumed within the figure for 'Net indebtedness'.

Other central government gross debt: Comprises market holdings of Northern Ireland government debt (principally Ulster Savings Certificates), bank lending and the balances of certain public corporations with the Paymaster General.

Public sector consolidated gross debt

This includes central government gross debt, as well as all local authority and public corporation debt. All holdings of each other's debt by these three parts of the public sector are netted off to produce a consolidated total.

The local authorities sector comprises all bodies required to make returns under the various local authorities acts. Public

corporations are trading bodies (including nationalised industries) which have a substantial degree of independence from the public authority that created them, including the power to borrow and maintain reserves. For further details see Chapter 4 of the *Financial Statistics Explanatory Handbook* published by the Office for National Statistics.

Public sector net debt

The public sector net debt is derived from the consolidated debt of the public sector by deducting the public sector's holdings of liquid assets.

General government consolidated gross debt (GGCGD)

Central government and local authorities' gross debt with holdings of each other's debt netted off to produce a consolidated total. The Maastricht measure of GGCGD is calculated on the European System of Integrated Accounts (ESA) basis, which differs slightly from the UK national accounts definition. In accordance with the ESA, IMF interest-free notes are excluded from the calculation of general government debt, but as a liability of the National Loans Fund, they are included in the other measures of government debt used in this article. Miscellaneous other instruments are also included in government debt on an ESA basis, but excluded on a domestic basis.

The external balance sheet of the United Kingdom: recent developments

This article[1] summarises the changes to the net external asset position of the United Kingdom during 1996[2] and the first half of 1997. It continues an annual series of articles in the Quarterly Bulletin *begun in 1985.*

The article describes the principal influences on the external asset position of the United Kingdom, arising from capital transactions and the changes in the value of existing assets and liabilities. It describes UK overseas investment earnings and compares the UK net external asset position with that of other major economies. The box on pages 372–73 presents the results of the most recent Bank of England survey of the geographical distribution of direct investment holdings by banks operating in the United Kingdom and of direct investment in UK banks.

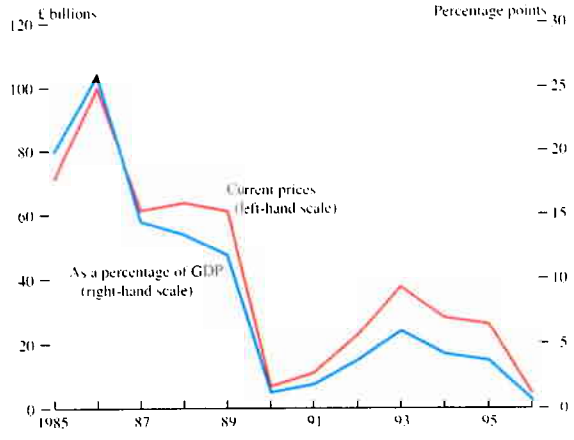
Overview

The United Kingdom's estimated overseas assets, net of foreign-held liabilities, fell to £5 billion at the end of 1996 from a revised £26 billion at the end of 1995 (see Chart 1). Gross external assets rose by nearly £78 billion to £1,666 billion, but the United Kingdom's liabilities to overseas residents rose more, by just under £99 billion, raising the total outstanding to £1,661 billion. To put the size of these holdings in context, the United Kingdom's gross domestic product in 1996 was a little under £750 billion. Preliminary data for the first half of 1997 show that the net external asset position rose by £20 billion, to £25 billion, almost entirely reversing the fall recorded in 1996.

The data discussed in this article are based on the latest published balance of payments data, but are subject to revision as the results of more detailed inquiries by the Office for National Statistics and its data suppliers become available. (For example, the net external asset position at the end of 1995 was revised down by almost a half between the publication of the 1996 and 1997 *Pink Books*.) Revisions to the net external position are usually small when compared with gross external assets and liabilities, but relatively small revisions to these gross levels have a significant effect on the net figure.

Problems in measuring the balance of payments accounts are acknowledged by the Office for National Statistics in the methodological notes to the *Pink Book*. It is generally presumed that official records of government departments are of good quality; data received through statutory enquiries are of reasonable quality; and data based on voluntary enquiries or estimates are of comparatively poor quality.

Chart 1
Net identified external assets



Source: ONS.

The recorded decrease in the net asset position during 1996 was more than accounted for by changes in the sterling value of existing holdings. Table A[3] shows that estimated valuation changes, resulting from price and exchange rate movements, reduced UK net external assets by £23 billion during the year. Movements in the foreign currency value of sterling appeared to have had particularly marked effects on UK banks' assets and liabilities.

More than half of the £1,666 billion UK external assets at the end of 1996 were owned by UK banks (see Table A). UK residents' direct investments and non-bank portfolio investments together accounted for nearly 35% of the total. The remainder comprised non-bank holdings of deposits with banks outside the United Kingdom, non-bank lending to overseas borrowers, and the external assets of general government (for example, the United Kingdom's foreign

(1) Prepared by Andrew Clayton of the Bank's Monetary and Financial Statistics Division.
(2) Using figures published in the *United Kingdom Balance of Payments (the Pink Book)*, Office for National Statistics, 1997.
(3) The net valuation effect in Table A is calculated by a residual: the part of the total change in stock that is not identified as a capital flow is presumed to be the result of revaluations. In Table C, an estimate of the composition of the revaluation effects is calculated. This is based on the movement of sterling against the US dollar, Deutsche Mark, Japanese yen and Swiss franc. In respect of portfolio assets and liabilities, movements in the FT-SE world index of leading shares, the FT-SE 100 share index and the S&P index of leading US equities are accounted for. Revaluation effects resulting from sterling, US dollar, Deutsche Mark, Japanese yen and Swiss franc bond yield movements are also included.

Table A
UK external assets and liabilities(a)(b)

£ billions

	Stock end 1995	Identified capital flows	Net valuation effect (c)	Total change in stock	Stock end 1996	Percentage of total stock
Non-bank portfolio investment:						
Assets	322.7	36.8	-2.2	34.6	357.3	*21*
Liabilities	238.4	19.6	8.8	28.4	266.8	*16*
Direct investment: (d)						
Assets	197.5	27.9	-15.4	12.6	210.1	*13*
Liabilities	131.5	20.8	1.8	22.5	154.0	*9*
UK banks' (e)(f)						
Foreign currency: Assets	811.6	76.4	-101.1	-24.8	786.8	*47*
Foreign currency: Liabilities	810.2	80.3	-106.0	-25.7	784.5	*47*
Sterling: assets	67.9	8.5	-0.1	8.3	76.2	*4*
Sterling: liabilities	98.1	-2.5	0.7	-1.8	96.3	*6*
Public sector:						
Reserves (assets)	31.8	-0.5	-3.9	-4.4	27.3	*2*
British government stock (liabilities)	45.7	7.6	-1.3	6.2	51.9	*3*
Other public sector:						
Assets	13.9	0.7	0.0	0.6	14.5	*1*
Liabilities	21.7	-2.4	-1.8	-4.2	17.5	*1*
Other assets	142.7	69.6	-18.7	50.9	193.5	*12*
Other liabilities	216.7	93.8	-20.4	73.4	290.1	*18*
Total gross assets	1588.0	219.3	-141.6	77.7	1665.8	*100*
Total gross liabilities	1562.2	217.1	-118.2	98.9	1661.0	*100*
Total net assets	**25.9**	**2.2**	**-23.3**	**-21.1**	**4.7**	

Sources: ONS and Bank of England.

(a) The sign convention is not the same as in the balance of payments: a transaction that increases an itemised stock is + and one that decreases it is -.
(b) Columns and rows may not sum because of rounding.
(c) Residual component.
(d) UK banks' external borrowing from overseas affiliates is treated in the published data as an offset to outward direct investment, but is treated here as part of the banks' net foreign currency liabilities.
(e) Estimated take-up of UK banks' bonds is not distinguished from foreign investment in other UK company securities in the published data, but is treated here as part of banks' net foreign currency liabilities. Banks' holdings of foreign currency bonds are treated as foreign currency lending.
(f) UK banking sector plus certain other financial institutions.

exchange reserves). UK banks also accounted for more than half of the total of the United Kingdom's liabilities to foreign holders but the composition of other liabilities differed from that of assets. Inward direct investment and investment in non-bank securities made up 25% of total liabilities; both were lower than the corresponding outward investments. Other liabilities, largely resulting from external borrowing by UK non-banks, amounted to nearly one fifth of total liabilities. The differing compositions of external assets and liabilities, and corresponding different rates of return, help to explain the net earnings of nearly £10 billion made in 1996 by UK residents from overseas (see 'Investment income' below).

UK external portfolio assets rose by £45 billion during 1996 to £517 billion, £166 billion more than outstanding portfolio liabilities. UK residents' holdings of direct investments overseas also increased, by £12 billion, to £210 billion,(1) exceeding the stock of inward direct investment by £56 billion. The United Kingdom continued to be a net borrower of funds from the rest of the world, and the net liabilities on outstanding sterling and foreign currency borrowing increased by £19 billion, to £257 billion. The net liabilities of general government fell to £28 billion.

Other significant points arising from the 1996 data include:

- increased net investment income for the United Kingdom:
- the impact of movements in security prices and exchange rates; and
- record foreign currency overseas borrowing and lending by UK banks.

Revaluation effects on the external balance sheet of the United Kingdom

The foreign currency value of sterling rose during 1996. The effective exchange rate index climbed from a level of 83.1 at the end of 1995 to 96.1 a year later;(2) the appreciation was particularly marked during the last quarter of 1996. Sterling rose against nearly all major international currencies during 1996, though the extent of these movements varied. Against the US dollar, sterling fell a little in the first quarter of the year, but closed the year 10% higher than it opened. Sterling gained 17% against the French franc and rose by 19% against the Deutsche Mark. Against the Japanese yen, sterling appreciated by almost a quarter from the end-1995 rate.(3) These changes will have reduced the sterling value of the United Kingdom's foreign currency denominated assets relative to its liabilities.

The value of UK companies' securities also rose during 1996. The FT-SE 100 index increased by more than 10% during the year, closing at 4,115.7. The prices of company securities in international equity markets generally rose during 1996. The S&P 500 measure of US equity prices rose by 20% in dollar terms during the year. The French and German markets, like those in the United States, rose by around 20% in national currency terms. In contrast, the Nikkei 225 index of Japanese equity prices fell slightly during the year. Bond prices followed a different pattern: prices of US dollar and sterling bonds fell, whereas prices of bonds denominated in other major currencies rose.

The FT-SE 100 share index rose by a further 10% in the first six months of 1997, closing at 4,604.6 at the end of June. The US and French equity markets all rose in the first half of 1997 by similar amounts to their 1996 increases, and the FAZ index of the 100 leading German equities gained nearly a third in the same period, following the 20% increase in 1996. The Nikkei 225 index of leading Japanese equities,

(1) Direct investment capital flows data are reasonably accurate. But estimates of balance sheet levels are less sound, because direct investments are usually recorded at book value, using historical costs, rather than market values. This makes it difficult to compare and contrast directly with other investments. It has been estimated that the market values of the stocks of inward and outward direct investment may both be double the recorded levels. See Pratten, C. *Overseas investments, capital gains and the balance of payments*, published by the Institute of Economic Affairs, February 1992. The report was based on end-1989 direct investment levels and a number of assumptions. A further report by Pratten estimated that the net direct investment stock in 1993 was underestimated by about £60 billion: see Pratten, C. (1994) *The valuation of outward and inward direct investment*, Department of Applied Economics, University of Cambridge, unpublished report to the (then) Central Statistical Office.
(2) *See Monetary and Financial Statistics*, Bank of England, July 1997, Table 2.7. figures quoted are based on average 1990 rates = 100.
(3) Changes in exchange rates are calculated as:

$$\frac{\text{(rate at close of business on last working day of 1996 - rate at close of business on last working day of 1995)}}{\text{rate at close of business on last working day of 1996}} \times 100$$

which fell slightly in 1996, rose by 6.4% in the first half of 1997. In the international bond markets, the prices of most bonds rose further during the first half of 1997; sterling bond prices also began to rise, but US dollar bond prices continued to fall. These movements in overseas securities prices had a significant effect on UK residents' portfolio assets, increasing their value by £41 billion.

The change in value of existing external assets and liabilities was greater than the fall in the net asset position (see Table B and Chart 2). The estimated value of the United Kingdom's net external assets decreased by £23 billion in 1996 as a result of revaluations. Exchange rates and security price movements both had a significant effect, causing downward revaluations of £12 billion and £16 billion respectively.

Table B
Change in identified net external assets

£ billions

		Average (a) 1982–92	1991	1992	1993	1994	1995	1996	1997 H1
A	Current balance (deficit = -)	-7	-8	-10	-10	-2	-4	0	1 (b)
B	Identified capital flows (inflows = -) (c)	-5	-7	-5	-12	3	-2	2	7
C	Revaluations	4	11	16	27	-13	0	-23	13
	of which:								
	Exchange rates		*10*	*63*	*1*	*0*	*10*	*-12*	*-9*
	Portfolio investment		*3*	*28*	*0*	*1*	*7*	*-7*	*-6*
	Direct investment		*6*	*27*	*0*	*2*	*0*	*-8*	*-3*
	Other net assets		*1*	*8*	*1*	*-2*	*3*	*3*	*0*
	Securities price effect		*11*	*-16*	*26*	*1*	*-2*	*-16*	*41*
	Others (d)		*-9*	*-32*	*1*	*-14*	*-9*	*4*	*-19*
D	Change in identified net assets (increase = +)	-1	4	12	15	-9	-2	-21	20
E	Net asset level (end-year)	22	11	22	37	28	26	5	25 (e)
F	Balancing item (f) (inflows/credits = +)	2	1	5	-2	5	2	3	6

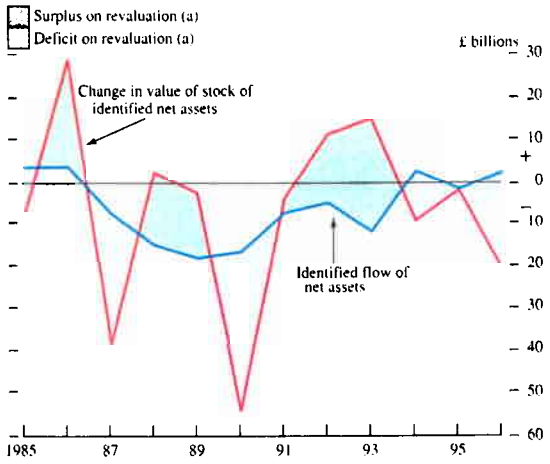
Sources: ONS and Bank of England.

(a) End-year net asset level refers to end 1992.
(b) Not seasonally adjusted.
(c) Note the difference between this sign convention and that of the balance of payments statistics.
(d) Including revaluations to direct investment stocks relating to write-offs, profitable disposals of assets etc as well as residual error.
(e) This is a preliminary estimate of the net stock position at the end of the second quarter of 1997.
(f) F = B – A: columns may not sum because of rounding.

Assets and liabilities can be revalued for a number of reasons: movements in the foreign currency value of sterling; changes in the prices of securities; revaluations of direct investments; and write-offs. But it is difficult to quantify each effect precisely, because information about the types of investment involved, their geographic location and currency of denomination is limited. Data in Table B should therefore be regarded as only broadly indicative.

The general rise in overseas equity and bond prices in 1996, relative to UK prices, suggests that UK residents made greater capital gains on their external assets than the

Chart 2
Contribution to changes in net external assets



(a) Residual component minus difference between change in recorded net stock and identified net flows.

gains made by non-residents on their holdings of UK securities. But the sterling value of UK residents' capital gains will have been affected by the fall in the sterling value of foreign currencies during 1996 (see Table B). This is particularly apparent in respect of UK banks' foreign currency assets and liabilities: exchange rate changes reduced the value of each by more than £100 billion (see Table A).

Capital flows

The United Kingdom's current account was £0.4 billion in deficit in 1996, though there was an identified capital outflow during the year of just over £2 billion. A current account deficit is usually accompanied by net capital inflows, so that either non-residents increase their holdings of UK assets or UK residents' holdings of foreign assets decrease. But the United Kingdom has regularly had a current account deficit while recording either net capital outflows or net inflows that are smaller than the current account deficit. As a result of this inconsistency, a balancing item has to be written into the balance of payments accounts (see Table C) to reflect unmeasured flows. It is not known whether the balancing item reflects under-recorded net capital inflows or mis-recorded current account credits or debits.

Direct investment

A direct investment may be broadly defined as a cross-border financial transaction in which an economic agent resident in one economy acquires a lasting interest in an enterprise resident in another economy.(1) This investment may subsequently be increased or decreased; these capital flows are also direct investment transactions, either positive or negative respectively. Similarly, any earnings from the direct investment enterprise that are

(1) See the IMF *Balance of payments manual*. (Fifth edition). 1993, paragraph 359. In the past, the United Kingdom has applied a minimum shareholding of 20% as the benchmark for a direct investment relationship. But the OECD and the IMF now recommend a 10% threshold, to which the United Kingdom is moving. The Bank of England has recently conducted a review of the statistics collected from the UK banking sector. This review is being implemented in stages, and when it is fully completed (at the end of 1998), UK banks will be asked to report as outward direct investments any holding of 10% or more in a non-resident company. Inward direct investments will also be reported based on a threshold of 10%. This accords with the OECD's *Detailed benchmark definition of foreign direct investment* (Third edition) and the IMF's *Balance of payments manual* (Fifth edition).

Table C
UK balance of payments: transactions data(a)

£ billions
Increase in UK assets (-)/increase in UK liabilities (+)

	1990	1991	1992	1993	1994	1995	1996
Current account							
Trade in goods	-18.8	-10.3	-13.1	-13.5	-11.1	-11.6	-12.6
Other current account	0.1	2.3	3.0	3.2	9.5	7.9	12.2
of which:							
Services	*3.7*	*3.6*	*5.0*	*5.5*	*4.8*	*6.9*	*7.1*
Investment income	*1.3*	*0.2*	*3.1*	*2.6*	*9.7*	*7.9*	*9.7*
Transfers	*-4.9*	*-1.4*	*-5.1*	*-4.9*	*-5.0*	*-6.9*	*-4.6*
Current balance	**-18.7**	**-8.0**	**-10.1**	**-10.3**	**-1.7**	**-3.7**	**-0.4**
Financial account	16.5	7.4	5.0	11.8	-3.4	1.7	-2.2
of which:							
Direct and portfolio flows	*2.6*	*-12.1*	*-4.4*	*-46.0*	*35.5*	*-32.3*	*-40.8*
Banking and other flows (b)	*14.0*	*19.6*	*9.4*	*57.9*	*-38.9*	*33.9*	*38.6*
Balancing item	2.2	0.5	5.1	-1.5	5.0	2.0	2.6

Source: ONS.

(a) Columns may not sum because of rounding.
(b) Includes UK residents' net lending/borrowing and external assets/liabilities of general government (other than portfolio and direct investment).

retained rather than repatriated to the investor also increase direct investment.

At the end of 1996, UK residents' total direct investment overseas reached £210 billion, an increase of £29 billion. Unremitted profits (earnings of established direct investment enterprises overseas that are reinvested in the overseas affiliate by the UK parent) accounted for most outward direct investment transactions in 1996, at £18 billion; outflows of capital to new or existing direct investment enterprises amounted to £10 billion.(1)

In contrast, non-residents significantly increased their direct investments into the United Kingdom, with net purchases of £21 billion, 45% more than in 1995. New investment in the United Kingdom and capital inflows to existing affiliates accounted for £13 billion of inward direct investment flows, with a further £3 billion invested in UK oil companies after net sales of £0.1 billion in 1995. Earnings retained in the United Kingdom by direct investment affiliates contributed £5 billion to the increased inward investment by non-residents. The stock of outstanding inward direct investment was £154 billion at the end of 1996.

The volume of international mergers and acquisitions has grown substantially during the last two years. In the United Kingdom, there were several high-profile acquisitions during 1995, and the increased activity continued throughout 1996 and into 1997. The largest individual inward transactions during 1996 included the purchase of Mercantile and General Reinsurance Ltd by Swiss Reinsurance Company; Trafalgar House by the Norwegian company Kvaerner AS; and News International PLC by News Corporation of Australia. Total inward investment from mergers and acquisitions amounted to £10 billion, with disposals of nearly £2 billion. In spite of an increase in the volume of transactions, the balance of £8 billion was £3 billion lower than in 1995. Outward mergers and acquisitions by UK companies of £12 billion in 1996 were offset by significant disposals of £6 billion. The balance was only £0.3 billion higher than in the previous year. Net inward investment resulting from acquisitions and mergers was therefore almost £2 billion.

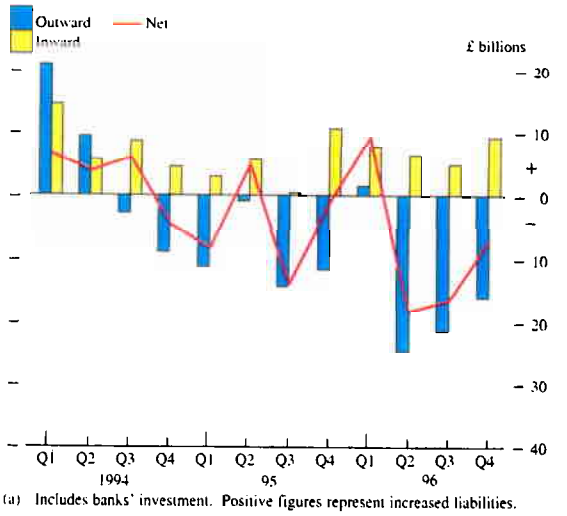
During the first half of 1997, a number of direct investment deals have taken place. Several of the privatised electricity companies have been bought by overseas companies, with those in Yorkshire, the East Midlands and London being purchased by US electricity and energy corporations. A number of UK companies have announced multi-billion dollar outward direct investment deals.

Portfolio investment

Portfolio investments are defined as investments in equity and debt securities, in the form of bonds and notes, as well as money-market instruments and financial derivatives.(2) Where any of these instruments satisfy the definition of direct investment, they cannot be portfolio investments.

UK residents continued to make substantial purchases of foreign securities during 1996, amounting to £61 billion, compared with £38 billion in the previous year.(3) In spite of the negative estimated effect of revaluations, the stock of UK portfolio assets increased. Increased purchases were largely of foreign bonds, which amounted to £51 billion, an increase of nearly 70% since 1995. Purchases of ordinary shares also rose, to £10 billion in 1996, £2 billion higher than the previous year. Chart 3 illustrates the net effect of inward and outward portfolio transactions during the last three years, showing the particularly high volume of transactions recorded in 1996.

Chart 3
Portfolio investment(a)



(a) Includes banks' investment. Positive figures represent increased liabilities.

(1) See the box on pages 372–73 for a geographical analysis of UK banks' direct investments overseas and non-residents' direct investments in UK banks.
(2) See the *IMF Balance of payments manual*, (Fifth edition), 1993, paragraph 385. Financial derivatives are treated as portfolio investments in the manual, because they are considered as separate (mainly financial) transactions, rather than integral parts of underlying transactions to which they may be linked as hedges.
(3) Data on outward portfolio flows for financial and non-financial institutions should be of reasonable quality, but data for the personal sector are weak. Data on inward investment in government and other public sector securities are good, but data on inward investment in UK companies' bonds have to be derived and are therefore subject to some margin of error.

A geographic analysis of UK banks' direct investments(1)

Every three years, banks operating in the United Kingdom are asked to submit to the Bank of England details of their holdings of direct investments overseas and any investment received by them from non-resident affiliates. This information is reported on a geographic basis, specifying the country of origin or receipt of the direct investment. This box analyses the results of the latest triennal census, which was conducted at the end of 1996.(2)

Direct investments can be either inward or outward. Inward investment in the United Kingdom is when an overseas company sets up or acquires a new branch, subsidiary or associate here. Outward investment is when a UK company sets up or acquires a branch, subsidiary or associate overseas.

A brief history of banks' direct investments

Overall, UK residents have net direct investment assets: direct investments overseas are greater than those in the United Kingdom. This has not been the case for banks since the late 1980s. Total overseas investment in UK banks stood at £20.2 billion at the end of 1996, much higher than overseas investment by UK banks of £9.3 billion.

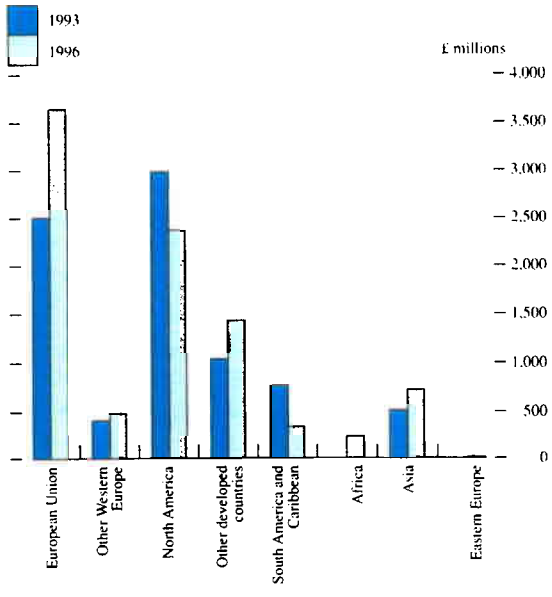
Motivations for direct investment have changed, particularly for banks. Historically, UK banks had substantial outward direct investment in the British Empire to serve trade finance. The United Kingdom became an attractive place for dollar lending by US banks in the 1960s and 1970s, because it was cheaper than lending from the United States. As these eurodollar markets expanded, inward direct investments in the United Kingdom increased, because US banks set up or acquired affiliates through which to lend dollars and other overseas banks invested here in order to borrow. During the 1980s many smaller US banks began to find the cost of their London operations prohibitive, and decreased their inward investments. At the same time, larger UK banks sought to increase their international presence and develop global operations, thus increasing UK banks' outward direct investments. Their success was limited and there has since been considerable retrenchment.

In the early 1990s, moves towards establishing closer EU integration led to a significant increase in the number of UK banking affiliates with overseas head offices and parents. The stock of inward investment in banks in the United Kingdom rose by nearly 50% between 1990–93, to £17.8 billion. These affiliates enable the overseas banks to benefit from access to different financial markets, counterparties and the location of the United Kingdom relative to other major financial centres. EU banking legislation, giving extra-EU banks access to EU markets through a single affiliate, has encouraged greater inward investment in the European Union, particularly the United Kingdom. More recently, a number of European investors, seeking to centre their activities on London, have bought UK investment banks.

Outward investment by UK banks

The total stock of all UK residents' overseas direct investments was £215 billion at the end of 1996, nearly treble the level a decade earlier and £46 billion higher than at the end of 1993. Within this, the stock of UK banks' outward direct investments increased by only £0.9 billion (see Chart A).(3)

Chart A
Outstanding stock of UK banks' overseas direct investment(a)



(a) Source: Bank of England.

UK banks' direct investment holdings in the European Union amounted to £3.6 billion at the end of 1996, up by £1.2 billion since the end of 1993. Investments in the Netherlands, Denmark and Portugal fell during these

(1) See page 370 for a definition of direct investment and a note of problems relating to measurement issues.
(2) The Bank of England has recently conducted a review of the statistics collected from banks operating in the United Kingdom. Implementation of the review began at the end of September 1997 and is taking place in stages. When implementation is completed, at the end of 1998, censuses of banks' levels of direct investment will be annual, instead of every three years.
(3) The geographic areas listed in the charts accord with the *Balance of Payments Vade Mecum*, published by the Statistical Office of the European Communities (EUROSTAT) and last updated in March 1996. This lists all the countries of the world and allocates them to a geographic area for the purposes of EU Member States' balance of payments accounting. For the purposes of the charts and to make comparisons easier, data for the European Union for both 1993 and 1996 include the 15 countries that were Member States at the end of 1996. (There were only twelve Member States at the end of 1993: Austria, Finland and Sweden joined the European Union on 1 January 1995.)

three years, but this was more than offset by increased investment in other EU countries, particularly France and Germany (both more than £1.1 billion at the end of 1996). Investment in 'other Western Europe' also increased during this period, to £0.5 billion, an increase of just under 20%. This was mainly because of more investment by UK banks in Switzerland.

Greater investment in Australia, New Zealand and Japan increased the level of investment in 'other developed countries' by £0.4 billion to £1.4 billion. No direct investment in South Africa was recorded at the end of 1993; a modest stock was shown at the end of 1996. UK banks also held more direct investment assets in Asia at the end of 1996; the level of investment in the Middle East fell slightly, but this was more than offset by increased investment in the Far East, bringing the total level of direct investment in Asia to £0.7 billion.

Though UK banks' investment in all these geographic areas rose between 1993–96, this was partly offset by disinvestment in North America (£0.6 billion) and in South America and the Caribbean (£0.4 billion). Disinvestment in North America was mainly in the United States, though investment in Canada also fell. The disinvestment in North America was the largest, but the disinvestment in South America and the Caribbean was proportionately greater.

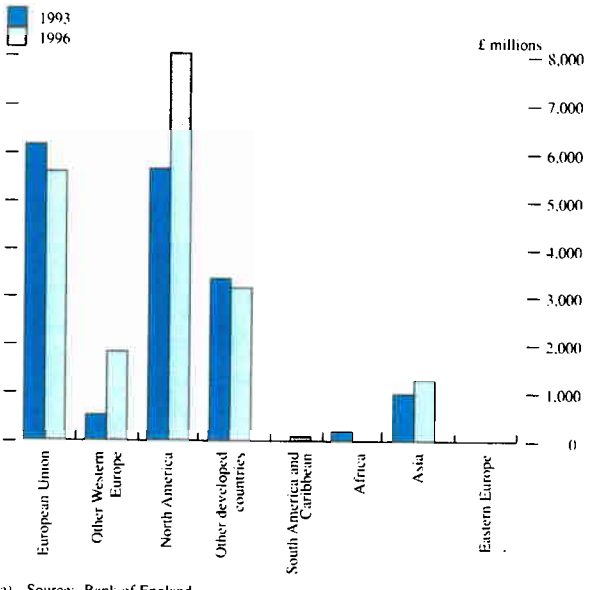
Inward investment in banks in the United Kingdom

The 1997 *Pink Book*[4] shows that the total stock of direct investment in the United Kingdom trebled in the ten years to the end of 1996, to £154 billion. UK labour market reforms and comparatively low corporate taxation and regulatory burdens have encouraged inward investment. Cultural factors such as language, workforce skills, the quality of infrastructure and spending on research are also thought to be influential. Establishing direct investments also enables the investor to minimise exchange rate risks by locating close to the final market, so that the costs of providing the product or service are in the same currency as the revenue derived from it.

The number of foreign banks in the United Kingdom more than doubled between 1986–96. Most have EU parents or head offices, (over 200).[5] But direct investment in UK banks from the EU countries fell from £6.1 billion in 1993 to £5.6 billion in 1996. Inward direct investment from the Benelux countries, particularly the Netherlands, fell by more than £1 billion, but this was partly offset by increased investment from other countries, particularly Germany and France. Inward investment from Germany almost doubled between 1993–96 to £2.1 billion, and investment from France increased by a half, to £750 million.

Inward direct investment in the UK banking sector from Japan has also decreased in value since the last triennial census. Total investment in UK banks from Japan amounted to £1.6 billion, a fall of nearly £0.2 billion. During these three years, there has been some retrenchment of Japanese bank investments, which is reflected in these data. A similar decrease in investment from Australia, to £1.3 billion, was recorded in the same period. The fall in investment from these two countries explains the decrease in inward investment from 'other developed countries' shown in the chart. This area also includes South Africa, from which investment in UK banks doubled to £0.3 billion between 1993–96.

Chart B
Outstanding stock of direct investment in banks in the United Kingdom[a][b]



(a) Source: Bank of England.
(b) Data on inward investment from South America and the Caribbean at the end of 1993. Africa at the end of 1996 and Eastern Europe at the end of both years are confidential. So that no individual institution's data are identifiable, the Bank of England ensures that all published figures contain data reported by at least three different institutions; data that have been suppressed do not satisfy this requirement.

Inward investment from North America, principally from the United States, increased most in value during this three-year period, ending 1996 at £8 billion, 42% higher than at the end of 1993. Though this was the greatest increase in value, a proportionally greater rise was recorded in inward investment from 'other Western Europe'. Investment received from these countries was nearly two and a half times higher at the end of 1996, at £1.8 billion, than at the end of 1993.

Investments from Asian countries rose by nearly a third, to £1.2 billion. This rise came mainly from the Middle East, which accounted for 85% of total investment from Asia at the end of 1996. Direct investment in UK banks by South American and Caribbean countries increased between 1993–96 to a modest £0.1 billion; investment from Africa and Eastern Europe fell.

(4) *United Kingdom Balance of Payments (the Pink Book)*, Office for National Statistics, 1997.
(5) Includes EU institutions authorised to take deposits in the United Kingdom; this excludes representative offices of foreign banks.

Bonds in the United Kingdom (along with those in the United States) were among the few major bonds whose prices fell during 1996. Purchases by UK banks of £24 billion of overseas securities were virtually unchanged from the 1995 figure. But other financial institutions more than doubled their purchases in 1996 to £37 billion. Unit trusts and property unit trusts were the most significant institutional investors in 1996, increasing their holdings of overseas securities by more than £10 billion. This rise was entirely concentrated in investment in the ordinary share capital of companies overseas, which exceeded £11 billion, but this was offset by some sales of preference shares and overseas governments' securities. The holdings of self-administered pension funds, insurance funds, investment, unit and property trusts at the end of 1996 were little changed from those at the end of 1995. Provisional data show that 18% of these investors' total portfolio holdings were invested in overseas securities at the end of 1996.

Non-residents' total holdings of UK portfolio liabilities were £351 billion at the end of 1996. Net purchases of UK companies' bonds and equities rose slightly, but net investment of nearly £8 billion in British government stocks contributed to the flows of portfolio investment into the United Kingdom of £28 billion, more than £8 billion higher than in 1995. This increased investment in government stocks contrasted with net sales of £1 billion in 1995, though net sales of other general government securities approached £2 billion in 1996.

Purchases in the first half of 1997 of £45 billion of overseas securities had a significant impact on the level of UK assets; revaluing these and the existing outstanding stock of portfolio assets increased the level by more than £70 billion. Table B suggests that revaluations have been particularly affected by changes in securities prices during the first half of 1997.

Other capital flows

UK banks' external transactions, other than direct and portfolio investments, resulted in a net inflow of more than £11 billion in 1996, 20% higher than in 1995. But this net inflow disguises the fact that gross external claims and liabilities (other than direct and portfolio investments) both more than doubled in 1996, to £63 billion and £75 billion respectively. Considered in this context, the £2 billion increase in 1996 in the net inflow of banking funds is comparatively small.

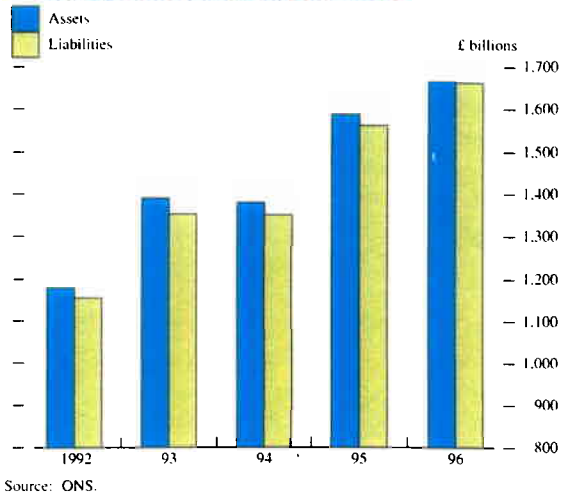
The United Kingdom is one of the world's leading centres for finance. The strong international financial presence in the United Kingdom may mean that flows are driven (at least in part) by relative interest and exchange rates, which would also help to explain why the series are so erratic. According to the Bank for International Settlements, 17% of the $8,000 billion total cross-border international lending in 1996 by banks originated in the United Kingdom.

There were record transactions in foreign currency lending to and borrowing from overseas by UK banks in 1996. UK-owned banks accounted for most of the currency borrowing, which totalled £78 billion, possibly influenced by the high foreign currency value of sterling. The same factor may be responsible for banks with ultimate parents overseas, particularly in America, Germany and Japan, being on balance net borrowers from the United Kingdom, reporting net outflows of funds. UK banks' claims on German residents have risen particularly in recent years. Germany's reunification in 1990 has required funding for the redevelopment of eastern Germany, and as a result, lending by UK banks to Germany has risen from 4% of total external bank lending in 1990 to 11% in 1996. Of the major industrial countries, only Japan has decreased its borrowing from the rest of the world during the 1990s. Banks' lending and borrowing transactions in the first half of 1997 were more than three times higher than in the same period of 1996 and resulted in a net increase of £11 billion in external lending.

Revisions

The identified net external asset position of the United Kingdom at the end of 1995 was revised downwards by £24 billion between the 1996 and 1997 *Pink Books*. Though this is a substantial change in terms of the net external asset position, it results from proportionately small adjustments to the estimates for gross assets and liabilities (of £1,588 billion and £1,562 billion, respectively) at the end of 1995 (see Chart 4). This should be borne in mind when interpreting the detailed developments described in this article.

Chart 4
Gross external assets and liabilities



Source: ONS.

Investment income

UK earnings from overseas assets increased by £5 billion to £96 billion in 1996, and payments abroad in respect of external liabilities increased by £3 billion to £86 billion (see Table D). These increases were both substantially smaller than those in 1995, but the improved balance of investment income, to just under £10 billion, reversed the fall recorded in the previous year.

Table D
Investment income

£ billions

	Annual average 1982–92	1993	1994	1995	1996	1997 H1
Earnings on assets						
Portfolio (a)	5.9	16.1	15.8	19.1	20.7	12.0
Direct	10.7	16.9	21.2	23.8	27.8	13.6
Other non-bank private sector	3.5	6.6	6.4	7.1	6.8	3.1
Public sector (b)	1.2	1.6	1.6	1.7	1.6	0.8
UK banks' spread earnings on external lending	37.0	33.2	32.8	39.6	39.1	17.6
Total (c)	**58.3**	**74.3**	**77.8**	**91.3**	**96.1**	**47.2**
Payments on liabilities						
Portfolio (a)	4.5	11.0	13.0	15.7	16.9	9.4
Direct	6.4	10.5	9.3	12.4	14.9	7.1
Other non-bank private sector	3.8	11.2	11.5	11.8	11.5	6.3
Public sector (d)	0.5	0.4	0.3	0.3	0.3	0.1
Banks' cost of net liabilities	40.1	38.7	34.0	43.3	42.9	19.6
Total (c)	**55.4**	**71.8**	**68.1**	**83.4**	**86.4**	**42.5** (e)
Net investment income earnings (c)	**2.9**	**2.6**	**9.7**	**7.9**	**9.7**	**4.7**

Sources: ONS and Bank of England.

(a) Non-bank private sector.
(b) Including official reserves.
(c) May not sum because of rounding.
(d) Including gilts.
(e) Not seasonally adjusted.

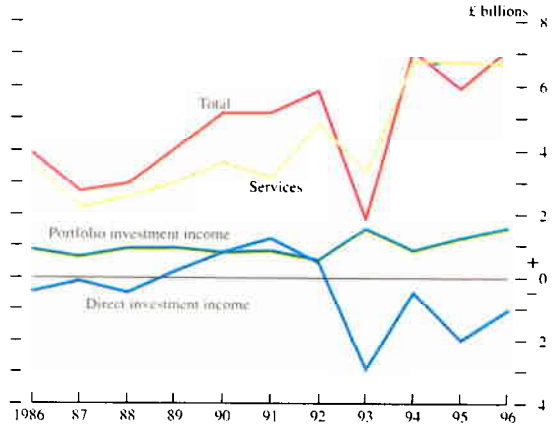
UK residents' earnings on portfolio assets rose to £21 billion in 1996, from £19 billion in 1995. Total income on overseas direct investments also increased during 1996, by £4 billion, to £28 billion. These increases occurred despite the appreciation of sterling.

The increase in total earnings on direct investments in 1996 was largely the result of a fall in the net outflow of earnings from the UK banking sector. The repatriation of income by UK subsidiaries to their overseas parents results in an outflow of earnings, but so too do payments by UK parents to meet any losses of their overseas subsidiaries. There was a particularly high net outflow in 1995, because of payments to cover the losses incurred by Barings in Singapore. In 1996, there was a net outflow of £1 billion on UK banks' direct investment earnings. This was about a half of the figure for 1995. Significant inward direct investment by non-residents in recent years has also increased the amount of income paid to non-residents and will continue to do so (see 'Capital flows' above). The quality of the estimates for banking sector direct investment was improved this year by inclusion of the results of the latest in a series of triennial benchmark surveys.(1)

Chart 5 shows that banks' net earnings from services in 1996 were £7 billion, £1 billion higher than in 1995 and similar to those in 1994. The increase in 1996 was largely a result of the fall in the net outflow of earnings from UK banks, but improved portfolio investment income also contributed. Banks' earnings on external lending increased strongly in 1995 but fell back slightly in 1996, to £39 billion, as shown in Table D. Payments on external borrowing fell similarly, to £43 billion.

On balance, therefore, UK banks paid nearly £4 billion (net) overseas as a result of their lending and borrowing

Chart 5
Net overseas earnings of UK banks



Source: British Invisibles *City Table*, 1996.

transactions. Data published by British Invisibles(2) show that this can be considered as comprising a positive margin of £5 billion earned by banks on their lending to and borrowing from overseas, less the cost of borrowing on behalf of other UK financial and non-financial institutions (£3 billion), less other costs of funding (£6 billion). The cost of borrowing on behalf of other UK residents is thought to be recouped by UK banks from the UK clients for whom the transactions are conducted. In addition, banks earned £2 billion from fees and commissions received for services performed for non-resident customers. Data for the first half of 1997 suggest that investment income this year is likely to be similar to that in 1996, with the earnings on assets and liabilities around half of the amounts recorded for 1996.

Capital gains and full rates of return

Table E gives details of the investment income and full rates of return on specific assets and liabilities in recent years. It shows that the estimated rate of return (interest and dividends only) on UK residents' outstanding external assets at the end of 1996 was unchanged from the end of the previous year, at 5.8%. But the estimated full rate of return, which also takes account of capital gains or losses arising from revaluations, fell substantially during 1996 from 11.4% to -2.7%, reflecting the downward effect of revaluations. The investment income is calculated by expressing earnings as a percentage of the stock of the investment. The full rate of return includes any capital gains or losses resulting from revaluations as well as the investment income, again calculated as a percentage of the stock.

This negative full rate of return contrasts with 1995 when the full rate of return increased significantly from the previous year, largely because of securities price movements. Securities prices continued to rise during 1996, but the value of UK residents' portfolio assets fell because of the appreciation of sterling (see Table E). Portfolio investment income was much the same as in 1995, but the full rate of return fell from 11% to 0.9%. The effect of exchange rate movements on overseas direct investments in

(1) See the box on pages 372–73 on the results of the Bank of England's latest triennial survey of direct investment.
(2) See *The City Table*, British Invisibles, 1997, Table D.

Table E
Estimated investment income (II)[a] and full rates of return[b] on identified assets and liabilities

Percentage points

Assets

	Total		Portfolio		Direct		Banks			
							Foreign currency		Sterling	
	II [c]	Full [d]	II	Full	II	Full	II	Full	II	Full
1991	8.1	10.1	3.8	13.0	10.2	7.4	9.8	8.8	15.2	11.6
1992	5.8	18.2	3.9	15.4	9.0	17.3	6.1	21.5	9.8	8.0
1993	5.3	9.4	3.7	15.4	10.0	11.7	5.8	5.9	7.1	7.4
1994	5.6	2.3	3.9	-0.7	12.3	1.4	5.4	9.2	6.1	7.4
1995	5.8	11.4	4.0	11.0	11.7	13.0	5.7	18.1	6.9	8.6
1996	5.8	-2.7	4.0	0.9	13.0	5.2	5.8	-2.0	6.5	6.6

Liabilities

	Total		Portfolio		Direct		Banks			
							Foreign currency		Sterling	
	II	Full	II	Full	II	Full	II	Full	II	Full
1991	8.2	9.0	6.4	12.7	3.8	2.5	9.3	8.6	13.6	11.5
1992	5.7	16.9	5.6	17.8	4.3	-1.5	5.6	21.5	9.2	7.2
1993	5.3	7.2	4.3	14.4	8.2	4.1	5.5	5.1	6.1	7.0
1994	5.0	2.5	4.8	-2.6	7.6	-2.6	4.6	4.5	4.4	0.2
1995	5.3	10.9	5.0	14.3	9.4	0.8	5.1	13.5	5.6	6.0
1996	5.2	11.2	4.8	14.6	9.7	24.3	5.2	2.1	5.6	2.5

Source: ONS.

(a) Investment income earnings as a percentage of the stock.
(b) Investment income earnings plus stock revaluations, as a percentage of the stock.
(c) Investment income.
(d) Full rates of return.

1996 was also marked: investment income on these holdings increased, but the full rate of return fell back from 13% to 5.2%.

The value of UK banks' foreign currency assets was considerably affected by the appreciation of sterling during 1996. Investment income on these assets was virtually the same in 1996 as in the previous year, but the full rate of return was negative, at -2%, a fall of more than 20 percentage points. In comparison, the full rate of return on banks' sterling assets overseas in 1996 was little different from in 1995.

In contrast, the full rate of return on total liabilities to non-residents increased slightly; investment incomes on all external liabilities were similar to those in 1995. The full rates of return on UK portfolio and direct investment liabilities were also little changed, but those on banks' liabilities were significantly lower. The full rate of return on banks' sterling liabilities more than halved, and the external rate of return on banks' foreign currency liabilities fell from 13.5% in 1995, to 2.1% in 1996.

International comparison of net external assets

Table F and Chart 6 compare the net external assets of several major economies and show that the trends in the United States, Germany and Japan in recent years continued in 1996. The gap between Japan and the United States widened in 1996 as a result of increases to both Japan's net external assets and the United States' net external liabilities. The steady decline in Germany's net external assets, which began following reunification in 1990, continued in 1996. The recent upward trend in French net external assets reversed in 1996.

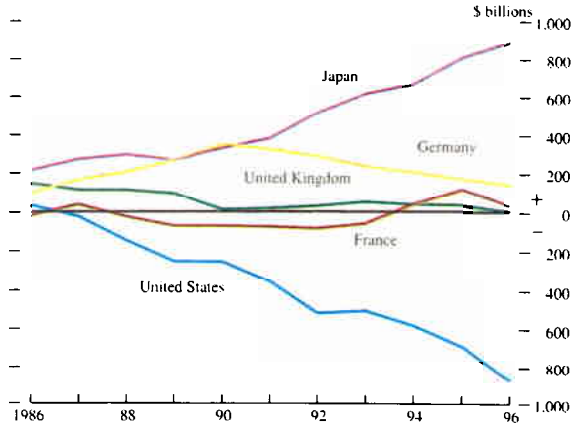
Table F
International comparisons of external net asset positions[a]

$ billions; *percentages of GNP in italics*

End years	1981	1985	1990	1994	1995	1996
United States	374.3	132.8	-251.1	-580.1	-687.7	-870.5
	13.9	*3.3*	*-4.5*	*-8.4*	*-9.5*	*-11.5*
Japan	10.9	164.5	327.5	669.9	809.9	890.6
	1.0	*10.3*	*10.2*	*14.1*	*17.3*	*20.4*
Germany	29.2	52.8	349.5	208.1	171.5	143.0
	4.0	*7.1*	*21.3*	*9.7*	*7.1*	*6.3*
France	56.4	6.1	-71.2	40.9	116.1	35.6
	8.6	*1.0*	*-5.7*	*3.0*	*7.4*	*2.4*
United Kingdom	62.3	102.5	13.3	43.7	40.1	8.1
	12.8	*19.8*	*1.3*	*4.1*	*3.7*	*0.6*

(a) The data underlying this table are taken from national sources, the IMF *International Financial Statistics Publication* (GNP figures) and OECD *Financial Statistics Part 2*. National sources may use differing methodologies.

Chart 6
International comparisons of external net asset positions[a]



(a) The data underlying this table are taken from national sources, the IMF and OECD.

Increases in net external assets are generally linked to current account surpluses. Continuing the trend of the last decade, Japan had a current account surplus again in 1996, and further increased its net external asset position. In the same period, the United States has had a persistent current account deficit; this rose in 1996 to more than 2% of US GDP and now exceeds the combined surpluses of the Japanese and EU economies.

Decomposing exchange rate movements according to the uncovered interest rate parity condition

By Andrew Brigden, Ben Martin and Chris Salmon of the Bank's Monetary Assessment and Strategy Division.

This article discusses the relationship between the exchange rate and monetary policy. It sets out some of the difficulties in identifying the underlying causes of exchange rate movements, and outlines one approach, based on the uncovered interest rate parity condition, that can be used to assess how far news about monetary policy has contributed to an exchange rate change.

Introduction

The monetary authorities of a country with a floating exchange rate, such as the United Kingdom, face the important and difficult issue of how to respond to exchange rate changes. As the price of one country's money in terms of another country's money, a floating exchange rate may change in response to developments either at home or abroad. The implications for monetary conditions, and so for the setting of national monetary policies, depend on the underlying causes. This article describes one approach, based on the uncovered interest rate parity (UIP) condition, used by the Bank to assess the contribution of monetary policy news to exchange rate developments.

The first section of the article discusses the relationship between the exchange rate and monetary policy in more detail. The second section describes techniques that have been used in the past to try to identify the underlying causes of exchange rate developments. The third section sets out in detail how the UIP condition can be adapted to provide an estimate of the contribution of news about monetary policy to exchange rate changes. The fourth section illustrates the potential use of this UIP decomposition with some case studies. The article concludes by assessing this technique, including some of its potential pitfalls.

Exchange rates and monetary policy

How monetary authorities with inflation targets react to economic developments depends on how the prospects for inflation are affected. This is as true for the exchange rate as for other economic factors—see King (1997).(1)

This section provides three hypothetical illustrations of why the link between exchange rate changes and monetary policy is not straightforward. The examples are: the impact of a temporary shock to foreign monetary policy; a permanent positive demand shock; and a reassessment by financial markets of the objectives of UK policy-makers.

Imagine first that the sterling exchange rate appreciated because markets correctly came to believe that overseas monetary policy would be loosened. The initial direct effect would be to lower domestic inflation, as the sterling price of imports fell. But after a time this would wear off as the foreign price of these imported goods rose (reflecting the looser monetary conditions abroad), and so their sterling price would return to its initial level. Overall, there would be an initial temporary fall, followed by a temporary rise in UK price inflation, with no net effect in the long run on the overall price level in the economy. These direct price-level effects would be unrelated to trends in domestically generated inflationary pressure.

But there could also be important indirect effects. In particular, following an overseas monetary expansion, domestic demand might be boosted by an increase in UK residents' real incomes and wealth (resulting from temporarily lower prices). But at the same time, demand for UK exports could fall if our exports became relatively more expensive (exporters did not change the sterling prices of their exports). Depending on the size and persistence of these indirect effects, expectations of inflation might change, requiring offsetting monetary policy action.

Now consider a real shock: for example, a change in overseas tastes that made UK domestically produced goods and services more popular abroad than before. The relative price of domestically produced goods would increase, through a real (and nominal) exchange rate appreciation, leaving domestic prices in the respective countries unchanged. If permanent, this might lead ultimately to a re-balancing of resources between the exporting and import competing sectors of the economy. The shorter-term indirect effects on net trade and GDP would largely depend on the immediate reaction of the exporting sectors to the increased popularity of their products. Again, any knock-on effect on the short-run path of demand and activity might require a monetary policy response.

(1) 'Monetary Policy and the Exchange Rate', speech to the Governors of the National Institute of Economic and Social Research, 27 February 1997, reprinted in the May 1997 *Quarterly Bulletin*, pages 225–27.

Finally, suppose sterling were to appreciate because financial markets changed their assessment of UK policy objectives, and concluded that official interest rates would need to be higher temporarily to satisfy these new objectives. In this case, the underlying shock would be news about domestic monetary policy. If the markets were correct, then there would be both a nominal and real exchange rate appreciation, which would be a consequence of the change in monetary policy objectives. The appreciation would be associated with falling prices (relative to the baseline case of no change in policy objectives) and would contribute to the monetary authorities' pursuit of the revised objective. The real exchange rate would ultimately return to its initial level, but there would be a permanent effect on the nominal exchange rate, reflecting the change in relative prices. Alternatively, if the markets were incorrect and policy objectives had not in fact changed, the exchange rate would probably fall back, other things being equal, as markets reassessed their views about likely monetary policy.

Many other factors can lead to exchange rate movements, but the hypothetical examples above illustrate why there is no simple link between the exchange rate and interest rates when the policy target is inflation. The appropriate policy response will depend on an analysis of the causes of the exchange rate change.

Identifying shocks

Given that the nature of the shock matters for policy, it is essential to try to identify the shocks underlying particular exchange rate movements. Though simple in theory, this is very difficult to do in practice.

Previous studies offer little consensus on which type of shock has been the predominant source of volatility in exchange rates since they were floated in the early 1970s.(1) Some argue that unexpected changes in monetary policy ('monetary shocks') have been responsible for the bulk of observed exchange rate volatility.(2) Others argue that real disturbances to the supply of and demand for goods, which require relative price adjustment, have been responsible for most of the volatility in exchange rates.(3)

Evaluating these views is difficult, because the underlying shocks are not directly observable. For this reason, it is necessary to rely on indirect evidence. A variety of techniques have been developed to do this. One approach, previously discussed in the *Bulletin*,(4) is to examine the relationship between two countries' output (as measured by GDP), inflation and the real exchange rate to identify the contribution of permanent real shocks, temporary real shocks and monetary shocks.(5) This technique assumes that only real (demand or supply) shocks can affect the permanent component of changes in real variables, and that only supply shocks affect output in the long run.

An alternative approach is to split changes in the real exchange rate into permanent and temporary changes using statistical tools, and to take the relative variance of these permanent and temporary elements as a measure of the

The real exchange rate

The nominal exchange rate is a relative money price. For example, the sterling/Deutsche Mark exchange rate, as quoted on the London market, is the price in Deutsche Marks of sterling currency. The real exchange rate is the relative price of (a representative sample of) two countries' output.

A country's price level is an index of the money price of a given basket of commodities. For example, in a consumer price index, the basket is a set of 'typical' household purchases. The real exchange rate is defined in this article as the relative cost of a common reference basket of goods in two countries, where the baskets' costs are compared after being converted into a common currency. For the United Kingdom and Germany, with price levels *PUK* and *PGER*, and nominal exchange rate *S* (defined as Deutsche Marks per pound sterling), the real exchange rate (*Q*) is $S \times PUK/PGER$. The United Kingdom experiences a real appreciation (and Germany a real depreciation) if *Q* rises. A real appreciation means that domestic goods become more expensive relative to foreign goods in common currency terms. The volume of exports of domestic goods might be expected to fall and the volume of imports of foreign goods to rise, so the volume of net trade (exports minus the volume of imports) is likely to decrease.

Aggregate demand is often split into domestic absorption, such as investment and consumption, and net trade. For a given level of domestic absorption, the equilibrium real exchange rate can be defined as the real exchange rate at which the net trade contribution to aggregate demand equates aggregate demand with the equilibrium rate of output in the economy.

(1) Rogoff, K (1996), 'The purchasing power parity puzzle', *Journal of Economic Literature*, June 1996, pages 647–68.
(2) Mussa, M (1982), 'Nominal exchange rate regimes and the behaviour of real exchange rates, evidence and implications', *Carnegie-Rochester Conference series on public policy*, 26.
(3) For a well-known statement of this position see Stockman, A (1987), 'The equilibrium approach to exchange rates', *Federal Reserve Bank of Richmond Quarterly Review*, March/April.
(4) Astley, M and Garratt, A (1996), 'Interpreting sterling exchange rate movements', *Quarterly Bulletin*, November 1996, pages 394–404, which was based on Clarida, R and Gali, J (1994), 'Sources of real exchange rate fluctuations; how important are nominal shocks?', *Carnegie-Rochester Conference series on public policy*, 41, pages 1–56.
(5) The shocks to monetary equilibrium identified in this approach capture the effects of shocks to both money supply and money demand (see Astley and Garratt, *Quarterly Bulletin*, November 1996 for more detail).

relative importance of real and monetary factors.[1] The underlying assumption is that only real shocks affect the permanent component of changes in real variables. So the variance of the temporary component of real exchange rate changes gives an upper bound to the contribution of monetary shocks to (the variance of) real exchange rate changes. It is an upper bound because some real shocks are themselves temporary (for example, a temporary fiscal boost) and so may affect the real exchange rate only temporarily.

The approach that this article presents also distinguishes between shocks that have permanent and temporary effects on the real exchange rate. But it does not use the same statistical tools. Instead, it uses the UIP condition to focus on the interaction between interest rates and exchange rates. It provides an alternative measure of the contribution of different types of shock to the exchange rate, which is important given the uncertainties implicit in exchange rate analysis. In general, the UIP method will permit timely analysis, since market interest rate and exchange rate data are available daily.

Using the UIP condition to help interpret exchange rate movements

The UIP condition can be written as:

$$E_t s_{t+1} - s_t = i_t^* - i_t + \rho_t \qquad \textbf{(1)}$$

where s_t is the spot exchange rate (defined as the foreign currency price of domestic currency); $E_t s_{t+1}$ is the market's one-step-ahead forecast for the spot exchange rate made at time t;[2] i_t is the domestic one-period nominal interest rate; i_t^* is the foreign one-period nominal interest rate; and ρ_t is a currency risk premium. Equation **(1)** says that, after adjusting for expected exchange rate movements, the one-period return on holding assets denominated in different currencies, allowing for any risk premium, must be equal.

Many authors question the empirical validity of UIP. But these tests invariably invoke additional assumptions that the decomposition set out below does not embody (see the box on page 380).

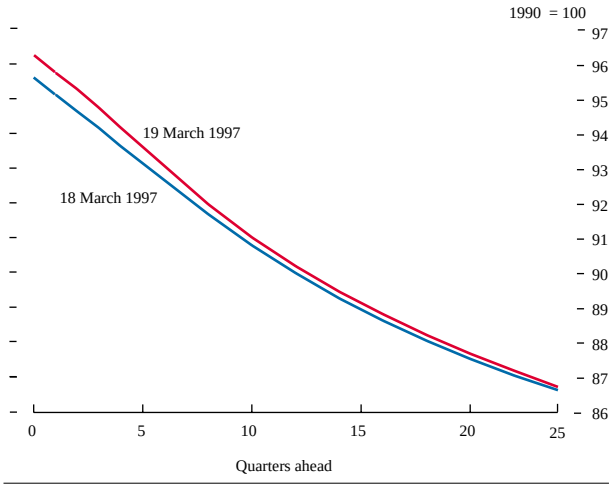
We illustrate the uses that can be made of UIP analysis with reference to the change in the sterling exchange rate between close of business on 18 March and close of business on 19 March 1997. Labour market statistics published on 19 March recorded a fall in claimant count unemployment to its lowest level since 1990, and a rise in measured average earnings growth to its highest since November 1992. At the time, commentators regarded these data as significant news about the need for further monetary tightening.[3]

The steps are broadly as follows. First, a measure of 'news' is derived, as the extent to which a change in the nominal exchange rate during a short period differed from the change implied by the differential between domestic and overseas interest rates for that period. Second, the factors lying behind the news are split into (i) changes in the differential between expected domestic and overseas interest rates up to some arbitrary terminal point, and (ii) a residual term that includes changes in the expected value of the nominal exchange rate at that terminal point and changes in currency risk premia. Third, using various assumptions about the influence that the monetary authorities can have on expected interest rates at different maturities, the news is attributed to 'monetary policy' and 'other' factors. As explained below, this final step also requires a judgment about the reasons for any changes in relatively short maturity interest rates; that is why the example chosen to illustrate the technique is a day when statistical releases caused market commentators to change their stated expectations about the path of official interest rates.

(a) Deriving a measure of news

The first step is to derive a measure of news. As an extension of the one-period example in **(1)**, it is assumed that UIP holds for every day into the future. Given the current spot exchange rate and information on domestic and foreign interest rates, an expected profile for the exchange rate can then be traced out. Chart 1 provides an example[4] for an effective index where sterling is measured against a basket of currencies from other G7 countries.[5]

Chart 1
UK effective exchange rate profiles



The line labelled 18 March shows how the exchange rate was expected to evolve from its level of 95.7, given the

(1) Beveridge, S and Nelson, C (1981), 'A new approach to the decomposition of economic time series into permanent and transitory components', *Journal of Monetary Economics*, 7, pages 151–74.
(2) The exchange rates in **(1)** are expressed as logs, and though **(1)** is the most commonly used representation of UIP, it is actually an approximation of the true UIP condition. See the mathematical appendix for details.
(3) See for example, 'Earning a Rise', *The Lex Column*, *Financial Times*, page 32, 20 March 1997.
(4) For simplicity, this chart is drawn on the assumption that the current and expected future currency risk premia are both zero. This assumption is not crucial to results that follow.
(5) The Bank calculates forward interest rates for these countries on a daily basis, and these data are needed to apply the UIP decomposition. The box on page 381 compares the G7 ERI with the official ERI, which is measured against a basket of 20 currencies.

Uncovered interest parity in practice

The method described in this article is based on the UIP condition. Economic models typically assume that it holds and that if markets are efficient and investors are risk-neutral, then the excess return on domestic assets, defined as the interest differential net of the observed exchange rate movement, should be unforecastable. Otherwise, investors would be systematically ignoring profit opportunities.

Much research has been directed into examining whether or not UIP holds in practice. The UIP condition cannot be estimated directly, since neither market expectations of the spot rate nor the currency risk premium are observable. Most empirical work has therefore tested the joint hypothesis that UIP holds together with market efficiency (investors are rational and use all available information to construct their forecasts) and risk neutrality. This joint hypothesis is frequently rejected. For example, using weekly data for the US dollar against six other major currencies, Cumby and Obstfeld (1981)(1) find that a significant portion of the excess return on each currency can be explained by previous excess returns. So excess returns appear persistent, and not random as predicted. But since Cumby and Obstfeld test a joint hypothesis, it cannot be concluded that UIP itself does not hold.

The decomposition described in this article is valid even when neither of the conditions of rational expectations and risk neutrality hold. The decomposition attempts to identify the contribution of interest rate expectations—as distinct from the risk premium or expected terminal exchange rate—to a change in the current spot rate. It is important for the decomposition that nominal interest rate differentials feed through one-for-one to expected changes in the price of domestic currency. To put it another way, the coefficient for i_t^*-i_t must be one. This can be tested econometrically.

Fisher *et al* (1990)(2) test to see if real interest differentials feed through one-for-one to the expected change in the real dollar/sterling exchange rate. To test this, they have to make some auxiliary assumptions: that expectations are rational, and that the current account/GDP ratio can be used as a proxy for currency risk. They find that the model works, in the sense that the coefficient on the current real interest rate differential equals one, and that previous lags of the exchange rate or interest rates have no explanatory power. Moreover, the model gives a better prediction of real exchange rate changes out of sample(3) than a simple random walk hypothesis—contrasting with the famous result in Meese and Rogoff (1983)(4) that simple random walk models predict exchange rate changes more accurately than theoretical models of the exchange rate.

But though the expected exchange rate movement may vary one-for-one with the interest rate differential, real interest rate differentials together with the current account/GDP ratio explain just 3% of the quarterly movement in the actual real sterling/US dollar exchange rate. This finding does not invalidate UIP, but merely implies that a large amount of the variation in spot exchange rates is driven by random innovations ('news' as defined by equation **(2)** on page 382) arriving each period.

In summary, a number of authors have found that excess returns in foreign currency markets are predictable. This is not in itself evidence against UIP; instead it means that UIP probably does not hold jointly with rational expectations and risk neutrality. Forecasts of the next period's spot exchange rate might well be biased and inefficient and risk premia might well be non-zero, but this would not affect the decomposition described in the article. All that matters is that interest rate differentials feed through one-for-one to expected exchange rate movements, which seems plausible.

(1) Cumby, R and Obstfeld M, (1981) 'A note on exchange rate expectations and nominal interest differentials: a test of the Fisher hypothesis', *Journal of Finance*, Vol 36, No 3 June, pages 1,231–44.
(2) Fisher, P, Tanna, S, Turner, D, Wallis, K and Whitley, J 'Econometric evaluation of the exchange rate', *Economic Journal*, 100, December 1990, pages 1,230–44.
(3) These out-of-sample tests used (National Institute) forecasts of the exchange rate as proxies for the markets' expectations for the exchange rate.
(4) Meese, R, and Rogoff, K, (1983) 'Empirical exchange rate models of the seventies', *Journal of International Economics*, No 14, pages 3–24.

A comparison of the full and G7 sterling ERIs

The Bank publishes an official effective exchange rate index, which measures the value of sterling against a basket of 20 other currencies. It is a weighted geometric average of exchange rates, expressed as an index. The weights are taken by the Bank from trade flows data published by the IMF and measure the relative importance of other countries as competitors to the UK manufacturing sector.(1)

Country weights in the official and G7 ERIs

Country	Weight (full ERI)	Weight (G7 ERI)	Country	Weight (Full ERI)	Weight (G7 ERI)
Germany	22.49	32.97	Republic of Ireland	3.08	n.a.
United States	16.49	24.17	Finland	1.41	n.a.
France	12.59	18.45	Canada	1.38	2.02
Italy	8.27	12.12	Denmark	1.38	n.a.
Japan	7.00	10.26	Austria	1.19	n.a.
Netherlands	5.71	n.a.	Norway	1.19	n.a.
Belgium and Luxembourg	5.39	n.a.	Portugal	0.84	n.a.
Spain	3.85	n.a.	Australia	0.48	n.a.
Sweden	3.45	n.a.	Greece	0.31	n.a.
Switzerland	3.27	n.a.	New Zealand	0.21	n.a.

n.a. = not applicable.

In the UIP decomposition described here, a weighted average of the other G7 currencies (the United States, Germany, France, Italy, Japan and Canada) is used, rather than the full ERI. The weights attributed to these six countries account for just over 68% of the total. Chart A compares the levels of these two indices since September 1992 (re-based to September 1992 = 100), and Chart B compares the monthly growth rates. The two series are very similar, especially in growth rate terms, possibly because the currencies excluded from the G7 effective measure move closely with the major currencies included. For example, ERM members excluded from the G7 ERI, accounting for a further 23% of the full ERI, might be expected to move quite closely with the Deutsche Mark.

Chart A
Comparison of G7 and full ERIs (levels)

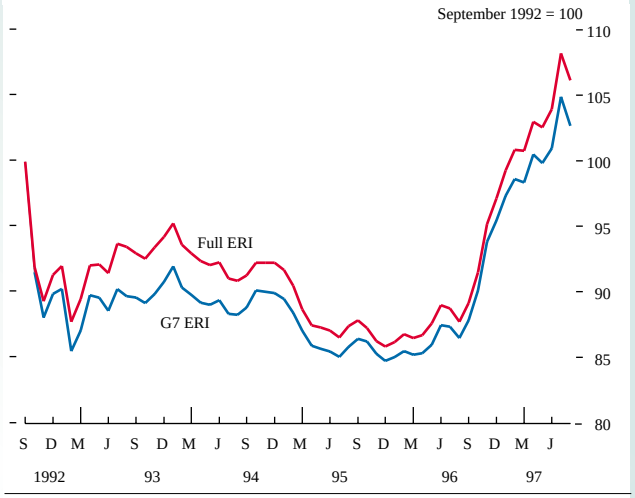
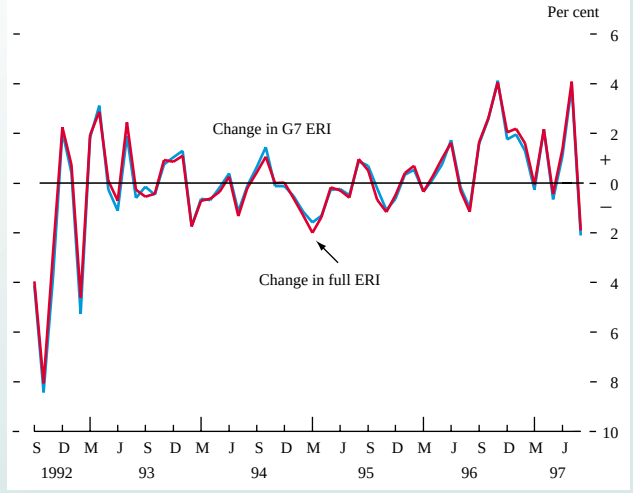


Chart B
Comparison of G7 and full ERIs (changes)



(1) See *Bank of England Quarterly Bulletin*, February 1995, pages 24–25.

differential on that date between domestic and foreign market interest rates. Thus between 18 March 1997 and 17 March 1998, the exchange rate was expected to depreciate in line with the differential between one-year domestic and overseas interest rates. And between 18 March 1998 and 17 March 1999, sterling was expected to depreciate in line with the one-year forward interest rate differential.(1)

During the next day sterling did not depreciate at all; it appreciated to 96.3, and the 19 March line shows how the exchange rate was expected to evolve, given the new starting-point and the new set of market interest rates at home and abroad. Domestic interest rates had risen in the 24-hour period, relative to those of other members of the G7, so the UIP condition implied that sterling was expected to depreciate more quickly on 19 than on 18 March, from the higher starting level.

Table A provides a breakdown of this analysis (and the decomposition into 'monetary policy' and 'non-monetary policy' factors that is described below). It reports results for the G7 effective rate and also changes in the bilateral dollar/sterling and Deutsche Mark/sterling rates. For the example used above, spot interest rates on 18 March implied no significant overnight change in sterling, so the news is broadly equal to the actual change of 0.7%.(2) Line 1 reports the actual change in each spot rate in the sample period.

(1) It is assumed that a forward interest rate is the interest rate expected in the future (eg the one-year rate expected next year). See Deacon, M and Derry, A (1994), 'Estimating market interest rate and inflation expectations from the prices of UK government bonds', *Quarterly Bulletin*, August, pages 232–40.
(2) This result is common for overnight changes. Annualised interest rate differentials would have to be very large to imply a significant overnight movement.

Line 2 reports the change predicted by UIP at the start of the period, and line 3 reports this definition of exchange rate news (line (1) – line (2)).

Table A
Sterling exchange rate movements between 18 and 19 March 1997

Per cent; *percentage points in italics*

		US$	DM	UK ERI
Actual change against	(1)	0.6	0.8	0.7
of which:				
Expected	(2)	0.0	0.0	0.0
'News'	(3) = (1) – (2)	0.6	0.8	0.7
Cumulative revision to nominal forward interest differentials (a)	(4)	*0.7 to 0.9*	*0.6 to 0.7*	*0.7 to 0.9*
of which:				
Estimated real component	(5)	*0.3*	*0.3*	*0.3*
Sensitivity band (b)	(6)	*0.3 to 0.4*	*0.2 to 0.4*	*0.3 to 0.4*
Residual	(7) = (3) – (5)	*0.3*	*0.5*	*0.4*
Sensitivity band (b)	(8) = (3) – (6)	*0.2 to 0.3*	*0.4 to 0.6*	*0.3 to 0.4*

Sources: Bank of England, Bloomberg, LIFFE and Financial Times.

(a) Range as terminal horizon (n) varies from eight to twelve years.
(b) Estimated range as p-horizon varies from four to eight years.

(b) Estimating the proportion of news accounted for by changes in nominal interest rate differentials

The second step is to look at how the news—the unexpected change in the spot exchange rate—is related to changes in the differential between domestic and overseas forward interest rates up to some terminal point, and to changes in the nominal exchange rate expected at that terminal point. In terms of Chart 1, this amounts to relating the change in the starting-point to the change in the slope and the change in the end-point of the trajectory of the exchange rate. As explained in detail in the Appendix, this can be set out algebraically as follows:

$$s_{t+k} - E_t s_{t+k} = \sum_{j=k}^{n-1}(E_{t+k}\delta_{t+j} - E_t\delta_{t+j}) + (E_{t+k}s_{t+n} - E_t s_{t+n}) - \sum_{j=k}^{n-1}(E_{t+k}\rho_{t+j} - E_t\rho_{t+j}) \quad \textbf{(2)}$$

where $\delta_{t+j} = (i_{t+j} - i_{t+j}^*)$, the difference between domestic and overseas forward interest rates at a given maturity.

In our example, t is 18 March 1997; $t + k$ is 19 March 1997; and $t + n$ is the chosen terminal point (18 March 2007 for n = ten years), which is arbitrary.

The first term (on the right-hand side) is the cumulative change in the expected difference between domestic and overseas interest rates (the forward differential). This term shows how the expected rate of depreciation of sterling up to some horizon $t + n$ has changed between t and $t + k$. The second term is the change in the expected nominal value of sterling at the chosen terminal date. The third term is the net change in the sterling risk premium up to the chosen horizon. Only the first term can be directly measured. In what follows, no attempt is made to analyse separately changes implied by the second and third terms; instead, they are treated together as a residual.

Line 4 of Table A shows how much of the news can be accounted for by changes in the forward nominal differential (first bracketed term of **(2)**), conditional on the simplest possible assumption that changes in the forecast long-run nominal value of sterling and in the mass of risk premia (second and third bracketed terms) occur independently. From equation **(2)** it is clear that this will be sensitive to the choice of terminal date ($t + n$). Results are reported for terminal points eight to twelve years after the starting date for the decomposition.

For the case illustrated in Table A, changes in interest rate differentials account for between 0.7 and 0.9 percentage points of the appreciation of sterling against the basket of G7 currencies between 18 and 19 March.(1)

Chart 2 shows the forward curve movements that underpin this result. Panel A shows UK and overseas forward rates on these two dates. On both dates UK rates were higher than overseas rates, producing the implied depreciation paths for sterling shown in Chart 1. Panel A also shows that overseas forward rates did not change much from one day to the next. By contrast, UK forward rates rose at all maturities. Panel B shows the difference between UK and overseas forward rates—the interest rate differential—on the two dates; the impact of revision to UK forward rates is clear. Finally, Panel C shows how this differential changed between 18 and 19 March. The area under the curve in this final panel is the graphical representation of the first bracketed term in equation **(2)**, and of the results reported in line 4 of Table A.

This second stage of the decomposition reveals how much of the exchange rate movement can be explained by changes in interest rate differentials up to some arbitrarily chosen horizon. But it does not help to identify the underlying shock that caused either interest rates or the exchange rate to change. The third stage draws inferences about the nature of these shocks on the basis of some further assumptions.

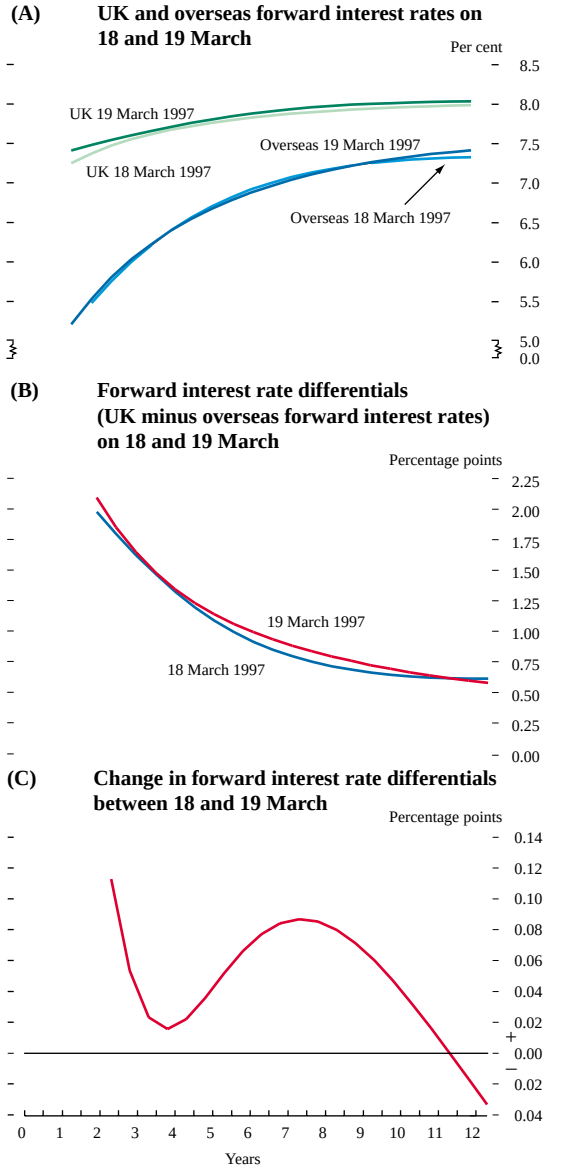
(c) Estimating the proportion of news accounted for by changes in expected monetary policy

Economic theory suggests that monetary authorities can influence real interest rates in the short run because goods prices are sticky, but in the long run prices will adjust, so monetary authorities can influence only nominal rates via inflation expectations. This theory also suggests that monetary policy is neutral in the long run: changes in nominal interest rates will have no long-term effect on real activity. This implies that the real exchange rate is independent of monetary policy in the long run, but that the

(1) Line 4 of the table shows the maximum and minimum change in the current exchange rate that the change in interest rate differentials predict, as the horizon up to which the change in the differential is cumulated varies from eight to twelve years.

expected nominal exchange rate will change in line with changes in the prospects for inflation.(1)

Chart 2
Deriving the news in UK forward interest rates relative to other countries(a)



(a) The overseas economies here are the M6. Their forward interest rates are weighted together using ERI weights to give the rate on a benchmark overseas asset.

The decomposition presented here embodies these features by assuming that when there is news about monetary policy (i) changes in near-term nominal interest rate expectations relative to overseas rates reflect a reassessment of future relative real interest rates (over which the monetary authorities have some influence), but in the longer term they reflect a reassessment of relative inflation prospects,(2) and (ii) any changes in expected prices (relative to overseas prices) have no impact on the real exchange rate expected in the long run. As monetary policy is not the only influence on interest rates, these assumptions are clearly valid only when monetary policy shocks are the main cause of interest rate movements.

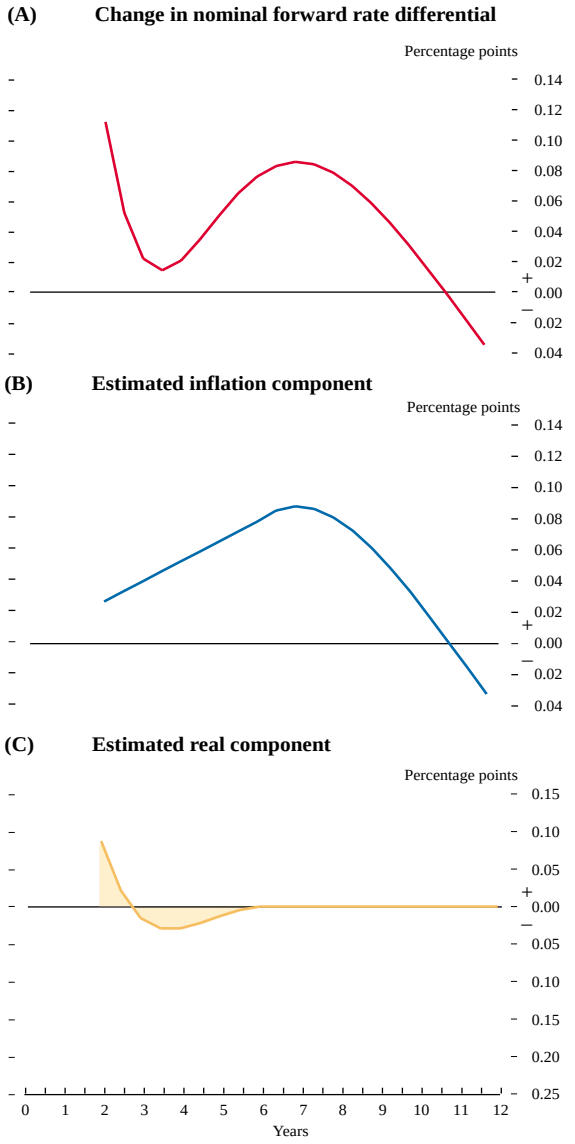
To put these assumptions into practice, a working definition of the short run is needed. Though the lags in the transmission mechanism are uncertain, many economists would probably agree that monetary policy does not have an effect on prices in modern low-inflation economies straightaway.(3) In addition, markets are unlikely to revise their views about relative monetary policies (as captured by the real rate differential) at maturities longer than a typical cycle, which is around six years.(4) One solution would be to assume that all movements in forward nominal interest rates up to some given maturity are driven by the real component, and thereafter all are driven by the inflation component. Though simple, this discrete switch approach would be unrealistic, as the impact of monetary policy changes on inflation builds up gradually. Instead, stage three embodies a smooth transition: it is assumed that news about relative inflation prospects runs from zero in the immediate period to equal the entire change in the nominal forward interest differential at some policy threshold point (p). Thereafter, all changes in the nominal forward interest differential are driven by the inflation component—relative real interest rates do not vary beyond the p-horizon. In the central case, p is set equal to 6 years. It may help to give a numerical example: imagine that the forward differential at six years has widened by 150 basis points. The assumption employed would imply that expected UK inflation six years hence has risen by 150 basis points relative to other countries, but by only 50 basis points after two years and by 25 basis points after one year. If the forward differential has in fact widened by 150 basis points at all horizons up to six years, a further implication would be that expected real rates had risen by 150 basis points in the immediate period, 125 basis points after one year, 100 basis points after two years, and so on down to zero at the six-year horizon. In practice, the p-horizon is varied from four to eight years to reflect the uncertainties about the speed of pass-through, and to provide a sensitivity test.

To capture the money neutrality notion, it is assumed that agents revise their expectation of the spot nominal rate at the terminal horizon one-for-one with the changes in expected relative prices identified from interest rates. For example, if changes in forward interest rates between two dates implied that, using the real/inflation split outlined above, expected UK prices relative to those abroad had been revised up by 10%, then, other things being equal, it is assumed that markets would revise down their expectation for the nominal

(1) Though this is a standard conclusion embedded in many economic models, some models do not have this neutrality. For example, Obstfeld, M and Rogoff, K (1995), 'Exchange Rate Dynamics Redux', *Journal of Political Economy*, 1995, Vol 103, No 3, pages 624–60, develop a model in which monetary shocks lead to permanent changes in wealth and the long-run real exchange rate.
(2) In the United Kingdom, estimates of real interest rates and inflation expectations can be derived by comparing changes in conventional and index-linked gilts. If index-linked bonds were common overseas, then it would be possible to measure changes in domestic real interest rates relative to overseas rates directly.
(3) Dale, S and Haldane, A (1995) 'Interest rates and the channels of monetary transmission: some sectoral estimates', *European Economic Review*, 39, pages 1,611–26.
(4) Cooley and Prescott describe methods used to extract data of business cycle frequency. They eliminate data of frequency less than three years and greater than eight years, which guides the choice of six years as an estimate for the central case (Cooley, T and Prescott, E (1995) 'Economic growth and business cycles' pages 1–39 in Cooley (Ed) *Frontiers of business cycle research*, Princeton).

value of sterling by 10%. This would imply that the expected value of the real exchange rate would be unchanged in the long run by the change in inflation expectations.(1) So the effect of monetary policy on the exchange rate is identified as the cumulative change in estimated real interest rate differentials.

Chart 3
Splitting the change in nominal forward differentials into real and inflation components



Line 5 of Table A reports the central, six-year, estimate for the case study. It suggests that the estimated change in relative real interest rates implied an appreciation of 0.3% between 18 and 19 March 1997. Line 6 shows that this estimate does not change much if the horizon up to which it is assumed that policy can influence real interest rates is shortened or lengthened. Overall, the decomposition suggests that monetary factors—as captured by estimated changes in real interest rate expectations—did play a significant role in explaining the appreciation of sterling on 19 March. But equally, it suggests that these monetary factors were not the only influence on sterling on that day. Lines (7) and (8) provide estimates of the influence of these other 'residual' factors.

Chart 3 provides a graphical representation of these results. Panel A shows the change in the nominal interest rate differential; Panels B and C show how the technique decomposes this into changes in relative inflation expectations (Panel B), and relative real interest rates (Panel C), with the pass-through parameter, *p*, set equal to six years. Line 5 in Table A shows the exchange rate shift implied by the shaded area in Panel C.

It is important to recognise that the assumptions underpinning this decomposition are highly stylised; it can provide only an approximate measure of the change in real interest rate expectations. And as monetary policy is not the only influence on these rates, care must be taken in linking real interest rate changes to monetary policy. Thus the prudent interpretation of results for this case study would be that monetary policy news can probably explain a significant proportion of the increase in sterling on 19 March, but that the method cannot support more precise conclusions.

Further case studies

This section reports some further case studies that illustrate the type of results that the decomposition gives. Another two one-day studies are presented: for the 25 basis point interest rate cut on 13 December 1995, and for the 25 basis point interest rate rise on 30 October 1996. These are the two most recent turning-points in official interest rates. Previous studies suggest that turning-points in official interest rates have a larger-than-average impact on market expectations.(2) The decomposition is also applied to two longer time periods in which sterling moved significantly: first, the four months after the suspension of sterling's membership of the ERM, when sterling depreciated by around 13%; and second, the period from August last year to May this year, in which sterling appreciated by around 17%.

Table B shows the UIP decomposition between 12 and 13 December 1995. The decomposition suggests that the rate cut did lead to a revision to the expected relative path of monetary policy, which is consistent with past studies: it implies that sterling should have depreciated by around 0.5 percentage points, other things being equal. In fact, the G7 ERI appreciated by 0.2% on 12 December, suggesting that other shocks more than offset any downward pressure from the rate cut.(3)

(1) In terms of equation **(2)**, a change in forward differentials relates to the spot rate directly (term 1) and also indirectly via the change in the expected nominal value of sterling at the chosen horizon (term 2). This is because changes in longer-term nominal differentials are assumed to be revisions to longer-term inflation expectations, and therefore the expected nominal value of sterling is revised down. The monetary news is identified as the sum of the changes in these two terms. A corollary of this assumption is that the estimate of the 'monetary' news is independent of the choice of terminal horizon in **(2)**.
(2) Dale, S (1993) 'The effect of official interest rate changes on market rates since 1987', *The Manchester School*, Vol 61, supplement, June 1993, pages 76–94.
(3) These shocks are measured by the residual in lines (7) and (8) of Table B and will include some combination of a change in the forecast long-run real exchange rate and a change in currency risk premia.

Table B
Sterling exchange rate movements between 12 and 13 December 1995

Per cent; *percentage points in italics*

		US$	DM	UK ERI
Actual change against	(1)	0.1	0.2	0.2
of which:				
Expected	(2)	0.0	0.0	0.0
'News'	(3) = (1) – (2)	0.1	0.2	0.2
Cumulative revision to nominal forward interest differentials (a)	(4)	*-0.8 to -0.2*	*0.5 to 2.8*	*-0.1 to 0.6*
of which:				
Estimated real component	(5)	*0.0*	*-0.5*	*-0.5*
Sensitivity band (b)	(6)	*-0.2 to 0.2*	*-1.1 to 0.0*	*-0.7 to -0.3*
Residual	(7) = (3) – (5)	*0.1*	*0.7*	*0.7*
Sensitivity band (b)	(8) = (3) – (6)	*-0.1 to 0.2*	*0.2 to 1.3*	*0.4 to 0.9*

Sources: Bank of England, Bloomberg, LIFFE and Financial Times.

(a) Range as terminal horizon (n) varies from eight to twelve years.
(b) Estimated range as p-horizon varies from four to eight years.

Table C shows the UIP decomposition between 29 and 30 October 1996. There is a similar impact on forward interest rates, and by extension on expected relative monetary policy. But this time there were no apparent offsetting factors, and the exchange rate moved in a direction consistent with monetary news. Monetary news explained around half of the appreciation against the G7 ERI.

Table C
Sterling exchange rate movements between 29 and 30 October 1996

Per cent; *percentage points in italics*

		US$	DM	UK ERI
Actual change against	(1)	1.4	1.2	1.2
of which:				
Expected	(2)	0.0	0.0	0.0
'News'	(3) = (1) – (2)	1.4	1.2	1.2
Cumulative revision to nominal forward interest differentials (a)	(4)	*-0.4 to 0.1*	*-0.7 to -0.6*	*-0.8 to 0.0*
of which:				
Estimated real component	(5)	*0.4*	*0.1*	*0.6*
Sensitivity band (b)	(6)	*0.3 to 0.5*	*-0.3 to 0.4*	*0.4 to 0.7*
Residual	(7) = (3) – (5)	*0.9*	*1.1*	*0.6*
Sensitivity band (b)	(8) = (3) – (6)	*0.9 to 1.0*	*0.9 to 1.5*	*0.5 to 0.8*

Sources: Bank of England, Bloomberg, LIFFE and Financial Times.

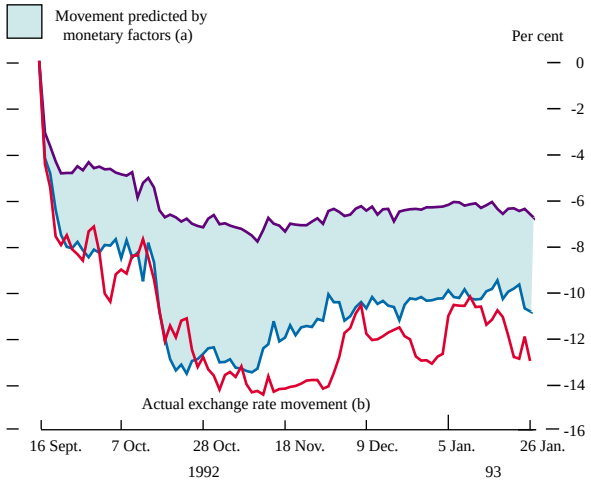
(a) Range as terminal horizon (n) varies from eight to twelve years.
(b) Estimated range as p-horizon varies from four to eight years.

Tables B and C also illustrate that bilateral exchange rate developments can be quite diverse. For instance, on 12/13 December 1995, the decomposition indicates that there was little monetary news relative to the United States, implying that expectations about monetary policy softened in the United States as well as in the United Kingdom. And on 29/30 October 1996, monetary factors can account for less of the appreciation against the Deutsche Mark than against either the dollar or the weighted basket of other G7 currencies. The implication is that expected monetary policy also tightened in Germany.

Sometimes the full implications of a given event for monetary policy do not become evident in a single day. Rather, market sentiment moves slowly in the same direction over a period of time. In these circumstances, it is possible to go a stage further and add up the identified real interest rate components to obtain a measure of cumulative news. There are two important caveats to this use of the decomposition—first, the assumption of unchanged relative prices, necessary to identify the movement in the terminal nominal exchange rate consistent with an unchanged terminal real exchange rate, becomes less plausible when the decomposition is conducted for a longer period. And second, it is increasingly likely that other factors will have caused relative interest rate movements as longer periods of time are considered.(1)

Sterling's membership of the ERM was suspended after trading hours on 16 September 1992. On 17 September, UK official rates were cut by 2 percentage points from 12% to 10%. UK forward interest rates fell at maturities up to four years by as much as 4 percentage points, and rose at longer maturities by as much as 1 percentage point. The UIP decomposition interprets this as a fall in real interest rate expectations in the short term and a rise in inflation expectations thereafter. As Chart 4 shows, the decomposition implies that almost all of the entire sterling depreciation on that day, of some 4.5%, can be accounted for by news about the expected future conduct of UK monetary policy relative to that in other countries.

Chart 4
News about monetary policy: from 16 September 1992 to 26 January 1993



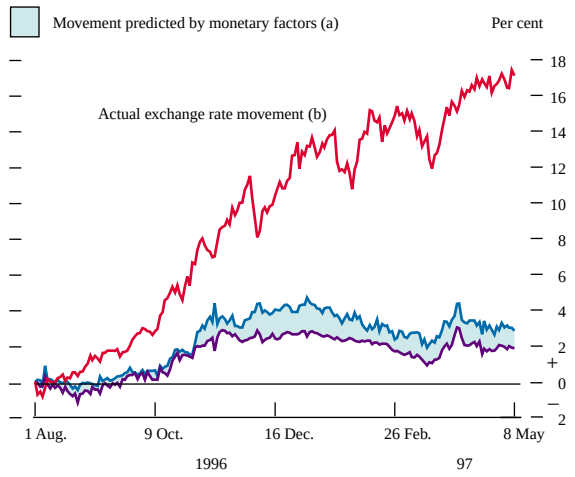
(a) Band shows estimated range as p-horizon varies from four to eight years, cumulated from 16 September 1992.
(b) In G7 effective index, cumulated from 16 September 1992.

In the subsequent period to 26 January 1993, the last date on Chart 4, official rates were reduced further, in four steps of 1 percentage point, to 6%. The short end of the UK nominal forward curve continued to fall and the long end continued to rise, with the result that, according to the decomposition, estimated monetary policy factors still accounted for most of the depreciation of sterling—by then 13% against G7 currencies—since the exit from the ERM.

(1) For such analysis, real interest data for other countries would therefore be especially informative.

Chart 5 shows how estimated news about UK monetary policy relative to other G7 countries has evolved since 1 August 1996. It suggests that until the end of September 1996, monetary factors had little net impact on the exchange rate, and so other factors were responsible for most of the 2% appreciation during that period. Market sentiment about the prospect for UK interest rates appeared to change from early October 1996: the identified contribution of monetary news began to rise quite sharply following the base rate change on 30 October, reaching a peak of around one half near the year end. It fell back a little by 7 February, when data for the February *Inflation Report* were finalised; according to the decomposition, news about relative monetary policies explained at most nearly one quarter of the cumulative sterling appreciation since August 1996.

Chart 5
News about monetary policy: from 1 August 1996 to 8 May 1997



(a) Band shows estimated range as *p*-horizon varies from four to eight years, cumulated from 1 August 1996.
(b) In G7 effective index, cumulated from 1 August 1996.

Assessment

The potential advantage of this decomposition is that it provides a cross-check on the interpretation of exchange rate developments that other models might provide, and gives an indication of broadly how much of a change can plausibly be explained by interest rate movements. Moreover, when it is believed that monetary policy factors have significantly influenced interest rates, it allows these rate changes to be used to identify whether the effect of expected monetary policy on the exchange rate has been significant.

The UIP decomposition should be able to distinguish the impact on the exchange rate of the three hypothetical events discussed in the first section. Consider first the example of a foreign monetary loosening. Other things being equal, short-term foreign real interest rates will have fallen relative to those in the United Kingdom (reflecting the easing of policy), but at longer maturities rates will only change to the extent that foreign inflationary prospects change. Assuming that UK interest rates remained unchanged, the decomposition would imply that an appreciation of sterling should occur (foreign interest rates fall relative to domestic rates). It would correctly ascribe the appreciation to foreign monetary factors. Conversely, in the third example (a perceived tightening of the domestic inflation objective), forward interest rates in the United Kingdom would rise relative to those overseas at short maturities, and fall at longer maturities as inflation expectations fell. The appreciation of sterling would again correctly be ascribed to domestic monetary news. By contrast, the second example—a shift in overseas tastes—has no obvious direct implications for foreign or domestic interest rates. And the appreciation of sterling would not be ascribed to monetary policy news at home or overseas, so long as forward interest rates did not change.

To make use of the UIP relationship, some quite strong assumptions are needed to derive a measure of real interest rate news. In particular, it is assumed that (i) short-term expectations of inflation are fairly rigid and (ii) after some threshold point, *p*, real interest rates move together across countries. It follows that the technique will give misleading results when presented with temporary nominal shocks that feed through rapidly to prices, or for example, a fiscal contraction overseas that has a sustained impact on real interest differentials due to, say, capital market imperfections. And of course, short-term relative real interest rates can vary for reasons other than monetary policy, which is why it is necessary to look for additional evidence of news about monetary policy when applying the decomposition.

The monetary policy news identified by the decomposition reflects the markets' assessment of how various underlying shocks have altered the prospects for monetary policy. This captures the notion of an exogenous monetary shock (such as a change to policy), as well as a monetary policy reaction to other shocks (an 'endogenous' change to policy). For instance, if the financial markets revised up their (near-term) expectations of UK short-term real rates relative to other countries in response to a positive temporary demand shock in the United Kingdom, the technique would label the resulting appreciation 'monetary', even though the underlying cause is not an exogenous monetary shock. The key point is that the 'monetary' part of an appreciation reflects expectations about the future path of real interest rate at the short end of the maturity spectrum, where they can be influenced by central banks.

Appendix: a mathematical treatment of the UIP decomposition

The UIP condition states that:

$$\frac{E_t S_{t+1}}{S_t} = \frac{(1+i_t^*)}{(1+i_t)} R_t \qquad \textbf{(A1)}$$

Here, S_t is the foreign currency price of sterling; i_t is the one-period domestic interest rate, i_t^* denotes the one-period foreign interest rate, and R_t is a risk premium.

It is standard to work with the log-linearised form of this equation,[1] making use of the Taylor series property that $\ln(1 + x) \cong x$ when x is small, and also ignoring Jensen's inequality (that the expressions $\ln E_t S_{t+n}$ and $E_t \ln S_{t+n}$ are not equal). This latter step simplifies the analysis considerably. The log-linearised version is:[2]

$$E_t s_{t+1} - s_t = (i_t^* - i_t) + \rho_t \qquad \textbf{(A2)}$$

That is, the expected change in the log of the exchange rate (s) between time t and $t + 1$ equals the interest rate differential on one-period foreign and domestic bonds plus ρ_t (= $\ln R_t$).

Forward substitution to period $t + n$ (n is typically set at ten years) gives the expression:

$$s_t = \sum_{j=0}^{n-1} E_t \delta_{t+j} - \sum_{j=0}^{n-1} E_t \rho_{t+j} + E_t s_{t+n} \qquad \textbf{(A3)}$$

where δ_{t+j}, the forward interest differential, equals $i_{t+j} - i_{t+j}^*$.

Now suppose that the first date in the UIP projection is t (take 18 March 1997 as an example) and the second is k periods later at $t+k$ (say 19 March 1997) where $k < n$, then the exchange rate at that point is obtained by rolling **(A3)** forward k periods:

$$s_{t+k} = \sum_{j=0}^{n-1} E_{t+k} \delta_{t+k+j} - \sum_{j=0}^{n-1} E_{t+k} \rho_{t+k+j} + E_{t+k} s_{t+k+n} \qquad \textbf{(A4)}$$

To obtain the same end-point for the projection at time t and at $t + k$, the projection in **(A3)** is truncated by k periods so that the end-point is at $t + n$ (18 March 2007):

$$s_{t+k} = \sum_{j=k}^{n-1} E_{t+k} \delta_{t+j} - \sum_{j=k}^{n-1} E_{t+k} \rho_{t+j} + E_{t+k} s_{t+n} \qquad \textbf{(A5)}$$

The UIP decomposition calculates the news between t and $t + k$, defined mathematically as: $s_{t+k} - E_t s_{t+k}$. The next step is therefore to express the expectation at time t of the exchange rate at $t + k$ (the expectation formed on 18 March 1997 for the exchange rate on 19 March 1997):

By analogy with **(A3)** it is clear that:

$$s_t = \sum_{j=0}^{k-1} E_t \delta_{t+j} - \sum_{j=0}^{k-1} E_t \rho_{t+j} + E_t s_{t+k} \qquad \textbf{(A6)}$$

And rearranging gives:

$$E_t s_{t+k} = s_t - \sum_{j=0}^{k-1} E_t \delta_{t+j} + \sum_{j=0}^{k-1} E_t \rho_{t+j} \qquad \textbf{(A7)}$$

Substituting in the expression for s_t given by **(A3)** gives:

$$E_t s_{t+k} = \sum_{j=k}^{n-1} E_t \delta_{t+j} - \sum_{j=k}^{n-1} E_t \rho_{t+j} + E_t s_{t+n} \qquad \textbf{(A8)}$$

The news from time t to time $t + k$ is then given by subtracting **(A8)** from **(A5)**:

$$\begin{aligned} s_{t+k} - E_t s_{t+k} &= \sum_{j=k}^{n-1} (E_{t+k} \delta_{t+j} - E_t \delta_{t+j}) \\ &+ (E_{t+k} s_{t+n} - E_t s_{t+n}) - \sum_{j=k}^{n-1} (E_{t+k} \rho_{t+j} - E_t \rho_{t+j}) \end{aligned} \qquad \textbf{(A9)}$$

The cumulative revision to nominal forward interest differentials is given by:

$$\sum_{j=k}^{n-1} (E_{t+k} \delta_{t+j} - E_t \delta_{t+j}) \qquad \textbf{(A10)}$$

This is reported in line 4 of Tables A, B and C, where a range is quoted as n varies from eight to twelve years.

The next step is to identify the 'monetary' component of observed news in the exchange rate at $t+k$, $s_{t+k} - E_t s_{t+k}$.

Assume that news about relative inflation performance feeds through to expectations of the long-run nominal exchange rate, but that the real exchange rate is unchanged by these changes in inflation expectations. As discussed in the third section, relative forward curve changes are decomposed into nominal and real components by assuming that near-term

(1) See, for example, Isard, P (1992), 'Uncovered Interest Parity' in the *New Palgrave Dictionary of Money and Finance*, Macmillan.
(2) All results presented in this article use the 'true' condition **(A1)** and not the log approximation **(A2)**.

changes predominately reflect real rate changes, but that the magnitude of country-specific real rate shocks falls to reach zero at some horizon $t + p$. After that point, changes in differentials reflect only changes in relative inflation rates. The central case for this cut-off point is six years, but results are also repeated with horizons ranging from four to eight years.

More precisely, the change in relative inflation expectations up to the *p*-horizon *(INF)* is defined as:

$$INF = \left(\frac{p}{2}\right)\left(E_{t+k}\,\delta_{t+k+p} - E_t\,\delta_{t+k+p}\right) \qquad \textbf{(A11)}$$

Expression **(A11)** represents the area of the triangle between the line and the axis in Panel B of Chart 3 up to the *p*-horizon (equals six years under the central case).

The change in relative real interest rates *(REAL)* is the total change in nominal interest differentials up to the *p*-horizon, minus the inflation component.

$$REAL = \sum_{j=0}^{p-1}\left(E_{t+k}\,\delta_{t+k+j} - E_t\,\delta_{t+k+j}\right) - \left(\frac{p}{2}\right)\left(E_{t+k}\,\delta_{t+k+p} - E_t\,\delta_{t+k+p}\right) \qquad \textbf{(A12)}$$

Note that **(A12)** does not sum at or beyond the *p*-horizon, since it is assumed that relative real interest rate expectations do not change at or beyond the *p*-horizon.

Expression **(A12)** represents the shaded area in Panel C of Chart 3.

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The relationship between openness and growth in the United Kingdom: a summary of the Bank of England Openness and Growth Project[1]

By James Proudman and Stephen Redding of the Bank's Structural Economic Analysis Division.

This article summarises the results of the Bank's Openness and Growth Project. The empirical findings suggest that openness is closely associated with growth in productivity both across countries and across sectors within the United Kingdom. Between 1970 and 1992, some 15% of the initial gap in productivity between the United Kingdom and the United States was closed. Of this, roughly half was attributable to the rise in international openness.

Introduction

Between 1970–90, value added per worker in the United Kingdom grew at an average annual rate of 1.9%.[2] But this aggregate figure conceals considerable variation across sectors and time. Value added per worker in services rose at an average annual rate of 0.5%, whereas in manufacturing the corresponding figure was 3.0%. From 1973–79—the peak-to-peak of the business cycle—the average annual rate of growth of value added per worker was 1.7% in manufacturing and 0.7% in services. In contrast, in the second peak-to-peak business cycle period from 1979–89, these figures rose to 3.7% and 0.8% respectively.

This differing growth was associated with considerable variation in the size of trade flows, trade barriers, foreign direct investment (FDI) and international expenditure on research and development (R&D). For example, between 1970–90, the ratio of exports to domestic output in manufacturing rose from 17.7% to 30.0%, within manufacturing, the average share of exports ranged from 5.4% in paper and printing to 79.8% in computing.[3]

The Openness and Growth Project examined how far these variations in economic growth rates related to differences in the degree of international openness, where openness is defined as the extent of impediments to international flows of goods and services, factors of production and ideas. The project resulted in a series of research papers, each of which focused on a particular aspect of the relationship. This summary paper draws together the detailed research.

The second section reviews theoretical relationship between international openness and rates of economic growth. Most of our research has been empirical, based on a detailed, disaggregated analysis of the links between openness and growth in the United Kingdom. To place this analysis in a wider context, the third section considers the relationship between openness and growth across 109 economies in the period 1970–89.

The rest of the project analyses the relationship between openness and growth at the sectoral level. The fourth section discusses the characteristics of the the United Kingdom's economic growth experience, and the fifth addresses the problem of moving from the conceptual definition of international openness to quantitative measures. Clearly, one of the main factors underlying a research project of this kind is the availability and quality of data. Where possible, we consider the relationship between rates of economic growth and international openness across the whole economy. But the quality of data for the service sector on domestic variables (such as output and the capital stock) is poor, and there is relatively little information on measures of international openness in services. So some of the detailed research has necessarily been restricted to manufacturing, where more and better data are available. Where enough data do exist, we find that the results for the whole economy are broadly similar to those for manufacturing alone.

The sixth section considers the empirical relationship between openness and growth at the sectoral level in the United Kingdom. First, we analyse the simple cross-section relationship between estimated rates of productivity growth and measures of international openness. Second, we consider a more formal econometric analysis, using a theoretical model in which an industry's productivity growth rate depends on the difference between the level of productivity and the level attained in the technologically most advanced economy. In this framework, international openness facilitates the transfer of technology from the most advanced economy. Using our econometric results, we estimate implicit long-run levels of productivity in the

(1) The Openness and Growth Project was reviewed at an academic conference held at the Bank in mid September. The conference proceedings, including the research papers and the comments of conference participants, will be published by the Bank in spring 1998. The project consists of six research papers. Details are provided in the Annex. The individual papers are available on request from the authors. One of the papers was written jointly with Marco Bianchi and three were written jointly with Gavin Cameron (Nuffield College, Oxford) whose research was funded by the ESRC. We are very grateful to them for their collaboration. Space prevents us from thanking all those from whose comments and suggestions we have benefited enormously, but we are particularly indebted to Steve Bond, Nigel Jenkinson, John Muellbauer, Danny Quah, Jon Temple and Peter Westaway for their invaluable help and advice.
(2) Source: OECD International Sectoral Database.
(3) Source: ONS Data.

United Kingdom relative to the United States, and relate changes in these levels to those in the main explanatory variables.

We conclude that though the relationship between openness and growth is complex, openness has raised the rate of productivity growth in the United Kingdom by increasing the speed of convergence with the technological leader.

Theoretical links between international openness and economic growth

The first research paper[1] surveys the theoretical literature on the relationship between international openness and economic growth. The recent literature on endogenous growth provides a useful framework.

In the long run, the rate of technological progress in an economy is endogenously determined by the profit-seeking choices of economic agents and is the prime determinant of *per capita* income growth. A range of formal econometric evidence suggests that the accumulation of physical and human capital is subject to diminishing returns: successive units of these factors of production yield ever-smaller increments in output. So even if physical and human capital accumulate at a constant rate, an economy's rate of growth of output will fall in time, in the absence of further technological progress.

But technological change can sustain long-run *per capita* growth. Technological innovation directly increases the flow of output from given stocks of physical and human capital and (by raising the marginal product of each factor of production) indirectly increases output by encouraging additional investment in physical and human capital. To assess informally the role of technological change in driving long-run growth, consider how manufacturing would proceed without electricity, the internal combustion engine and the computer.

In the endogenous growth literature, the process determining long-run growth rates is represented as either an increase in the variety or an improvement in the quality of the goods produced by an economy. The rate of output growth is determined by the rate of introduction of new designs for goods discovered in the research sector. The pace of innovation itself is a function of the amount of skilled labour employed in research and the productivity of that research.

In a world with many economies at different stages of economic development, it is also likely that technologically less advanced economies grow more rapidly by adopting technologies discovered in their more advanced counterparts.

So international openness may affect an economy's growth rate by influencing either the rate of innovation or the rate of adoption of existing technologies. Grossman and Helpman (1991), for example, examine the relationship between international openness and the rate of innovation in advanced economies. Openness will raise an economy's rate of innovation insofar as it increases the incentive to engage in R&D activities (for example, by increasing market size), raises the productivity of those activities (for example, by facilitating the diffusion of ideas among research communities) or reallocates resources between final goods sectors with different rates of innovation. Parente and Prescott (1994) consider how openness may also make it easier to adopt existing technologies in other economies and use them in final goods production, which not only increases an economy's growth rate in the medium term, but also raises its long-run level of productivity.

In this project, we consider the effect of openness in a framework that allows for levels of productivity to converge towards the technological leader, assumed throughout to be the United States.

The association between openness and growth at the international level[2]

The academic literature (Quah 1993a, 1996) provides evidence that the world is evolving into two distinct 'convergence clubs': a group of high-income, fast-growing economies and a group of low-income, slow-growing economies. In this section, we consider how far this trend in the evolution of *per capita* income is associated with international openness, where openness is defined in terms of a variety of measures of the average stance of trade policy in the period and the degree of exchange control.[3] To do so, we first use the statistical technique of discriminant analysis to sort the countries into groups of relatively open and relatively closed economies. This technique selects groups by emphasising both the similarities of the trade characteristics of the data within the same group and the differences between the representative properties of the groups.[4] We then examine how the distributions of countries' income *per capita* relative to the United States have evolved, for open and closed economies separately. In particular, we analyse how countries move within this distribution.

The results are briefly summarised in Table A, which gives estimates of the percentages of each group that would eventually converge into one of five bands of relative incomes.[5] For example, it is estimated that only just over 1% of the group of closed economies would tend towards an eventual steady-state income level of between about 50% and 100% of the US level, compared with 90% of the group of open economies.

(1) *Openness and Growth: theoretical links and empirical estimation*, by Stephen Redding (July 1996).
(2) *Is international openness associated with faster economic growth?* by James Proudman, Stephen Redding and Marco Bianchi (June 1997).
(3) These are the most informative openness variables available for such a large cross-section of countries for the sample period.
(4) Formally, we choose linear combinations of the openness variables to maximise the ratio of between-group to within-group sums of squares.
(5) These proportions are independent of the initial distribution across states.

International openness appears to be associated with convergence with a higher relative income *per capita*, even after taking into account different investment levels. But it is difficult to make the stronger claim that increased international openness causes higher growth. In particular, there may be an endogeneity problem: lower trade barriers could themselves result from membership of the high-income convergence club. We consider this endogeneity problem more fully below.

Table A
Estimated steady-state distribution for groups of open and closed economies, 108 countries, 1970–89

Group (a)	0.9%–5.9%	5.9%–11.4%	11.4%–21.2%	21.2%–47.2%	47.2%–100%
Open	0.0	0.0	0.0	10.0	90.0
Closed	38.8	24.9	18.1	16.7	1.4

(a) Boundaries of bands are income *per capita* relative to the United States (entries in percentages). The boundaries between the five bands are chosen so that the observed sample is divided into categories with an approximately equal number of observations.

UK economic growth

In this section, we look at the characteristics of economic growth in the United Kingdom.(1) The rate of output growth can be decomposed into the contributions from increased hours worked, physical capital accumulation and a residual. This residual encompasses the effect of influences on how efficiently existing quantities of capital and labour are used. It includes, for example, the influence of technology, and the extent of competition, training and unionisation. In practice, empirical evidence suggests that the residual is largely determined by technological change, and it provides a widely used empirical measure, known as Total Factor Productivity (TFP) growth, of the rate of technological progress.

The decomposition of UK output growth between 1970–90 is summarised in Table B. These results are derived from internationally comparable data provided in the OECD's International Sectoral Database, disaggregated into nine industrial sectors. Unfortunately, the accuracy of the data—particularly for service industries—is poor. For instance, the estimated negative TFP growth in financial services is difficult to reconcile with informal evidence of financial liberalisation and innovation. It seems likely that this partly reflects the difficulties of measuring service sector output and capital.

Table B
Sources of UK output growth, 1970–90 (annual percentage change)

Sector	ISIC code (a)	Output	Labour	Capital	TFP
Agriculture	1	2.07	-0.90	0.53	2.43
Mining	2	3.20	-1.13	3.02	1.31
Manufacturing	3	0.84	-1.77	0.33	2.27
Utilities	4	5.18	-0.73	0.50	5.42
Construction	5	0.74	0.30	0.42	0.03
Wholesale and retail	6	2.00	1.05	0.86	0.08
Transport	7	2.71	-0.30	0.37	2.64
Financial services	8	3.37	2.23	1.88	-0.74
Social services	9	3.98	2.25	0.86	0.87
Whole economy					
of which:	0	2.28	0.17	0.85	1.26
Government services	0	1.09	0.76	0.23	0.10

Source: OECD International Sectoral Database.

(a) International Standard Industrial Classification.

But we are able to make use of a much more detailed and accurate ONS dataset, extended by Cameron (1997). This only covers manufacturing, disaggregated into the 19 subsectors shown in Table C. We use both datasets in this paper.

Table C
Sources of output growth in UK manufacturing 1970–92: annual percentage change

Sector (abbreviation)	ISIC Code	Output	Labour	Capital	TFP
Total	3	-0.18	-2.16	0.60	1.38
Food and drink (FBT)	31	-0.23	-1.16	1.19	-0.26
Textiles (TAT)	32	-1.49	-3.13	-0.12	1.76
Timber and furniture (WPP)	33	-0.71	-1.84	0.86	0.27
Paper and printing (PPP)	34	0.88	-1.43	0.99	1.32
Minerals (NMM)	36	-2.33	-2.11	0.84	-1.06
Chemicals (CHEM)	35	1.40	-1.11	0.98	1.52
of which:					
Chemicals nes (a) (CNES)	351..354–3522	-0.31	-1.62	0.82	1.10
Pharmaceuticals (DM)	3522	4.72	-0.65	1.52	3.85
Rubber and plastics (RPP)	355+356	1.24	-1.21	0.87	1.58
Basic metals (BMI)	37	-3.60	-5.43	0.09	1.73
of which:					
Iron and steel (IS)	371	-4.20	-6.46	0.04	2.22
Non-ferrous metals (NFM)	372	-1.93	-3.40	0.27	1.20
Fabricated metals (FMP)	38	-0.01	-2.56	0.48	2.07
of which:					
Metal goods (MNES)	381	-1.01	-2.71	0.31	1.39
Machinery (NEM)	382–3825	-1.54	-2.74	0.48	0.72
Computing (OCE)	3825	7.62	-1.17	3.12	5.67
Other electrical engineering (OEE)	383–3832	-0.31	-2.63	0.63	1.68
Electronics (RTV)	3832	1.91	-2.28	1.18	3.01
Motor vehicles (MV)	3843	-1.22	-2.72	0.56	0.93
Aerospace (AERO)	3845	2.58	-1.52	-0.07	4.17
Instruments (PG)	385	2.16	-1.67	0.88	2.95
Other manufacturing (OM)	39	-1.38	-2.69	0.03	1.27

(a) Nes: not elsewhere specified.

Aggregate productivity growth can be broken down into the contributions made by productivity growth *within* individual sectors, and by transfers of factor resources *between* sectors with differing levels of productivity. This decomposition may be undertaken for either TFP or labour productivity. Table D presents this decomposition, first for the whole economy at the level of aggregation in Table B, and then at the disaggregated level within manufacturing.

Table D
Decomposition of UK productivity growth, 1970–92

Shares of total growth (per cent)		Between	Within	Total
TFP growth	Whole economy	17.1	82.9	100.0
	Manufacturing	9.2	90.8	100.0
Labour productivity growth:	Whole economy	4.4	95.6	100.0
	Manufacturing	3.0	97.0	100.0

Analysis of the productivity data suggests a number of stylised facts about the UK growth performance:

- Technological change was estimated to be the major source of output growth, both within manufacturing

(1) *Deconstructing growth in UK manufacturing*, by Gavin Cameron, James Proudman and Stephen Redding (May 1997).

and for the whole economy. Between 1970–92, manufacturing output fell (by -0.2% per year). TFP and capital accumulation both made positive contributions to output growth, with the contribution of TFP (+1.4% per year) much higher than that of capital accumulation (+0.6% per year). Labour utilisation fell sharply, accounting for the overall decline in output.

- Average growth rates of TFP (and labour productivity) varied across sectors. Within manufacturing, TFP annual growth ranged from 5.7% in computing—and was more than 3.5% in pharmaceuticals and aerospace—to negative numbers in food and minerals. The level of total factor productivity across sectors also varied considerably.

- The share of output growth accounted for by TFP growth relative to that accounted for by capital accumulation was higher during the 1980s' business cycle (1979–89) than during the 1970s' cycle (1973–79).

- The average growth rate of TFP (and labour productivity) was higher in the 1980s than in the 1970s. In manufacturing as a whole, TFP fell at an average annual rate of 1.9% between 1973–79, but rose at 3.3% per year between 1979–89.

- Most of the growth in aggregate TFP and labour productivity was generated by growth within sectors, rather than by shifts in resources from low to high productivity sectors. This is true for both manufacturing and the whole economy.

Quantifying international openness in the United Kingdom

In this section, we try to quantify the degree of international openness in terms of the size of impediments to flows of goods, factors of production and ideas. We draw upon two research papers. The first analyses changes in the UK pattern of specialisation in trade in manufactured goods;(1) the second assesses the extent of international openness and examines the partial correlation between the latter and economic growth rates.(2) Some of the analysis is restricted to manufacturing, because of the absence of comprehensive and compatible service sector data.

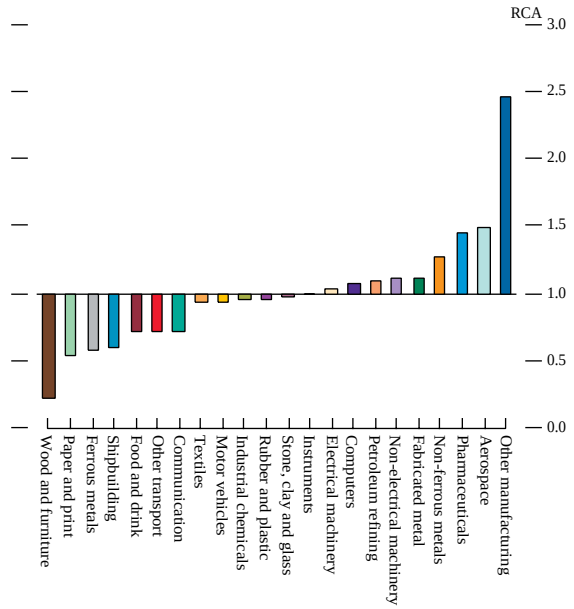
Trade in goods and services

International trade affects growth through two main channels. First, specialisation according to comparative advantage changes the allocation of resources across industrial sectors. Suppose that sectors exhibit different equilibrium rates of growth. Then an economy's aggregate rate of growth may either increase or decrease, depending on which sectors the economy specialises in as a result of changes in its comparative advantage.(3)

These changes in patterns of international trade specialisation have received relatively little attention in the empirical literature. To assess their importance in the sample period, this section examines the dynamics of international trade in manufactured goods in the United Kingdom between 1970–93.

The extent of specialisation is measured by a slightly modified version of Balassa's (1965) index of Revealed Comparative Advantage (RCA).(4) A value greater than one indicates an industry in which an economy's share of world exports exceeds its share of total world exports across all industries—in other words, an industry in which an economy specialises. Charts 1–3 show the evolution of patterns of international specialisation in the United Kingdom across industries. In Chart 1, industries are ordered in terms of increasing RCA for the period 1970–74. The same ordering is preserved in Charts 2 and 3, which show the pattern of RCA for two further five-year periods, with a gap of five years between them.

Chart 1
United Kingdom RCA(a) 1970–74



(a) Disaggregated data compiled from the OECD's Bilateral Trade Database.

If the nature of international specialisation stayed relatively constant, the pattern of RCA in Charts 2 and 3 would resemble that in Chart 1. But considerable changes in international specialisation are observed—a finding confirmed using more formal indices of mobility. The

(1) *Persistence and mobility in international trade*, by James Proudman and Stephen Redding (June 1997).
(2) *Openness and its association with productivity growth in UK manufacturing*, by Gavin Cameron, James Proudman and Stephen Redding (June 1997).
(3) Note that even if this mechanism reduces an economy's own aggregate rate of growth, economic welfare may still rise because the economy benefits (through an improvement in the terms of trade) from output growth in its trade partners. Nonetheless, it is theoretically possible (though this is unlikely to be important in the United Kingdom) for trade to have a negative effect on economic welfare through this mechanism.
(4) This index is given by an economy's export share in an industry divided by its average export share across all industries.

previous section, however, showed that transfers of resources between sectors contributed relatively little to the growth in aggregate TFP and labour productivity. Overall, the analysis suggests that changes in international specialisation have not been a channel through which international openness has substantially affected UK productivity growth in the sample period.

Chart 2
United Kingdom RCA 1980–84

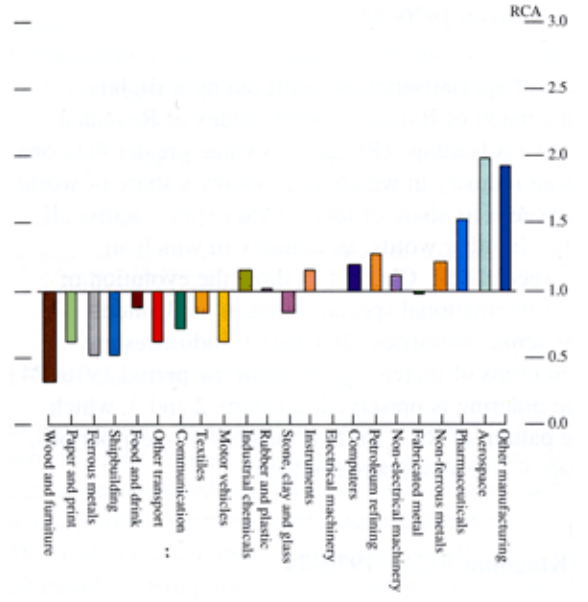
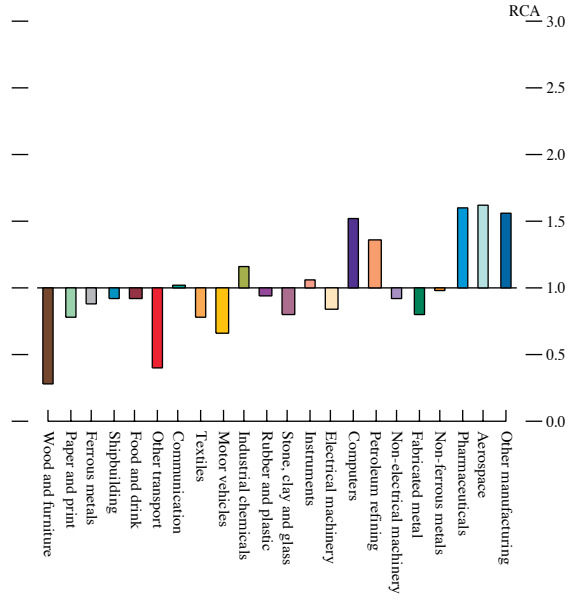


Chart 3
United Kingdom RCA 1990–93



Having discounted this channel, we consider the effects of trade within individual sectors. In this context, there are five interrelated ways in which international trade may affect rates of productivity growth. The first four would increase growth; the effect of the fifth is uncertain:

- Trade may be directly responsible for the transfer of technology between countries with differing productivity levels. That is, trade enables sectors to catch up to the productivity levels of technologically more advanced economies more quickly than otherwise. For example, trade may allow firms to 'reverse engineer' their foreign rivals' products.

- Trade may be directly responsible for the spillover of ideas, thereby generating a larger pool of knowledge to assist future innovation, raising the productivity of research and boosting long-run growth rates.

- Trade eliminates incentives for duplication in innovation. The integration of countries' product markets through openness to trade places innovators in different countries in competition with one another, giving them the incentive to pursue new ideas in the world economy. So trade tends to reduce duplication of research effort, increasing the aggregate productivity of resources employed in innovation.

- Trade increases the market size available to successful researchers, increasing the incentive to engage in research.

- Trade enhances the intensity of product market competition. Increased competition reduces the equilibrium profits to be derived from successful research, which in turn may either increase or decrease the incentive to engage in research.(1)

In practice, it seems plausible that the effects of trade on growth will be largely positive. Before estimating the strength of this link, we examine the time-series and cross-section behaviour of two quantitative measures of openness to trade at the sectoral level (the exports/output ratio and imports/domestic sales ratio).

A well-known problem with all possible measures of openness is their potential endogeneity. To help mitigate the effects of the simultaneity problem in our empirical analysis, we use a number of econometric techniques—in particular, instrumental variables and lagged values of openness measures—and try to show that our results are generally robust.

The exports/output and imports/domestic sales ratios in selected manufacturing sectors are shown in Charts 4–7, and in selected non-manufacturing sectors in Charts 8–9. In almost all manufacturing sectors, both measures increase significantly in the sample period. Non-manufacturing sectors also display high rates of growth, particularly for the exports/output ratio. But the rates of change of openness vary considerably between sectors.

The flow of capital

Another measure of openness that may affect rates of productivity growth is foreign direct investment (FDI).

(1) See for example, Grossman and Helpman (1991), Aghion, Dewatripont and Rey (1996) and Aghion, Harris and Vickers (1996).

Chart 4
Exports/output ratio for selected manufacturing sectors with above-average export and import ratios

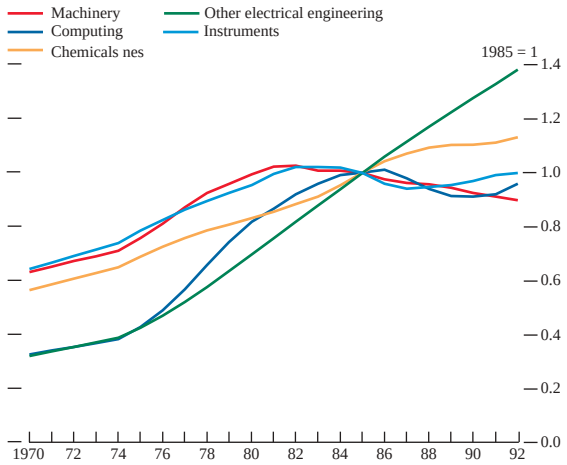


Chart 5
Exports/output ratio for selected manufacturing sectors with below-average export and import ratios

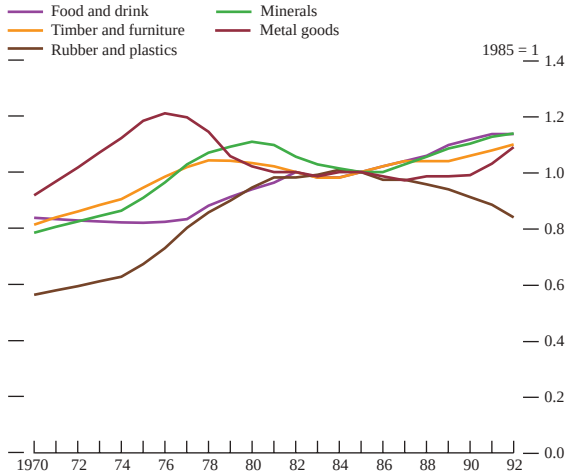


Chart 6
Imports/sales ratio for selected manufacturing sectors with above-average export and import ratios

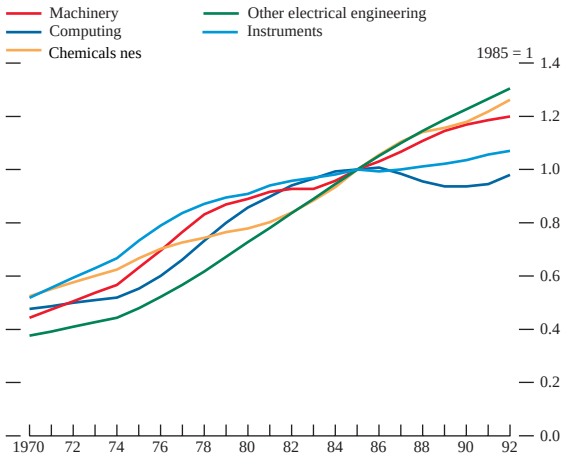


Chart 7
Imports/sales ratio for selected manufacturing sectors with below-average export and import ratios

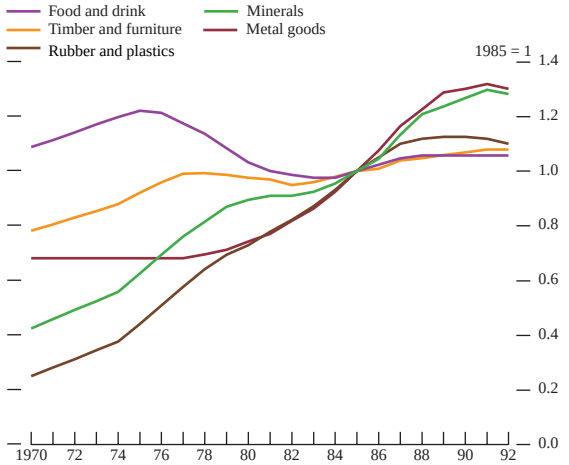


Chart 8
Exports/output ratio for selected non-manufacturing sectors

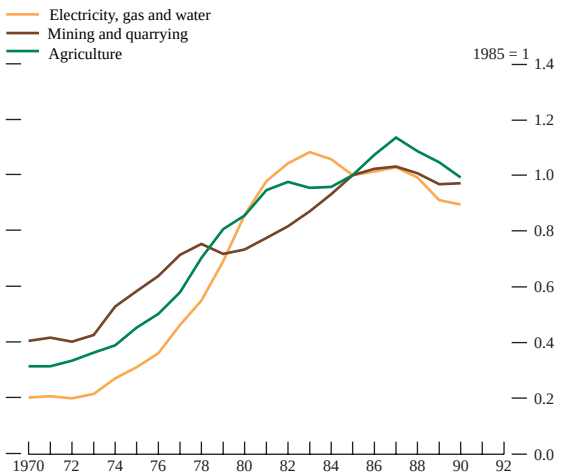
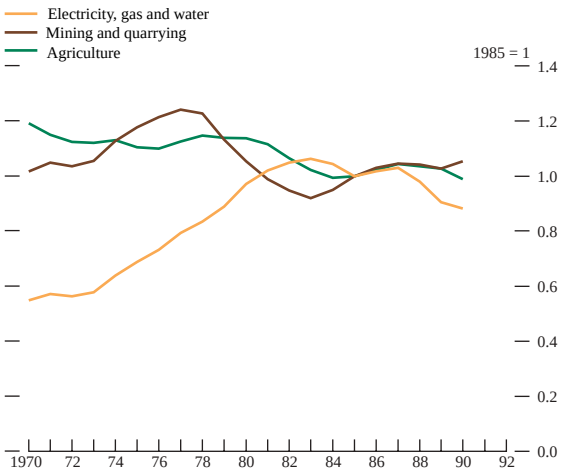


Chart 9
Imports/sales ratio for selected non-manufacturing sectors



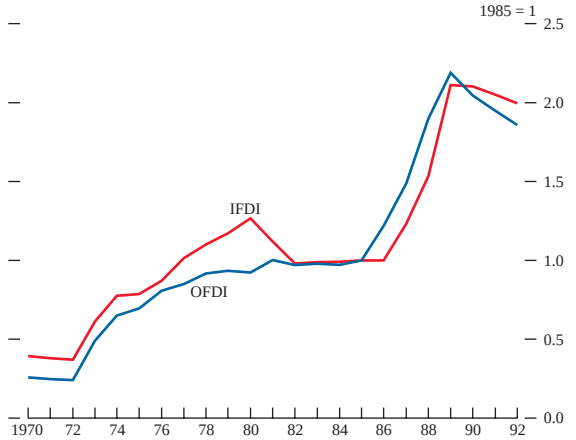
Inward FDI may be a determinant of TFP growth because it facilitates the transfer of technology into the United Kingdom from abroad. FDI allows foreign firms to exploit superior technology when they are unable to do so from, for example, the international licensing of patents. This may occur both because the technology is somehow specific to the production processes of the individual firm, and because potential purchasers of the patent are, by definition, unable to obtain full information on its value. At the same time, FDI may result in positive externalities to the host economy, in the form of spillovers of technology or better business organisation. For example, the introduction of superior technology or production processes can be emulated by other firms and spread by workers who may transfer their skills elsewhere.

Outward FDI may also be an important factor in determining domestic productivity growth rates. For example, outward FDI may act as a means of appropriating foreign technology. Through FDI in a more advanced economy, the investor may acquire information on superior technology in companies or skills possessed by the foreign labour force.

Before examining the strength of this relationship between FDI and productivity growth in Section 6, we therefore also constructed disaggregated measures of inward and outward FDI stocks. To construct FDI stocks, we cumulated ONS data on real FDI flows, imposing a common rate of depreciation and imputing an initial value of the stock in each sector.(1)

An estimate of the stock of inward FDI in manufacturing—expressed as a ratio to the domestic capital stock—is shown in Chart 10. The stock of inward FDI rose during the period in most manufacturing and non-manufacturing sectors, with a particularly pronounced increase in the second half of the 1980s. The estimated stock of outward FDI in manufacturing is also shown in Chart 10. As for inward FDI, there was an increase in the period, with a particularly marked rise in the late 1980s.

Chart 10
Inward and outward FDI stocks/total domestic capital stock ratio in UK manufacturing



The international spillover of ideas

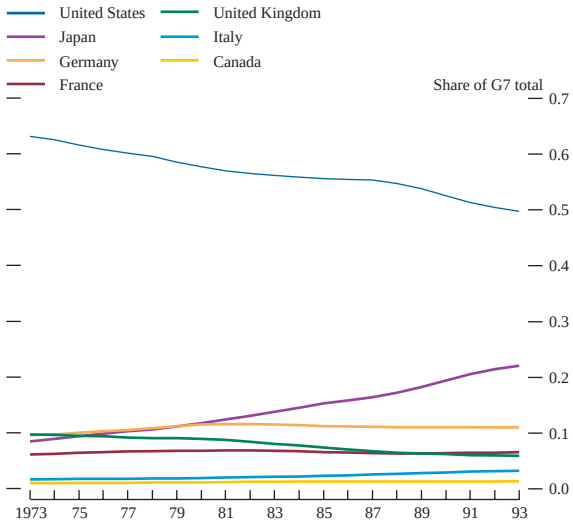
A domestic economy's rate of growth may also be affected by spillovers of ideas from other economies. These may occur directly or through flows of goods and services and FDI.

Spillovers of ideas across economies may be proxied using expenditure on R&D, as in Coe and Helpman (1995). There is well-documented evidence at the sectoral and firm level that firms' own expenditure on R&D and that of their near rivals are both significantly correlated with productivity.(2) There is also evidence at the economy-wide level that foreign R&D affects domestic productivity (though the spillovers are generally found to be far from complete). For example, Coe and Helpman (1995) estimate that the elasticity of UK TFP with respect to foreign R&D stocks was between 0.06% and 0.08% between 1970–90.(3)

R&D stocks for manufacturing enterprises in the OECD have been derived from the OECD's ANBERD(4) database (see Chart 11). Preliminary analysis suggests that:

- By the end of the period, nearly 75% of the OECD's R&D expenditure in manufacturing was undertaken in the United States and Japan, the two countries one would expect to be most technologically advanced and for whom technology transfer is least likely to be a major source of growth. The UK share amounts to some 6%.
- The growth rate of aggregate R&D in UK manufacturing has been slower than in its G7 partners.

Chart 11
Shares of total R&D stocks in G7 manufacturing



(1) More specifically, we employ the same method as that used by Coe and Helpman (1995), among others, to construct R&D stocks.
(2) For a survey of this literature, see Cameron (1996).
(3) This is considerably lower than most estimates of the elasticity of TFP in the United Kingdom with respect to domestic R&D stocks [Cameron (1996)], though Coe and Helpman (1995) do not report their estimate for the latter.
(4) Analytical Business Enterprise Research and Development.

During the period, R&D stocks of UK manufacturing enterprises were overtaken by Japan, Germany and France.

Simple measures of foreign R&D stocks are unlikely on their own to be good proxies for the extent of knowledge spillovers. International knowledge is likely to flow between countries in proportion to the amount of contact between them, particularly resulting from trade, foreign investment and the flow of technological licences, but the precise mechanisms by which ideas flow across national borders are not well understood. In our empirical analysis, three alternative approaches to weighting R&D stocks were considered: import-weighted, inward FDI-weighted and outward FDI-weighted.(1) But the correlation between these measures is high and it is hard to distinguish between them: Section 6 reports the results for the import-weighted R&D stock.

An empirical analysis of the links between openness and growth

The earlier discussion suggested that international openness can affect growth in a number of ways and that quantifying the overall effect is not straightforward. Most channels imply a positive link, though one is ambiguous. In practice, as will be seen below, there is considerable empirical evidence that the net effect in the United Kingdom is positive.

A number of other factors are also likely to affect the rate of economic growth. For example, domestic rates of research and development, educational standards, the degree of unionisation and changes in capacity utilisation are frequently cited as important determinants of rates of productivity growth.(2) Because of this complexity, we take a two-stage approach to analysing the relationship between openness and growth. We begin by simply analysing partial correlations, which provide important stylised facts about the association between openness and growth.(3)

Having shown that there is a clear association, we move on to a more formal econometric analysis.(4) This draws on a theoretical model in which productivity in an industry may grow as a result of either innovation or technical transfer from the technologically most advanced economy. The difference between the initial level of productivity and that in the most advanced economy becomes an important determinant of rates of productivity growth. We therefore discuss the behaviour of TFP in UK manufacturing sectors relative to this standard, proxied throughout by the United States. International openness may affect either rates of innovation or rates of technological transfer, and we investigate the relative importance of these two channels with a variety of different measures of international openness. We also take into account the impact of the other potentially significant determinants of productivity growth cited above. Having estimated the econometric model, we briefly consider the effect of openness on the levels of long-run relative productivity and compare it with the effects of the other major explanatory variables.

The association between openness and growth

One problem in evaluating the relationship between openness and growth is that there are many different measures of international openness. We begin by trying to combine the information contained in the different measures to classify sectors as either relatively open or relatively closed. Drawing again on the technique of discriminant analysis, groups were selected that emphasise both the similarities of the openness characteristics of the sectors within the same group and the differences between the representative properties of the groups.

UK manufacturing sectors were divided into 'relatively open' and 'relatively closed' groups on the basis of five measures of openness: imports/sales (*M/S*), exports/output (*X/Y*), inward FDI flows/output (*IFDI/Y*), outward FDI flows/output (*OFDI/Y*) and trade-weighted foreign R&D stocks/output (*TWRD/Y*). Values of these variables in 1970 were chosen to try to address the endogeneity problem. The results are presented in Tables E and F.

Table E
Average growth characteristics for manufacturing industries classified as relatively closed using openness measures in 1970

Industry	*M/S*	*X/Y*	*IFDI/Y*	*OFDI/Y*	*TWRD/Y*	*ΔTFP*
Textiles	0.21	0.16	0.001	0.000	0.03	1.76
Timber and furniture	0.08	0.16	0.000	0.000	0.09	0.27
Minerals	0.11	0.06	0.000	0.000	0.06	-1.06
Iron and steel	0.12	0.07	0.000	0.019	0.08	2.22
Non-ferrous metals	0.21	0.37	0.000	0.057	0.19	1.20
Average closed	**0.15**	**0.16**	**0.000**	**0.015**	**0.09**	**0.88**

Table F
Average growth characteristics for manufacturing industries classified as relatively open using openness measures in 1970

Industry	*M/S*	*X/Y*	*IFDI/Y*	*OFDI/Y*	*TWRD/Y*	*ΔTFP*
Food and drink	0.09	0.19	0.014	0.037	0.02	-0.26
Paper and printing	0.03	0.23	0.003	0.008	0.03	1.32
Chemicals nes (a)	0.24	0.19	0.041	0.049	0.59	1.10
Pharmaceuticals	0.31	0.11	0.188	0.225	1.25	3.85
Rubber and plastics	0.13	0.06	0.019	0.000	0.20	1.58
Metal goods	0.12	0.09	0.016	0.031	0.09	1.39
Machinery	0.28	0.15	0.007	0.015	0.17	0.72
Computing	0.34	0.49	0.324	0.198	8.76	5.67
Other electrical engineering	0.19	0.24	0.066	0.041	2.56	1.68
Electronics	0.18	0.08	0.072	0.044	2.04	3.01
Motor vehicles	0.28	0.07	0.025	0.005	0.50	0.93
Aerospace	0.27	0.22	0.054	0.010	15.97	4.17
Instruments	0.35	0.29	0.285	0.174	2.75	2.95
Other manufacturing	0.32	0.19	0.076	0.245	0.86	1.27
Average open	**0.22**	**0.19**	**0.085**	**0.077**	**2.56**	**2.10**

(a) Nes: not elsewhere specified.

(1) The Coe and Helpman (1995) method was used. For a critique of weighting foreign R&D stocks by trade shares, see Keller (1996).
(2) For a theoretical model in which R&D expenditures are an important determinant of growth, see Aghion and Howitt (1992). Benhabib and Spiegel (1994) emphasise human capital, and Ulph and Ulph (1994) consider the role of unionisation.
(3) *Openness and its association with productivity growth in UK manufacturing*, by Gavin Cameron, James Proudman and Stephen Redding (June 1997).
(4) *Productivity convergence and international openness* by Gavin Cameron, James Proudman and Stephen Redding (August 1997).

The average values of the openness measures are considerably higher for the group of 'relatively open' sectors than for the group of 'relatively closed'. At the same time, average annual productivity growth for the group of open sectors is 2.1% compared with 0.9% for the closed sectors, suggesting a striking degree of association between openness and rates of growth of TFP.(1) There is also a positive association between openness and levels of productivity.

Though discriminant analysis offers a simple way of illustrating that relatively open sectors tend to experience faster rates of productivity growth, it does not allow for differences in the degree of openness between members of the same group. Linear regression allows this restriction to be relaxed. In the next step of the analysis, we separately regress the average annual rate of growth in labour productivity, the rate of growth of TFP and the contribution to labour productivity growth from increases in the capital/labour ratio between 1970–92 against the 1970 value of each measure of openness.(2)

These cross-section regressions indicate that within manufacturing, the ratios of inward FDI to output (*IFDI/Y*), outward FDI to output (*OFDI/Y*) and trade-weighted R&D stocks to output (*TWRD/Y*) are positively and significantly correlated with labour productivity growth. All of these measures, and the exports to output ratio (*X/Y*) are significantly correlated with the rate of TFP growth. But none of the measures of openness is significantly correlated with that part of labour productivity growth explained by increases in the capital/labour ratio. This is consistent with the hypothesis that openness affects growth through rates of technical change, rather than through capital accumulation.

To address the endogeneity problem at least partly, the results reported in Table G are coefficients derived using 1970 values of openness. These results are in fact fairly robust to alternative specifications: for example, similar results were derived using an instrumental variables technique. The estimates are also robust to the exclusion of extreme values.

Table G also presents estimates for the whole economy as memo items. These were derived by extending the sample of 19 manufacturing sectors to include the eight non-manufacturing sectors listed in Table B. Estimation is undertaken using trade and foreign direct investment ratios only, since no consistent data on foreign R&D expenditures are available. The same general finding emerges: measures of openness are positively and significantly associated with rates of growth of TFP and labour productivity, but not with rates of growth of the capital/labour ratio.

Table G
Cross-section regressions of average TFP growth (1970–92) against initial (1970) measures of openness (standard errors in brackets)

Openness measures (logs)	β (labour productivity)	β (capital/labour	β (TFP)
Exports/output (*X/Y*) (c)	0.0109 (0.007)	0.0010 (0.003)	0.0112 (a) (0.005)
Imports/sales (*M/S*) (c)	0.0069 (0.007)	0.0025 (0.003)	0.0094 (0.006)
Inward FDI flows/output (*IFDI/Y*) (d)	0.0026 (a) (0.001)	0.0004 (0.001)	0.0023 (a) (0.001)
Outward FDI flows/output (*OFDI/Y*) (d)	0.0022 (b) (0.001)	0.0005 (0.001)	0.002 (a) (0.001)
Import-weighted R&D/output (e) (*TWRD/Y*)	0.0059 (a) (0.002)	0.0004 (0.001)	0.0056 (a) (0.001)
memo items: whole-economy data			
Exports/output	0.0139 (a) (0.0052)	0.0028 (0.0019)	0.0069 (a) (0.0033)
Imports/sales	0.0137 (a) (0.0036)	0.0013 (0.0015)	0.0081 (a) (0.0026)
Inward FDI flows/output (*IFDI/Y*)	0.0031 (b) (0.0017)	0.0008 (0.0006)	0.0024 (a) (0.0012)
Outward FDI flows/output (*OFDI/Y*)	0.0033 (b) (0.0019)	0.0008 (0.0007)	0.0025 (a) (0.0012)

(a) Indicates significance at the 95% level.
(b) Indicates significance at the 90% level.
(c) Flow of goods.
(d) Flow of capital.
(e) Flow of ideas.

Productivity convergence and international openness

The empirical results presented in the previous section provide evidence that openness is associated with growth across sectors: sectors that were relatively open in 1970 tended to have higher rates of productivity growth between 1970–92. But this association reflects a partial correlation. This cannot be interpreted as a structural relationship, since no allowance has been made for interactions with and between other economic variables. In this section, we therefore move on to consider the effect of openness on growth in a more formal econometric framework, derived from an underlying theoretical model.(3) As discussed in the second section, one of the most important ways in which international openness may affect rates of economic growth is by facilitating technological transfer from a more technologically advanced economy. Based on a theoretical model of the determinants of productivity growth, in which international openness may affect the rate of technological transfer or the rate of innovation, a simple mathematical expression for the rate of growth of TFP in each manufacturing sector can be derived:

$$\Delta \ln(A_t) = \gamma + \lambda . \ln\left(\frac{A^{US}_{t-1}}{A_{t-1}}\right) \qquad \textbf{(1)}$$

where λ and γ are both functions of openness, human capital, R&D etc. A_t and $\Delta\ln(A_t)$ denote the level and rate of growth of productivity respectively in the relevant sector in the United Kingdom, and A^{US}_t denotes the level of productivity in the United States. The subscript (t) corresponds to time.

(1) Assuming the two samples are drawn from two normally distributed populations with the same variance, we can reject the null hypothesis that the TFP growth rates are the same in each population at the 90% level.
(2) We make use of the fact that the rate of growth of labour productivity may be decomposed into the rate of growth of TFP and the capital share times the rate of growth of the capital/labour ratio.
(3) *Productivity convergence and international openness*, by Gavin Cameron, James Proudman and Stephen Redding (August 1997).

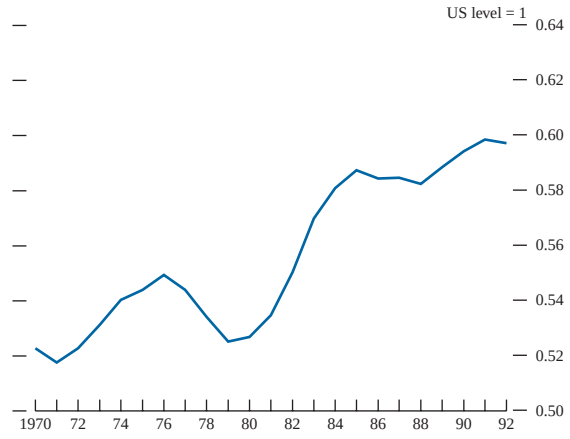
Equation **(1)** states that the rate of growth of UK productivity depends on two terms. The first term (γ) captures the effect of various economic variables (such as domestic R&D intensity and human capital) on the rate of innovation, and the second implies that, other things being equal, a sector's rate of productivity growth will be higher as the gap between UK and US productivity increases. The parameter (λ) determines the rate at which productivity in the United Kingdom catches up with that in the United States. This parameter is allowed to be a function both of the level of openness in each sector and of other economic factors that may affect the rate of convergence.

One of the most important features of the model of technology transfer is the level of productivity relative to the technological leader. But to measure relative productivity, one must first convert values of output and physical capital into a common currency. So in principle, the exchange rate is central to relative productivity measurement.

Conceptually, the appropriate exchange rate is the purchasing power parity (PPP) exchange rate, which represents the number of dollars required to buy the same quantity of goods that can be purchased with one pound sterling. But since relative prices may vary significantly across different industries, it would be misleading to use a single, economy-wide PPP. The approach taken is to use the industry-specific PPPs presented in Van Ark (1992), derived from unit value ratios(1) for a variety of individual products within each manufacturing sector. Though we favour the unit value approach, we have tested the sensitivity of our data by replicating our estimates of relative productivity using four other sets of disaggregated PPPs.(2) The evolution of relative TFP over time was generally robust to the choice of PPP.

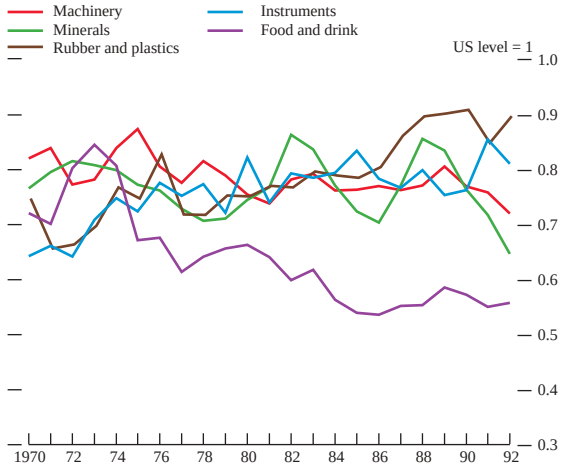
Charts 12–15 plot the evolution of TFP in the United Kingdom relative to the United States for total manufacturing and the disaggregated manufacturing subsectors.(3) Two features stand out fairly clearly. First, UK TFP rose towards US levels in the period from 1970–92. TFP in aggregate UK manufacturing rose from around 52% of the US level to roughly 60%, implying a closing of roughly 15% of the productivity gap with the United States in the 22-year period. How fast the productivity gap was closed varied during the sample period (see Chart 12). At the end of the 1973–79 peak-to-peak business cycle, there was very little change in UK relative productivity from its 1973 level. In contrast, in the 1979–89 business cycle, UK relative productivity rose from about 53% of the US level to about 58%. This improvement is consistent with the earlier evidence showing a rise in the United Kingdom's domestic rate of TFP growth.

Chart 12
The evolution of TFP in aggregate UK manufacturing relative to the United States(a)



(a) Five-year moving average.

Chart 13
The evolution of relative TFP in the five UK manufacturing sectors with the *highest* initial level of TFP



Second, the rate at which relative productivity catches up with US levels is on average higher in sectors with low initial levels of relative productivity. This is shown in Charts 13–15, where we compare the evolution of relative TFP for each of the disaggregated manufacturing sectors, grouping sectors by the initial levels of UK productivity relative to that of the United States. This evidence is confirmed by a cross-section regression of average annual rates of growth of relative TFP between 1970–92 against 1970 levels of relative TFP. The estimated coefficient on the initial level of TFP is negative and statistically significant: the rate of productivity catch-up across sectors was inversely related to the initial level of relative productivity.(4) The estimated coefficients are shown in Table H.

(1) A unit value ratio is simply the ratio of producers' sales values to the corresponding quantities.
(2) The four alternative sets were: the OECD whole-economy PPP; disaggregated PPPs taken from Pilat (1996); disaggregated OECD estimates derived from the UN International Comparisons Project [ICP see Kravis, Heston and Summers (1978)]; and our own estimates derived from the UN ICP.
(3) To obtain data in the same industrial classification in the United States and the United Kingdom, we have had to aggregate data into 14 manufacturing sectors.
(4) In terms of the cross-country convergence literature, relative productivity exhibits absolute β-convergence. Note that the fact that the rates of growth of relative TFP are negatively correlated with the initial level (β convergence) does not necessarily imply that the dispersion of relative TFP levels across sectors is declining over time (σ convergence). To suppose so is to fall foul of Galton's fallacy (see Quah (1993b)).

Chart 14
The evolution of relative TFP in the five UK manufacturing sectors with the *intermediate* initial level of TFP

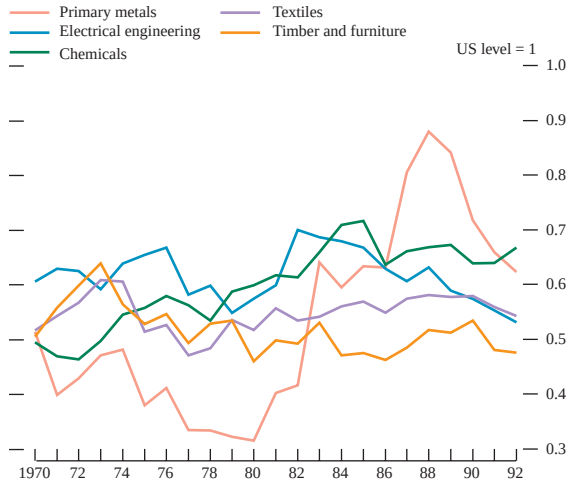


Chart 15
The evolution of relative TFP in the four UK manufacturing sectors with the *lowest* initial level of TFP

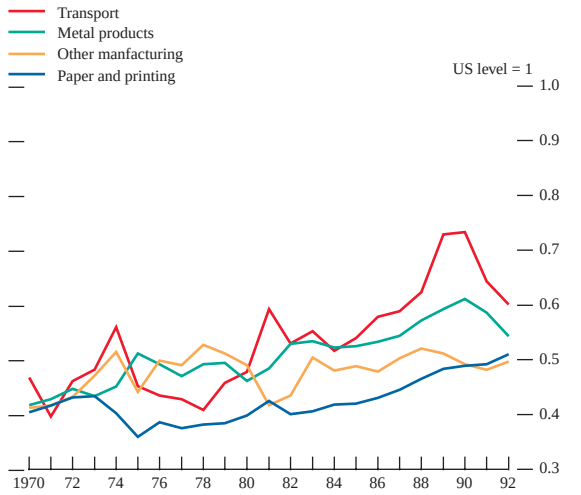


Table H
Cross-section regression of average relative TFP growth (1970–92) on 1970 values of relative TFP (standard errors in brackets)

Dependent variable:	Average annual relative TFP growth
Constant	-0.0098 (a) (0.0049)
Initial relative TFP	-0.0232 (a) (0.0078)

(a) Indicates significance at the 95% level.

Having analysed movements in relative TFP during the sample period, we model econometrically the role of the productivity gap between the United States and United Kingdom in determining the growth of UK TFP.

In our estimation, we wish to allow the rate of growth of TFP in a sector to be a function of a number of variables that, in addition to openness, we believe may affect either the rate of innovation (γ) or the rate of technological transfer (λ). These variables include the intensity of commercially funded R&D, levels of human capital, the degree of trade unionisation, changes in capacity utilisation, and the ratio of input to output prices, which may distort the estimation of TFP. Not only does this approach permit a more general specification of growth, but it also allows us to explore the robustness of the association between productivity growth and openness to the inclusion of other economic variables.

We capture the impact of economic variables, including openness, on the rate of technology transfer econometrically by including more than one productivity gap term. One is simply the size of the productivity gap: the level of US TFP relative to that of the United Kingdom. The others are the size of the productivity gap multiplied by the level of variables—including international openness—that may influence the rate of technology transfer.(1) A positive coefficient for the first term implies that the sectors with low initial levels of UK TFP relative to the United States grow more rapidly; a positive coefficient for the openness interaction term implies that more open sectors converge more rapidly with the technological leader for a given size of the technological gap.

Our data set includes time-series and cross-section dimensions, with a total of about 300 observations. The technique of fixed-effects panel estimation was used to estimate the model. This pools observations across sectors and time, but allows for differences between sectors by estimating separate constant terms for each. Within this framework, the model was estimated using least squares.(2) The precise specification of the model—reported in Table I—was arrived at by initially including a large number of variables that we believed might be important, and then dropping those that were insignificant. The most notable variable that we were able to drop was the degree of trade unionisation.

Reflecting the variety of measures of openness corresponding to the flow of goods, ideas and capital, the system was estimated separately for each measure in an otherwise identical regression. In Table I, we report the regression results for the export and the import ratios. Identical regressions were run—but are not reported here—measuring openness as the inward and outward FDI ratios and as the trade-weighted R&D stock ratio.

We find that the coefficient of the openness interaction term ('ln(openness) interaction (-1)') is correctly signed and significant at the 95% level when estimated using the export ratio and the import ratio. The term is also correctly signed when openness is measured using the trade-weighted R&D

(1) Formally, the terms are $\ln(A^{US}_{t-1}/A_{t-1})$ and $\ln(openness)_{t-1}\ln(A^{US}_{t-1}/A_{t-1})$.
(2) Least squares can potentially generate inconsistent estimated coefficients within a fixed effects panel. To test for the extent of this potential problem, we re-estimated the system using an instrumental variables approach. The instrumental variables estimates differed little from their OLS counterparts. We also tested for the sensitivity of the results to extreme values. Again, this made little difference to the results.

Table I
Fixed effects panel data least squares estimation[a] (dependent variable: UK TFP growth)
Sample period, 1970–92. Total panel observations 294.

Dependent variable: UK TFP growth	Coefficient number	Export/output		Import/sales	
		Coefficient	Standard error	Coefficient	Standard error
ln (openness interaction (-1))	(α_1)	0.0780 (b)	0.0347	0.0394 (b)	0.0198
ln (gap(-1))	(α_2)	0.2178 (b)	0.0376	0.2025 (b)	0.0357
ln (R&D intensity (-1))	(α_3)	0.0350 (b)	0.0142	0.0352 (b)	0.0142
ln (human capital interaction (-1))	(α_4)	0.0899 (b)	0.0389	0.0788 (c)	0.0413
Δln (capacity utilisation (-1))	(α_5)	-0.0904 (b)	0.0139	-0.0908 (b)	0.0139
ln (input/output prices (-1))	(α_6)	-0.0901 (b)	0.0349	-0.0942 (b)	0.0356
Fixed effects:	($\alpha_{i,0}$)				
Food and drink		0.1024		0.0778	
Textiles		0.0935		0.0877	
Timber and furniture		0.1774		0.0970	
Paper and printing		0.1051		0.0497	
Minerals		0.1236		0.1212	
Chemicals		-0.0204		-0.0041	
Rubber and plastics		0.1441		0.1423	
Primary metals		0.0347		0.0316	
Metal products		0.0839		0.0902	
Machinery		0.0609		0.0721	
Electrical engineering		-0.0197		-0.0139	
Transport		-0.0560		-0.0334	
Instruments		0.0378		0.0536	
Other manufacturing		-0.0908		-0.0443	
R-squared		0.2619		0.2591	
Adjusted R-squared		0.2132		0.2102	
S E of regression		0.0630		0.0631	
Log likelihood		724.3306		727.8821	
Durbin-Watson stat		2.0530		2.0559	
Mean dependent variable		0.0131		0.0131	
S D dependent variable		0.0710		0.0710	
Sum squared residual		1.1437		1.1481	
F-statistic		20.4346		20.1392	
Prob (F statistic)		0.0000		0.0000	

Note: Differences between US and UK industrial classifications mean that we can only disaggregate relative TFP into 14 sectors rather than the original 19.

(a) Estimated equation:

$$\dot{A}_{i,t} = \alpha_{i,0} + \alpha_1 . \ln\left(\Omega_{i,t-1}\right) . \ln\left(A^{US}_{i,t-1} / A_{i,t-1}\right) + \alpha_2 . \ln\left(A^{US}_{i,t-1} / A_{i,t-1}\right) + \alpha_3 . \ln\left(R_{i,t-1}\right) + \alpha_4 . \ln\left(H_{i,t-1}\right) . \ln\left(A^{US}_{i,t-1} / A_{i,t-1}\right) + \alpha_5 . \Delta \ln\left(C_{i,t-1}\right) + \alpha_6 . \ln\left(IO_{i,t-1}\right) + \xi_{i,t}$$

(b) Denotes significance at the 95% level.
(c) Denotes significance at the 90% level. (-1) denotes variables lagged by one period.

ratio. These results suggest that trade in goods and the flow of ideas are channels through which technology transfer occurs. But the coefficient on the openness interaction term is incorrectly signed and insignificant when estimated using either the inward or the outward FDI ratio. This suggests that though FDI is positively correlated with TFP growth across sectors, this correlation does not persist when the size of the technology gap in a sector and a number of other determinants of economic growth are also taken into account.

Turning to the other variables in the model, the coefficient of the productivity gap term (‘ln(gap_t(-1)) is significant and correctly signed, consistent with the technological transfer theory. Domestic R&D intensity is also significant and our measure of human capital (given by the ratio of workers with high and medium qualifications to workers with low qualifications) is positive and significant when combined with the productivity gap (hence implying that higher levels of human capital accelerate the speed of technology transfer). We also find that the change in capacity utilisation is a significant influence on TFP growth.

The model of technology transfer described in equation **(1)** and estimated in Table I implicitly incorporates a long-run steady-state level of productivity in each sector relative to that of the United States. By definition, the growth rate of TFP in the United Kingdom will equal that in the United States in the steady state. So by setting the growth rate of TFP in the United Kingdom—the left-hand side of equation **(1)**—equal to the estimated long-run rate of growth of TFP in the corresponding US sector, we can derive an expression for the steady-state—or long-run—level of productivity in the United Kingdom relative to that of the United States.[1] Rearranging equation **(1)** and denoting steady-state values with a star yields the following expression:

$$\ln\left(\frac{A}{A^{US}}\right)^{*} = \frac{\gamma - \Delta \ln\left(A^{US*}\right)}{\lambda(openness)} \qquad \textbf{(2)}$$

It follows that in the long run, the level of relative productivity tends to a constant that is determined by the rate of catch-up, the level of openness and the levels of the other significant explanatory variables (domestic R&D intensity, human capital and the input/output price ratio). Openness accelerates the rate of productivity growth in the transition to the steady state (through the rate of convergence) and increases the long-run steady-state level of relative productivity.[2]

(1) We proxy the long-run rate of growth of TFP in the United States in each sector by the sample average annual growth rate of TFP.
(2) We do not attempt in this model to determine the long-run world growth rate. But it is consistent both with the theoretical literature in the second section and with the empirical framework outlined here for the long-run joint growth rate to be affected by changes in the degree of openness in the international economy.

We can use the estimated coefficients from Table I to make inferences about changes in the steady-state level of relative productivity. The implicit steady states in 1970 and 1990 are presented in Table J, using coefficients estimated using the import ratio. Taking the average of the 14 sectors, the steady-state level of productivity in UK manufacturing rose from roughly 58% of US levels in 1970 to some 69% in 1990.

Table J
Actual and steady-state levels of UK TFP relative to those in the United States at the start and end of the sample period (1970–90)

Steady-state levels derived from coefficients estimated using imports/sales ratios

	Relative TFP in 1970		Relative TFP in 1990	
Sector	Actual	Steady-state	Actual	Steady-state
Food and drink	0.7210 (a)	0.5527	0.5725	0.6743
Textiles	0.5171 (a)	0.5755	0.5801	0.5827
Timber and furniture	0.5054	0.5555	0.5349	0.5757
Paper and printing	0.4041	0.4537	0.4891	0.5298
Minerals	0.7654 (a)	0.7172	0.7629	0.8257
Chemicals	0.4951	0.5734	0.6397	0.7846
Rubber and plastics	0.7475	0.8192	0.9082	0.9212
Primary metals	0.5146	0.5381	0.7177 (a)	0.6693
Metal products	0.4172	0.5169	0.6107	0.7052
Machinery	0.8202 (a)	0.7240	0.7688	0.8595
Electrical engineering	0.6057 (a)	0.5166	0.5742	0.7010
Transport	0.4672 (a)	0.4626	0.7335 (a)	0.6633
Instruments	0.6431	0.8137	0.7620	0.7839
Other manufacturing	0.4119	0.4336	0.4914	0.5722

(a) Denotes a sector in which actual relative TFP exceeds estimated steady-state relative TFP.

This average conceals variations across sectors. But it is clear from the estimates that the steady-state level of relative TFP increased considerably across almost all sectors in the period. In only one sector (Instruments) did the steady-state level fall.

An important issue to explore is which factors contributed to the rise in steady-state relative productivity during the period. The contribution of each factor may be approximated by simulating the steady state using 1990 values of each explanatory variable in turn, holding all others constant at their 1970 level. This calculation indicates that some 51% of the rise in the steady-state level of productivity in the period was related to the increase in openness (as measured by the import ratio). 55% of the increase was linked to the increase in human capital. Changes in R&D intensity in UK manufacturing reduced the steady-state level of productivity by 17%, and the fall in the ratio of input to output prices made a small positive contribution.

Summary

The Openness and Growth Project examined how far variations in rates of UK economic growth across time and sectors are related to differences in the degree of international openness. Three main channels were identified through which openness may affect growth: international trade in goods and services, international movements in factors of production and the international spillover of ideas. Given these three dimensions to international openness, quantifying its overall effect on rates of productivity growth is not at all straightforward.

An important part of the project has been to compile and estimate accurate measures of productivity and openness at a disaggregated level. Two particular data issues stand out. First, there are problems associated with the potential endogeneity of measures of openness. We have used a variety of econometric procedures to deal with this, and have shown that our results are robust to the use of alternative techniques. Second, problems of data availability and quality have necessarily restricted parts of our analysis to the manufacturing sector, where there are more and better data. Nonetheless, we have replicated our results with data for the whole economy wherever possible.

The recent theoretical literature provides two main mechanisms through which it is likely that openness may affect growth. International openness may affect either the rate of innovation or the rate of adoption of technologies from more advanced countries, thereby increasing an economy's rate of total factor productivity growth.

In summary, the main empirical findings of our research are:

- There is a clear association between openness and growth in *per capita* income across a large number of developed and developing countries.

- At the sectoral level in the United Kingdom, average rates of labour productivity growth across sectors are positively correlated with a number of measures of international openness. Labour productivity growth may itself be decomposed into changes in technical efficiency, as measured by Total Factor Productivity (TFP) growth, and the contribution of increases in the capital/labour ratio. TFP growth exhibits a statistically significant and positive correlation with international openness; that part of productivity growth explained by capital accumulation exhibits a low and statistically insignificant degree of correlation with openness.

- Using the statistical technique of discriminant analysis to classify sectors as relatively open and relatively closed, fourteen UK manufacturing sectors were found to be relatively open and five relatively closed. Open sectors exhibited higher average rates of TFP growth than closed ones.

- Between 1970–92, the pattern of specialisation in trade in UK manufactured goods underwent substantial change. In principle, changes in the allocation of resources across sectors as a result of international trade may affect an economy's growth rate. But during the same period, the vast bulk of UK productivity growth was found to be due to growth within sectors, rather than to movements of factor resources between sectors.

- Between 1970–92, some 15% of the initial gap between the UK and the US manufacturing TFP was closed, mostly during the 1980s. Manufacturing

sectors with the lowest productivity levels relative to the United States tended to experience the fastest rates of growth of relative productivity.

- The rate at which TFP in sectors within UK manufacturing converged with levels in the United States depended on the degree of international openness, as measured by flows of goods or flows of ideas. This finding remained true when we allowed for other explanatory variables, such as changes in capacity utilisation, the intensity of domestic research and development, education standards and the degree of trade unionisation. Measures of the flow of capital were found to be insignificant.

- Between 1970–90, the estimated average long-run level of productivity in UK manufacturing relative to that in the United States rose from 58% to 69%. It was estimated that about one half of this increase was attributable to the increase in openness during the period. The vast majority of the remainder was associated with improvements in educational standards.

Taken together, these empirical findings provide a body of evidence to suggest that greater international openness is closely associated with higher rates of productivity growth, both across countries and across sectors within the United Kingdom. Though the interactions between openness and growth are complex and not easy to disentangle, the evidence suggests that openness raises the rate of productivity growth in the United Kingdom by increasing the speed of productivity convergence with the technological leader.

Annex

List of research papers

Openness and Growth: theoretical links and empirical estimation, by Stephen Redding, *mimeo*, (July 1996).

'Is International Openness associated with Faster Economic Growth?' by James Proudman, Stephen Redding and Marco Bianchi, (June 1997), *Bank of England Working Paper*, No 63. Presented at the European Economic Association Conference, August 1997.

'Persistence and Mobility in International Trade', by James Proudman and Stephen Redding, (June 1997), *Bank of England Working Paper*, No 64. Presented at the Royal Economic Society Conference, March 1997 and at the European Economic Association Conference, August 1997.

'Deconstructing Growth in UK manufacturing', by Gavin Cameron, James Proudman and Stephen Redding, (May 1997). Presented at the LSE Money Macro Workshop, May 1997 and accepted for the *Bank of England Working Paper* series.

Openness and its association with productivity growth in UK manufacturing, by Gavin Cameron, James Proudman and Stephen Redding, *mimeo* (August 1997).

Productivity Convergence and International Openness, by Gavin Cameron, James Proudman and Stephen Redding, (August 1997). Presented at the European Science Foundation Conference on Growth in Open and Closed Economies, September 1997.

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Rationalisation of European equity and derivative exchanges

By Claire Williamson of the Bank's Markets and Trading Systems Division.

This article outlines recent structural changes in EU equity and derivative markets, and some of the main factors underlying the increasing trading links between exchanges, both within countries and across borders. It concludes that such links are likely to continue to prove attractive, and notes that this raises a number of issues for market participants, exchanges and regulators.

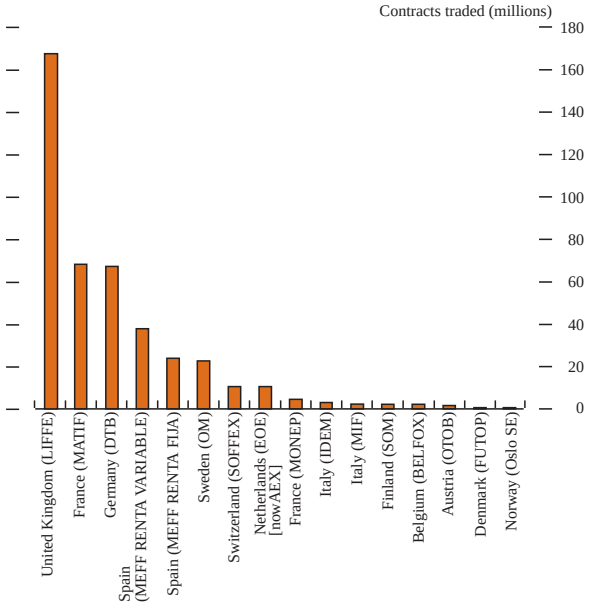
Introduction

The structure of Europe's equity and derivative exchanges(1) is changing rapidly. Mergers between equity and derivative exchanges have already taken place in a number of European countries, and more are planned. Where regional stock exchanges remain, they are largely also being consolidated. In addition, cross-border co-operation (and competition) between exchanges is increasingly taking new forms, as alternatives to the traditional cross-listing of products are developed. Shared electronic trading platforms and the provision of remote trading terminals—both of which enable exchanges to reach a wider market—are becoming more common. This in turn modifies the familiar notion of where a market is based: the location of its systems can now be quite distinct from where trading takes place. Derivative exchanges have been particularly active in this area, motivated by competitive pressures—in which the prospect of European Monetary Union (EMU) is a key driver—and assisted by technological developments. Other recent changes, in particular the implementation of the Investment Services Directive, have significantly reduced the obstacles to cross-border market access within Europe and so have facilitated this tide of change in market organisation and structure.

The eventual outcome may be a significantly different international market environment and pattern of trading activity worldwide. Turnover on the London International Financial Futures and Options Exchange (LIFFE) in 1996, for example, was the highest of any European derivative exchange (see Chart 1) but was broadly the same as the German, French and Swiss derivative exchanges (DTB, MATIF, SOFFEX) combined. If the planned alliance between these latter exchanges goes ahead, turnover on their shared position could exceed this, even without generating additional activity. As in any industry, a change of this scale could in turn influence how—and where—business is done, and affect other associated markets.

This article sets out the main recent developments in the structure of European equity and derivative exchanges, and considers some of the factors behind them.

Chart 1
Turnover of European derivative exchanges in 1996



Note: 1996 FIA statistics do not include turnover of individual equity options. Commodity derivative exchanges have not been included.

Source: FIA.

Mergers within countries

The recent and planned mergers between equity and derivative exchanges build on previous domestic rationalisation of equity exchanges. Regional stock exchanges were once commonplace in Europe, but improvements in communication and the increasing importance of intermediaries' size and scale of operations have reduced their rationale. Only Germany and France still have active regional trading floors, though activity is steadily concentrating in Frankfurt and Paris respectively. The United Kingdom's regional stock exchanges amalgamated as long ago as 1973, Italy's in 1994, and Switzerland's in 1996 (when electronic trading began there).

Financial derivative exchanges, being much younger (the first European derivative exchanges—the London Traded Options Market and the Amsterdam European Options Exchange—were established in 1978), were never set up on

(1) The derivative exchanges involved principally list financial derivative products.

a regional basis and have often developed separately from the well-established stock markets. In London's case, the traded equity options market did begin as part of the Stock Exchange, but merged with LIFFE in 1992. Here too, though, changes are now taking place and there have been a number of mergers between equity and derivative markets within countries: in Switzerland in 1993, in Germany in 1994, and in the Netherlands in 1997, creating the consolidated equity/derivative exchanges the Swiss Exchange, the Deutsche Borse and the Amsterdam Exchange respectively. In Denmark, the Copenhagen Stock Exchange (which also offered derivatives trading) merged with the derivative clearing house (the FUTOB clearing centre) in 1997. Mergers between equity and derivative exchanges are also planned in Austria, Finland and, most recently, France. In addition, discussions are continuing between the equity and derivative exchanges in Sweden about co-operation, including a possible merger.

There are several reasons for these equity/derivative mergers:

- Changes in business organisation, though costly in management time, provide scope to reduce costs. For example, the merged German and Swiss exchanges have integrated product development and marketing departments; the Amsterdam exchange plans to integrate functions and move to one building. Members may also benefit from having to deal with only one exchange, with harmonised rules and regulations. As well as reducing costs, these changes to business organisation may facilitate the development of new cross-market products.

- Technology has widened the potential gains from merger. Though these merged equity and derivative markets currently retain separate electronic markets, it will be possible to integrate the two in the future. An integrated equity/derivative market should be less costly to operate than two separate markets. The same is true of clearing—the Amsterdam Exchange plans to integrate equity and derivative clearing into one clearing house, which would allow the benefits of cross-margining. In addition, a merged equity/derivative exchange can use information and experience from one trading system to develop another. For example, the Swiss Exchange used lessons learned from the derivative exchange system when it developed an electronic system for the stock exchange in 1996.

- Competition is also an important factor. There is likely to be fierce competition for euro derivative products after EMU, and local currency interest rate products in participating countries will disappear. This could threaten the independent survival of some exchanges, and increase the pressure to reduce costs. Competition is also leading directly to cross-border consolidation (outlined below); some exchanges are merging partly to strengthen their national markets, in order to bolster their bargaining position in the event of subsequent European consolidation. For example, one reason cited by the Copenhagen stock exchange for its merger with the FUTOB clearing centre, and by the French exchanges for their planned merger, is the desire to have one body to represent their national markets in international negotiations.

The current round of equity and derivative exchange mergers may also be related not only to the very recent (and planned) cross-border co-operation, but also to the earlier wave of rationalisation of regional equity exchanges: with fewer parties involved, co-operation agreements are likely to be easier to reach and the possibility of an inconclusive outcome to any vote on such a proposal much reduced.

Another factor that may have facilitated mergers is the change in attitudes of equity market participants towards derivative markets. Where derivatives were once seen as a threat, taking business away from the cash market and from traditional broking firms, it is now more widely accepted that the two markets are often complementary; many firms are now active in both areas of business, having developed the necessary derivatives trading expertise. As most of these markets remain mutual organisations (though there are significant moves towards demutualisation here, as in other spheres of financial activity), the acceptability of co-operation or merger therefore depends crucially on members' perceptions of their own best interests. A high degree of membership overlap should reduce the obstacles to merger. Membership overlap is not easily measurable, because group entities are often members of the stock exchange and the derivative exchange under the names of different subsidiaries. But there is typically now an overlap in the range of 15%–60% between the equity and derivative exchange memberships within countries.(1)

Cross-border co-operation and competition

The character of cross-border activity of exchanges in 'same product' markets is also changing. Until now, derivative exchanges have usually linked up through cross-listing products—allowing one or more of their products to be traded on another exchange (see the box on page 408). This increased exchanges' access to potential users of the product (generally in another time zone) and to intermediaries willing to trade and distribute it; at the same time it could add to their own product range, through a reciprocal agreement to trade some of the other market's established products. Stock exchanges, on the other hand, have tended to compete rather than co-operate, either by encouraging dual listing or by offering alternative trading facilities (as the London Stock Exchange did successfully for a while with SEAQ-I).

Electronic trading platforms make other forms of co-operation and competition possible. They allow both the

(1) Calculated from individual exchanges' membership lists.

Cross-listings on derivative markets

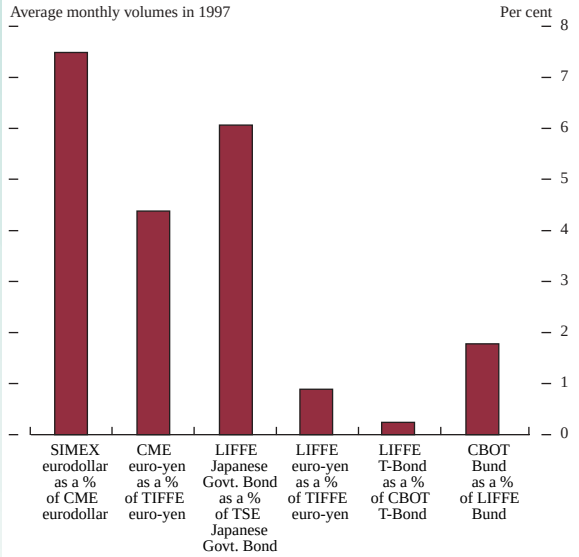
Cross-listing of contracts on derivative exchanges allows members of one exchange to trade contracts associated with/introduced by another exchange when it is closed. This involves an exchange A arranging for its product(s) to be listed on another exchange B, usually when exchange A has closed for the day; and may involve exchange B similarly allowing its product(s) to be traded after-hours on exchange A. This type of link is mostly between open-outcry exchanges. Exchanges A and B are typically in different time zones, so this arrangement provides a way for an exchange to reach a wider market for its existing products by both extending the trading hours for which the products are available and offering them to new customers. This differs from shared electronic orderbooks, which allow members from both exchanges to trade both exchanges' products simultaneously.

There are two main types of cross-listing arrangements: (1) contracts that are cross-listed but return to a single 'home' clearing house (the clearing house for the exchange that introduced the contract), usually at the end of the trading day; and (2) mutual offset, where clearing members may choose to have their side of the trade cleared locally (at the clearing house of which they are a member), so positions can be transferred between the two clearing houses. Mutual offset implies that contracts traded on one exchange can be transferred to or liquidated on the other exchange and add to/offset existing positions there. Examples of cross-listing links between financial derivative exchanges are given in the table below.

Cross-listing of products has had only limited success in generating additional turnover: trading volumes on the links have not been large, with the principal exception of the CME-SIMEX link, where volumes are thought to have been at the expense of LIFFE's eurodollar contract. Link volumes have also been low relative to turnover of the contract on the home exchange (see the chart). There may simply not be sufficient demand for after-hours trading of all products. These links are also costly to establish in terms of management time and often have major systems implications, particularly in relation to clearing aspects. There appears, however, to be a substantial defensive/spoiling element to these links—linking prevents other exchanges from doing so, or from listing similar products. Another motivation may be that they can provide an exchange with favourable publicity and marketing profile.

Looking forward, DTB and SIMEX signed a link agreement in June 1997 that will allow DTB's Bund, Bobl, and Schatz contracts to be traded on the SIMEX floor during its open-outcry hours. It is also envisaged that SIMEX members will be able to install DTB screens to trade all DTB products during DTB trading hours.

Link volumes as a percentage of volumes of the contract at the home exchange(a)



Source: FIA Fact Sheet.

(a) This chart shows volumes of a contract traded on a link as a percentage of the volume of that same contract traded at the 'home' exchange, ie where the contract originated. This is a way of illustrating the significance of link volumes.

Exchanges with cross-listing arrangements	Start date	Contracts covered	Type of clearing arrangements for cross-listed contracts
Chicago Mercantile Exchange (CME) *and* Singapore International Monetary Exchange (SIMEX)	1984	CME's eurodollar futures SIMEX's euro-yen futures (since 1996)	Mutual offset
London International Financial Futures and Options Exchange (LIFFE) *and* Tokyo International Financial Futures and Options Exchange (TIFFE)	1996	TIFFE's euro-yen futures	Trades transferred to home clearing house (TIFFE) at end of day
London International Financial Futures and Options Exchange (LIFFE) *and* Tokyo Stock Exchange (TSE)	1997	TSE's Japanese government bond futures	Contracts held intra-day only —LIFFE JGB contracts are automatically closed out at the end of the LIFFE business day
London International Financial Futures and Options Exchange (LIFFE) *and* Chicago Board of Trade (CBOT)	1997	LIFFE's Bund futures and options CBOT's T-bond futures and options	Trades transferred to home clearing house at the end of the day (LIFFE for Bunds, CBOT for T-Bonds)

trading of exchanges' products simultaneously from either exchange—the co-operative approach, generating economies of scale and other benefits—and remote trading. Remote terminals allow an exchange to widen its direct membership to include foreign-based participants who can trade its products from other (generally EU) countries in exactly the same way as local members. This is a recent development, and depends heavily on electronic trading to be fully effective.

Shared electronic trading platforms

A shared electronic trading platform, involving Scandinavian derivative exchanges, was established earlier this year. Another is planned between the German, Swiss and French derivative exchanges. The Copenhagen Stock Exchange and the Stockholm Stock Exchange have also signed a letter of intent about a trading link for securities.

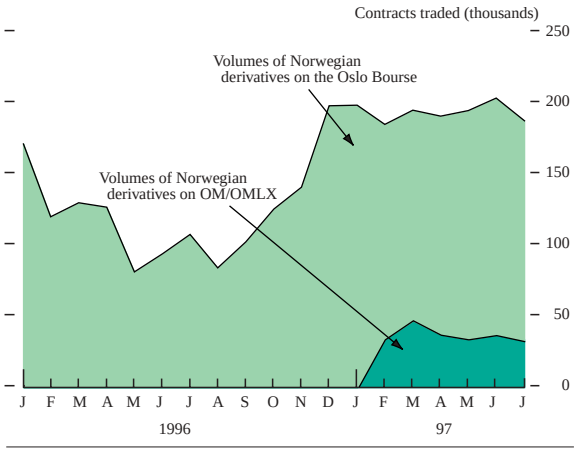
- *The Scandinavian experience*

  Sweden's OM Stockholm/OMLX[1] and Norway's Oslo Stock Exchange are developing Europe's first shared trading platform for derivative products involving independent exchanges. Since February 1997, members of each exchange have been able to trade simultaneously all equity-based derivatives listed on the other exchange.[2] (Both exchanges use OM's Click trading system.) Clearing occurs locally at each exchange; that is, at the clearing house of which the firm is a member, rather than at the clearing house attached to the exchange that originally introduced the contract.[3]

  Preliminary evidence indicates that this link has increased liquidity in Norwegian equity derivative products: more than 200,000 Norwegian derivative contracts were traded on the OM/OMLX platform from February to July 1997, the equivalent of 24% of the volume of Norwegian derivatives traded on the Oslo Stock Exchange. (Volumes of Swedish products traded on the Oslo Stock exchange have, however, so far been negligible.) Virtually all of this activity was on London-based OMLX rather than Swedish OM, suggesting that demand came from international firms in London trading on OMLX, rather than from Scandinavian firms. It does not seem to have been at the expense of Oslo Stock Exchange volumes: Chart 2 demonstrates that from February to July 1997, volumes on the Oslo Stock Exchange actually rose by 2%, in contrast with lower Q2 volumes (compared with Q1 volumes) on the Oslo Stock Exchange in the previous two years.

  OM Stockholm/OMLX also began a link with the Finnish Securities and Derivatives Exchange (SOM) in September 1996, which enables Finnish bond and interest rate products to be cleared on OM and *vice versa*. The relevant exchanges also hope to include SOM in the OM-Norway link.

Chart 2
Turnover of Norwegian derivatives on the Oslo Bourse and on OM/OMLX



- *The EUREX proposal*

  The German and Swiss derivative exchanges, the DTB and SOFFEX, announced on 4 September that they planned to establish a common market for their products on a single trading and clearing platform by mid 1998 (called EUREX). This was followed on 17 September by an announcement that the French exchanges (SBF–Bourse de Paris, MATIF and MONEP) will join the link, which will initially involve MATIF's fixed income derivatives being traded electronically on a system that will be linked to EUREX. It seems to be open to other exchanges to join if they wish. If this alliance goes ahead (and there is clearly much to be done before it can become a practical reality), it would—on current turnover—create the largest derivative market in Europe.

  But it is difficult to predict combined turnover if the exchanges do link up. First, some contracts are likely to cease to exist after EMU. Differences in bond yields may remain as a result of differences in governments' credit risks, but short-term interest rate (STIR) contracts are likely to converge, perhaps leaving only one STIR contract for the EMU area. Second, though the combined turnover of the DTB, SOFFEX and MATIF currently exceeds LIFFE's turnover, LIFFE's turnover has been growing faster. On the other hand, the linked exchanges, should the proposals be successfully implemented, may create an additional pool of liquidity and attract new users to the market.

  Many of the details of the proposed platform have still to be worked out. In essence, the plan is that the DTB

(1) OM Stockholm and OMLX (The London Securities and Derivatives Exchange) are part of the same company, OM Gruppen, and operate as two exchanges linked through an electronic common trading platform.
(2) There was a delay in June 1997 in providing access to Swedish products to members of the Oslo Stock Exchange.
(3) An OMLX member trading a Norwegian equity derivative product via the joint orderbook, for example, will have its trade cleared at OMLX rather than on the Oslo Stock Exchange.

and SOFFEX will link their electronic trading systems and clearing functions to allow members of each exchange to trade both exchanges' products. The MATIF link would allow MATIF members access to German and Swiss products, and *vice versa*. There will be harmonised rules and regulations. But it is not clear what other changes these links will involve; MATIF is currently an open-outcry exchange, and it seems that it will use the new electronic trading link in parallel with floor-based trading. The derivatives link may also open the way for a fully-fledged alliance embracing their respective equity markets.

Common trading platforms are not easy to establish; the exchanges need compatible electronic trading systems, and it is probably also important that they should have distinct markets and products (so that the threat of loss of business to their existing members is small and the opportunities from new products large). But unlike a fully-fledged merger, they allow the partners to retain a degree of local autonomy—for example, over product design and membership matters—which (particularly with mutual ownership structures) may be important in securing member acceptance. Linking different electronic systems can be difficult; in the Scandinavian example, the Oslo Stock Exchange adopted OM's trading system. In addition, these Scandinavian exchanges do not directly compete in the markets they cover or products they list, and none is individually a leading exchange in Europe (in terms of turnover), though when linked, they are more significant. But even in this case, the benefits of a common platform—as with cross-listing—do not necessarily accrue in equal measure to all the participating exchanges.

The difficulties involved in establishing common trading platforms are illustrated by a previous attempt by the French and German exchanges to establish a link for equities and derivatives in 1995. Discussions eventually broke down last year, with both sides agreeing that this was too expensive and problematic—possibly in part because of opposition from MATIF floor traders to a screen-based system. The current EUREX project may, however, be better placed to succeed: the French Stock Exchange, the SBF-Bourse de Paris, which is first to merge with MATIF, is already an electronic exchange. Other specific factors favour the DTB-SOFFEX link: they have the same basic electronic trading systems (though of different vintages) and they are not competing in the same markets.

Technological improvement is a key factor in the prospects for cross-border links between derivative exchanges. Most European derivative exchanges established during the past decade are electronic, and most open-outcry exchanges, established before electronic trading was feasible, have now introduced some form of electronic trading: LIFFE and MATIF now have after-hours electronic trading systems, LIFFE is also aiming to automate equity options in 1998, and the Amsterdam Exchange is planning to introduce electronic trading for derivatives next year. The extent of electronic trading has also been increasing in equity exchanges. The trading floors in London and Sweden were abandoned in the 1980s (London has also now introduced a fully electronic order book for FT-SE 100 stocks), and in Amsterdam and Oslo, traders meet on the trading floor but trade with each other mainly through electronic links. The Paris, Milan, Zurich, Helsinki and Copenhagen stock exchanges are almost entirely electronic. Germany is the only remaining major equity market in Europe with open-outcry trading, though Frankfurt's electronic IBIS system is gaining market share and now accounts for 40% of turnover.

Because it is easier to set up common trading platforms when trading is electronic, these technological advances help to facilitate electronic linkages. Cross-listing links are of course possible with open-outcry exchanges, but it is difficult for such a link to allow the simultaneous trading of both exchanges' products by all members (which is why cross-listing links are typically between exchanges in different time zones). In addition, the cost advantages are probably much greater with electronic links: a shared electronic platform can absorb additional activity at relatively low marginal cost, whereas an open-outcry link still involves the expense of two separate floors, and the savings are probably confined to marketing and product design. Provided that the systems are electronically compatible—or one partner adopts the other's system (perhaps as an alternative to developing its own)—the economies of scale are likely to be substantial.

The importance to exchanges of these trading links is much enhanced by the heightened competition expected after EMU. For many of Europe's derivative exchanges, contracts based on national interest rates form a significant part of total volumes. In countries that become part of EMU and adopt the euro as their national currency, short-term interest rates for separate national currencies will be subsumed by the single euro interest rate. It therefore seems unlikely that there will be sufficient business to justify an independent futures exchange in every country in Europe. Links may provide some assurance of continuity and a role in governance that independence—particularly for the smaller markets—may not (though liquidity may flow to one of the partners of a link).

There is currently more cross-border activity—actual and planned—between derivative exchanges than between stock markets. Stock exchanges are, however, also likely to face increased incentives to follow derivative exchanges and embark on trading links. It has been suggested, for example, that EMU will result in increased cross-border share ownership. Pension fund rules typically require funds to match their liabilities with assets in the same currency. EMU will therefore broaden the range of securities that qualify as 'domestic' for these purposes and so should stimulate cross-border activity in euro securities. In addition, EMU may reduce the distinctions between exchanges in the eyes of investors. This may increase the incentives for national equity exchanges themselves to forge closer ties.

Remote trading

Remote access allows members of an exchange to trade the exchange's products from remote terminals on the same basis as local members. Use of remote terminals is increasing throughout Europe, and they are becoming a notable feature of the new market framework. With 61 remote members in October 1997, the DTB has so far been the most successful in attracting such members, though many other exchanges also have remote members.

Remote access is essentially a competitive rather than a collaborative tool, allowing an exchange to distribute its products to a wider market, but without the benefit of new products or the support of an incumbent local exchange—with the ready access to intermediaries and customers that this can provide.(1) It is potentially an easier way for an exchange to disseminate its products more widely, since it can control the process and does not need to rely on gaining the co-operation of a foreign partner.

As with electronic trading links, a key factor in the development of remote trading is the increased use of electronic trading systems: without an electronic trading platform, the most that can be achieved is remote order routing rather than direct access to the trading mechanism itself. But within Europe, it has been greatly facilitated by the implementation during 1996 of the Investment Services Directive (ISD).(2) The ISD enables a securities firm that is registered and authorised in one Member State to trade in any other without needing additional regulatory approval; equally, exchanges recognised in one Member State can gain unrestricted access to other Member States, for example by setting up terminals in them. So securities firms can now trade directly on any EU exchange without being physically present in that exchange's country, and without the additional regulatory burden of authorisation by that country's regulatory authorities.

Remote trading did take place before the ISD,(3) and in non-EU countries, such as Switzerland, where the ISD does not apply. In these cases, exchanges have negotiated bilaterally with the relevant countries. SOFFEX, for example, has a reciprocal agreement with the DTB under which SOFFEX terminals can be located in Frankfurt—there are currently twelve—and DTB terminals can be located in Switzerland.

There are of course some disadvantages to remote trading. A presence in the country where the exchange is based is valuable for obtaining local knowledge and local clients. In addition, most exchanges require a local presence for clearing, even when remote trading is offered. The consequent restrictions on cross-border settlement are a barrier to cross-border trading for firms that do not have branches throughout the European Union. But attitudes to the location of clearing members seem to be changing. The London Clearing House and MATIF, for example, each have one remote clearing member.

Conclusion

Mergers between equity and derivative exchanges within countries have already taken place in Germany, Switzerland and the Netherlands, and are planned in Austria, France and Finland. There are good reasons for such mergers: they allow cost reductions of various kinds and can improve the efficiency of the respective markets by bringing the participants closer together. They have been facilitated by the consolidation of regional equity markets and greater understanding of derivative markets by stock market participants, which have reduced previous barriers; and the potential gains from merger have increased as trading technology has become more dependent on electronic systems, which generate greater economies of scale. These factors, together with the need to establish a strong competitive position in advance of EMU, suggest that such mergers will continue to be attractive.

A distinctive feature of the current co-operation between exchanges is a new form of trading link between them—common electronic trading platforms. Though only one has so far been set up and the volumes on this (and indeed on earlier cross-listing links) have not generally been high, common trading platforms have a potentially powerful role to play in Europe. They allow exchanges to consolidate the trading mechanism and the liquidity of the market, while allowing smaller exchanges to retain independence on matters such as their internal governance and product design. For a small exchange with a limited product range and only a local customer base, a common trading platform may be a better way to distribute its products than remote trading, as the exchange can benefit from being able to offer the other exchange's products to its members, and from a larger pool of liquidity. Providing and servicing remote terminals for only a small number of participants may also not be cost-effective.

But it is perhaps in the area of remote trading—the possibilities of which are being greatly expanded through technological advances—that we may see the most change. Remote trading seems to be an easier way for an exchange to distribute its products widely than negotiating and implementing a trading link with another exchange, since it does not require co-operation and involves no loss of control. It is probably particularly suited to larger exchanges, with a well-developed product base and liquidity that they simply want to distribute more widely.

These changes in the structure and organisation of equity and derivative exchanges have a number of consequences—

(1) Remote trading can also be collaborative, though this is more likely in non-EU countries where the ISD does not apply. For example, the DTB is co-operating with SIMEX in its plans to locate trading terminals in Singapore.
(2) The ISD has been implemented in the United Kingdom, France, Italy, Belgium, the Netherlands, Sweden, Denmark, Finland, Austria, Ireland, Portugal and Greece.
(3) The GLOBEX trading system, owned by the CME, Reuters and initially the CBOT, is used as an after-hours trading system for CME and for MATIF. Plans for GLOBEX had been more ambitious, with 24-hour trading envisaged, but restrictions were placed on its use. (For example, an exchange using GLOBEX could not develop its own automated trading system.) The system was developed in 1992 and CME and MATIF both plan to abandon it in favour of the Paris Bourse's NSC trading system in April 1998.

for market participants (members and end-users), exchanges and regulators:

- Common trading platforms, consolidation of exchanges and wider product availability through remote access may all improve the price formation process: they expand the trading population and expose the contracts to a wider market. If this—as might be expected—results in more liquid, deeper markets, this could encourage new investors to participate in the market, attracted by the more efficient pricing. The Scandinavian link is an example: the ability to trade Norwegian products from London has already attracted new participants into the Norwegian derivatives market. In addition, common trading platforms may create new arbitrage opportunities, which could reinforce the price efficiency improvements.

- Mergers and co-operation on trading technology should result directly in cost reductions for exchanges, which should in turn reduce trading costs. They may also allow exchanges to develop improved trading systems more cheaply. The relative ease with which electronic exchanges can establish common trading platforms and provide remote terminals may place exchanges that rely solely on open-outcry platforms—and so cannot easily undertake these new forms of activity—at a competitive disadvantage, as fewer competitive options are open to them.

- These new forms of cross-border trading may also have regulatory implications. It will be important, for example, that exchanges operating as one market are supervised as one market. Similar issues may arise about the regulation of remote trading: it is important that remote users are subject to the same standards of regulation as local members. There may also be issues of regulatory jurisdiction to be clarified, so that remote trading is not used to exploit differences in standards in different markets. There is also a risk—if consolidation is taken too far—that a single exchange may come to dominate the market. This is potentially unhealthy, in that it would weaken the competitive forces that are creating such powerful incentives to develop cheap and efficient trading systems, to the benefit of all market participants.

It is clear that there is still some way to go before the full effects of the recent and prospective changes in structure of these markets will be reflected in the pattern of trading and the location of business within Europe. The eventual structure may well be quite different from the one we see today. But it should be more efficient, and better able to take full advantage of the facilities that modern technology can bring.

Implied exchange rate correlations and market perceptions of European Monetary Union

By Creon Butler and Neil Cooper, of the Bank's Monetary Instruments and Markets Division.

A number of 'EMU calculators' have been developed to assess market expectations of the likelihood of particular countries joining European Monetary Union (EMU). Most of these techniques attempt to infer this information from interest rate differentials. Typically, they also require assumptions about the level of interest rates that would hold should a country not join EMU. This article discusses an alternative measure of EMU convergence—the expected correlation between currencies implicit in foreign exchange options prices. It shows how implied correlations may be calculated, and how they may be used to gauge expectations of EMU participation by continental European countries and to interpret sterling's movements since mid 1996.

Introduction

There has been increasing interest in techniques to gauge financial market expectations about the likelihood of European Monetary Union (EMU) going ahead and the probabilities attached to participation by certain countries. A number of 'EMU calculators' that attempt to assess EMU convergence have been developed.(1) Most of these techniques rely on interest rate differentials in the swap market. But some strong assumptions are also needed to interpret the results. After briefly reviewing some of the drawbacks of relying solely on interest rate differentials, this article presents an alternative indicator of EMU sentiment—the expected future correlation between currencies implied by foreign exchange options prices. These implied correlations provide information on the market's perceived likelihood of two countries joining EMU, since a necessary condition for them both to participate is that their exchange rates should be perfectly correlated beyond the date they join.

A simple approach to assessing market expectations of EMU relies on forward interest rate curves derived from government bond prices.(2) These enable an estimate to be made of the short-term interest rates expected to hold beyond 1 January 1999 in Germany—assumed to be a core member of EMU—and a second country of interest.(3) If the market were sure that the second country would join in the first wave of EMU, the expected short-term interest rates in the two countries after 1 January 1999 would be identical and the forward rate estimates of these expectations would be very close. But if there is uncertainty, it is argued that the expected interest rates in the second country would be above those in Germany. Moreover, the more doubtful the participation of the second country, the wider the divergence is likely to be. Though useful, this analysis is dependent on some key assumptions: (i) that Germany will definitely join EMU; and (ii) that the monetary policy of the second country will be less credible outside EMU than in. But expectations of the second country's interest rates after 1999 could be very close to Germany's, even if it were not expected to join EMU. Put another way, convergence in expected short-term interest rates is a necessary, but not sufficient condition for the perception that both countries will join EMU.

The EMU calculators take this analysis further. They first estimate what interest rate spreads between countries would be if EMU were not in prospect, using either a time-series forecast or a full macroeconomic forecasting model. By comparing these estimates with the spreads that actually hold, and those that would hold if EMU participation were a certainty, they calculate the probability that individual countries will join EMU. But the results of this approach are inevitably dependent on the model for predicting interest rate spreads in the 'no-EMU' world.

Using implied (expected) exchange rate correlations as a gauge of EMU expectations does not generally require such detailed assumptions or forecasts about alternative scenarios. The key assumption is that there is a link between the probability the market attaches to two currencies joining EMU in 1999 and the implied correlation between their exchange rates *vis-à-vis* the dollar. The more likely they are to join, the closer to one the implied correlation will be, and *vice versa*. This is reasonable since if the two currencies do join, then the actual correlation coefficient must equal one (ie perfect correlation) from 1 January 1999 onwards; and there are few scenarios other than EMU that would produce an expectation of very high correlation between the two currencies.

The remainder of the article is structured as follows. The second section describes the technique for deriving implied

(1) See, for example, J P Morgan (1997) and Goldman Sachs (1996).
(2) See Cooper and Steeley (1996a) and (1996b).
(3) On the assumption that interest rate risk premia are similar and/or small.

Deriving implied correlations

From the price of an option on an underlying currency, we can derive information on the market's uncertainty about the future value of the currency. This is done by inverting a variant of the Black-Scholes formula with a given option price, to calculate the 'implied volatility'.

Since an option on a currency is quoted in terms of an exchange rate (ie the level of that currency *vis-à-vis* another currency), we can go a step further and derive an implied correlation—the market's expected future correlation between the exchange rates of any two currencies, using a third as a numeraire. This is a unique feature of currency options.

For example let S_1 = \$/¥, the dollar/yen exchange rate, S_2 = \$/DM, the dollar/Mark exchange rate; and S_3 = DM/¥ = S_1/S_2, the Mark/yen exchange rate. Then the proportional change in the exchange rate S_i, r_i, is approximated by:

$$r_i = \ln\left(\frac{S_{i,t+1}}{S_{i,t}}\right) \quad \textbf{(1)}$$

Let the time interval be small—a day or less. From the definition of the Mark/yen cross-rate, S_3, it follows that the proportional change in the period is given by:

$$r_3 = \ln\left(\frac{S_{1,t+1}/S_{2,t+1}}{S_{1,t}/S_{2,t}}\right) \quad \textbf{(2)}$$

Rearranging the terms in brackets, we get:

$$r_3 = \ln\left(\frac{S_{1,t+1}/S_{1,t}}{S_{2,t+1}/S_{2,t}}\right) \quad \textbf{(3)}$$

$$= \ln\left(\frac{S_{1,t+1}}{S_{1,t}}\right) - \ln\left(\frac{S_{2,t+1}}{S_{2,t}}\right) \quad \textbf{(4)}$$

so that:

$$r_3 = r_1 - r_2 \quad \textbf{(5)}$$

It then follows that:

$$\text{var}(r_3) = \text{var}(r_1) + \text{var}(r_2) - 2\text{cov}(r_1, r_2) \quad \textbf{(6)}$$

Now take the implied volatility derived from an option on \$/¥ as an estimate of the expected average standard deviation of movements of the US dollar expressed in terms of yen for the lifetime of the option (we will return to whether this is a reasonable assumption later). Let the implied volatilities for \$/¥, \$/DM and DM/¥ be termed σ_1, σ_2, and σ_3 respectively. Inserting these into equation **(6)**, we get:

$$\sigma_3^2 = \sigma_1^2 + \sigma_2^2 - 2\,\text{cov}(r_1, r_2) \quad \textbf{(7)}$$

so

$$\sigma_3^2 = \sigma_1^2 + \sigma_2^2 - 2\sigma_1\sigma_2\rho_{12} \quad \textbf{(8)}$$

exchange rate correlations. The third discusses the information that they give about the perceived likelihood of certain continental European countries joining EMU. In the fourth, we look at sterling's behaviour since August 1996 in the light of this technique. The final section extends the technique to derive the expected future path of the short-term correlation between two exchange rates. This is then used to provide a further insight into the factors expected to influence sterling in the future.

Derivation of implied exchange rate correlations

The Black-Scholes pricing formula shows how the fair market value of a call or put option on an equity will depend on the degree of uncertainty about the future value of the underlying asset, plus a number of other known factors. Extensions to the formula have also been developed to price options on a currency or interest rate. This means that we can take the price at which an option is traded in the market and, using the Black-Scholes formula, derive the expected volatility implied by the price. This is known as 'implied volatility'.

Because an exchange rate option gives us information on the market's uncertainty about the price of one currency in terms of another, with three currencies and options on each of the possible exchange rate pairings, we can derive an estimate of the market's expected future, or implied, correlation between any two of the exchange rates. To see the intuition behind this, let the three currencies be the US dollar, Japanese yen and Deutsche Mark (Mark). Suppose that the expected volatilities of the yen and of the Mark against the dollar are both very high, but that the volatility of the yen against the Mark is expected to be very low. This means that the market expects the dollar to drive most of the volatility between the yen and the dollar, and between the Mark and the dollar. It follows that the market will expect the dollar/yen exchange rate and the dollar/Mark exchange rate to be highly correlated. Another way to characterise the implied correlation is that it represents the degree of co-movement between two currencies using a third as numeraire. The box above provides a technical description of the method for deriving implied correlations.

What value is added by knowing the implied correlation for two exchange rates with a common numeraire if

and rearranging, we get the implied correlation between the Mark and the yen using the US dollar as numeraire:

$$\rho_{12} = \frac{\sigma_1^2 + \sigma_2^2 - \sigma_3^2}{2\sigma_1\sigma_2} \qquad \textbf{(9)}$$

To calculate the implied correlation between \$/¥ and \$/DM on a particular date, we insert the observed implied volatilities for that date into equation **(9)**.

We use data from over-the-counter (OTC) market makers,(1) rather than from the FX option exchanges such as Philadelphia and the Chicago Mercantile Exchange. This is first because liquidity is generally much higher on the OTC market than on the exchanges. Second, prices in the OTC market are quoted directly in terms of implied volatilities. This avoids the errors that may be introduced by slightly non-synchronous data, when trying to calculate implied volatilities using quotes on spot exchange rates and options prices. Finally, the OTC market trades options on a wider range of cross-rates than the exchanges. This is important, since to calculate the implied correlation we need implied volatilities for the three relevant currency pairings. Even where we use the dollar as the numeraire, this means that we need to use one cross-rate implied volatility, which may not be available from the exchanges.

A further feature of using OTC quotes is that they have constant maturities. Typically, one can observe quotes ranging from one week to one year on market makers' screens. This may be an advantage or a disadvantage, depending on the application. Having continuously quoted data with the same time horizon makes it easier to generate meaningful time series. On the other hand, it makes it harder to see how expectations about a future fixed date have changed.

One possible objection to the use of implied volatilities is that the Black-Scholes pricing model assumes that the underlying asset price has constant volatility. Yet it is widely recognised that volatility changes over time. Does this affect the validity of our estimates of implied correlation?

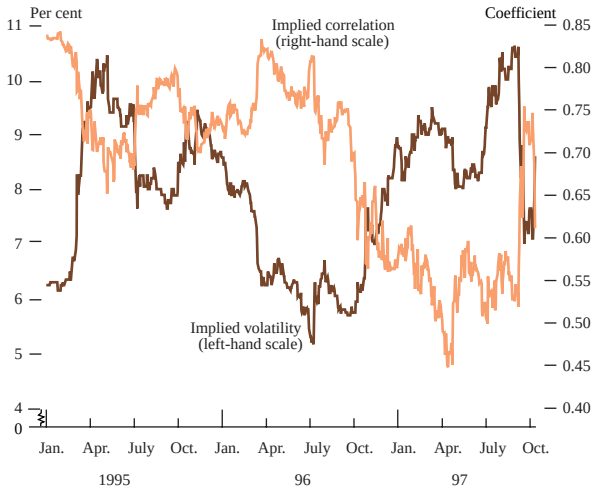
Fortunately, the method appears robust to the presence of variable exchange rate volatility. From a theoretical perspective, Feinstein (1989) investigated the true value of an at-the-money equity option in the presence of uncertain time-varying volatility. He showed that it is approximately equal to the Black-Scholes valuation, provided that the volatility estimate used in the Black-Scholes formula is the average expected volatility of the underlying stock for the remaining lifetime of the option.

Heynen, Kemna and Vorst (1994) extended this work to examine the relationship between implied volatilities derived using the Black-Scholes formula, and the true volatilities under three alternative stochastic models with uncertain time-varying volatility. From each of these models, they generated theoretical option prices. They then compared the Black-Scholes implied volatilities derived from these prices with the true average expected volatilities. For all three models the implied volatilities were very close to the average expected volatilities. This suggests that our use of Black-Scholes volatility is acceptable.

(1) The data used in this article comes from Citibank FX Options, London.

one already knows the implied volatility for the two currencies in which one is interested? Chart 1 shows

Chart 1
Twelve-month implied volatility for £/DM and implied correlation of \$/£ with \$/DM

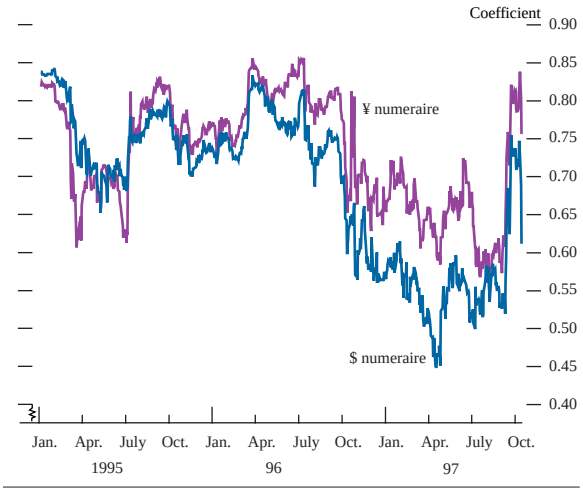


that, as one would expect from the above intuition, the implied volatility for £/DM moves inversely with the implied correlation between the \$/£ and \$/DM. The inverse relationship is fairly close, though there are clearly times when it breaks down, such as in spring 1995, which was a period of generally high exchange rate volatility. This illustrates one advantage of implied correlations: they adjust for general shifts in uncertainty affecting all countries.(1)

One concern is that the choice of numeraire may affect the results. To check this, we compared the implied correlation between sterling and the Mark using two different numeraires—the dollar and the yen. The results are shown in Chart 2. It can be seen that the choice of numeraire has not altered the general pattern of movement, but it does affect the absolute level of the implied correlation. This suggests that the choice of numeraire may at times be important. We use the US dollar as the benchmark currency where possible in the analysis that follows.

(1) A second advantage is that the correlation coefficient—a number between -1 and +1, where a figure close to +1 represents a very high degree of co-movement—is more readily understood than the implied volatility measure, which can in theory take any positive value.

Chart 2
Twelve-month implied correlations of $/£ with $/DM and £/¥ with DM/¥



Implied exchange rate correlations for continental Europe

Limits on the liquid maturities available in the market for over-the-counter (OTC) exchange rate options mean that twelve months is the longest time horizon up to which we can calculate implied exchange rate correlations. So at the time of writing this article, the furthest time horizon is October 1998. This goes beyond the date when the initial members of EMU and their bilateral conversion rates are due to be announced, but stops short of the start date for EMU itself. Nonetheless, we can already learn quite a lot about market perceptions of EMU from the implied correlations we do have. In this section we use implied correlations to investigate changing market perceptions of the likelihood of different continental European countries participating in EMU. In the following section, we look at the information provided on market perceptions of sterling.

If EMU is expected to proceed on schedule, the market will expect the dollar exchange rates of any two participants to be perfectly correlated from 1 January 1999 onwards. But the market is also likely to expect two currencies that it thinks will participate at the start of EMU to be closely correlated between now and 1 January 1999. The current forward exchange rate between one currency and the other will be the market's best guess (or average view) of the level at which the exchange rate will in due course be irrevocably locked. Where short-term interest rates in the two countries are the same, the forward rate will be the same as the current spot rate. So in the absence of any news, the market would expect the dollar exchange rates for the two countries to be highly correlated in the run-up to EMU. If there is an interest rate differential between the two countries, it means that their exchange rate is expected to move to a new level in the period to 1 January 1999. But given that daily interest rate differentials are typically small and stable relative to daily exchange rate fluctuations, this movement on its own will have at most a small impact on the expected future correlation between the two countries' dollar exchange rates. Only if there is significant uncertainty about whether one or other of the countries will join, or about the exchange rate at which they will join, will the market look forward to news that could lead to uncorrelated movements in the dollar exchange rates for the two currencies. Otherwise, future news will be expected to affect both currencies similarly.

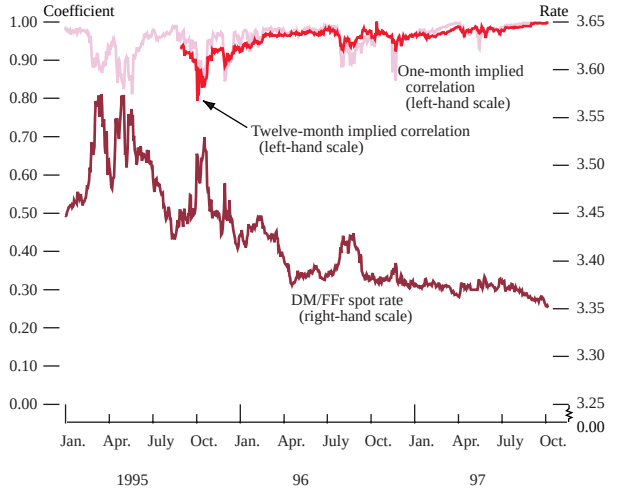
Equally, if we observe a very high twelve-month implied correlation between two potential participants in EMU, this should generally be a good indicator that both currencies are expected to join. But there are two possible exceptions to this conclusion. The first is the scenario where there is considerable uncertainty about whether one of the countries will join, but it is all focused in the period between October 1998 and 1 January 1999, for which we have no data. This seems very unlikely in practice, since the initial participation in EMU is due to be announced in spring 1998. Second, certain currencies that do not participate in EMU as from 1 January 1999 may join a new exchange rate mechanism ('ERM2'). If the fluctuation bands were very tight, it would be impossible *ex ante* to distinguish this scenario from that of EMU participation. But it seems unlikely that the market would perceive a country to be able to maintain a tight ERM band after 1 January 1999, and yet not expect it to qualify for participation in EMU at the outset, though some countries that are perceived as eligible to participate in EMU, but that have decided not to join on 1 January 1999, might be an exception.

As described in the introduction, implied exchange rate correlations and the spread between implied forward interest rates provide alternative measures of market expectations about EMU. One advantage of implied correlations is that aside from EMU, there are relatively few scenarios that could lead to the expectation that two currencies will be very highly correlated during a given period of time—the narrow band ERM2 discussed above is perhaps the most likely. By contrast, there are a number of economic scenarios other than EMU that could lead to two countries having similar expected future short-term interest rates for a period. Another advantage of implied correlations is that they are not susceptible to the estimation errors involved in fitting yield curves and deriving implied forward interest rates. They also avoid the problem introduced by market expectations that longer-term government debt from different countries participating in EMU will carry different credit or liquidity spreads. This could result in two countries having different implied forward interest rates, even though both were thought certain to participate. On the other hand, implied forward interest rate spreads have the important advantage at present that we can estimate them for the period after EMU is due to begin.

Chart 3 shows the implied correlation between the dollar/Mark exchange rate and the dollar/French franc exchange rate up to a one-month and twelve-month horizon since the start of 1995 and mid 1995 respectively. The implied correlations have both remained high throughout the period, but in the past six months have become more stable, with a rising trend towards almost one. This suggests that

the market has had a reasonably high degree of confidence during the period that both the Mark and the French franc will participate in EMU, and that it has become even more confident in the past six months.(1) The spread between ten-year implied forward rates in Germany and France provides a much noisier series, from which one cannot so readily read a trend.

Chart 3
One-month and twelve-month implied correlations of $/DM with $/FFr, and DM/FFr exchange rate



Charts 4 and 5 show implied correlations between the Spanish peseta and the Mark, and between the Italian lira and the Mark, respectively. At the start of 1996, the implied twelve-month correlation between the peseta and the Mark was 0.87, whereas for the lira and the Mark, the figure was 0.44. In both cases the implied correlations have been rising since then, but more markedly in the case of the lira. Given the independent evidence from the French franc/Mark comparison that a high probability has been assigned during the whole period to the Mark participating in EMU, this suggests that the market has attached a rising probability to these two countries joining. But the shift in perception has been greater for Italy than for Spain. Both charts show a step up in the twelve-month implied correlation to nearly one on 16 September, shortly after an ECOFIN meeting that confirmed that the initial participants in EMU and their bilateral parities would be announced in spring 1998.

Chart 6 shows the spread between the implied forward interest rates in Germany and Italy ten years ahead. The general picture of a narrowing spread since the start of 1996 tells a similar story to the implied correlations. But the month-to-month changes are sometimes different. For example, the measures in both charts suggest there was a sudden but temporary fall in the perceived probability of Italy joining Germany in EMU in August 1996, but this appears sharper when judged by the implied correlation measure than when judged by the forward interest rate spread measure.

Chart 4
One-month and twelve-month implied correlations of $/DM with $/Pta, and DM/Pta exchange rate

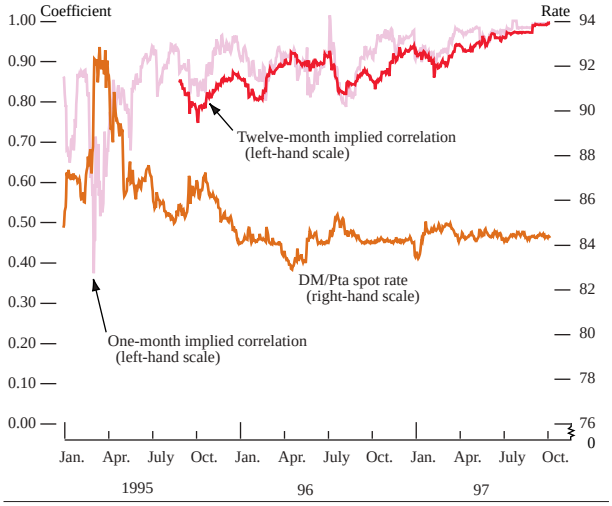


Chart 5
One-month and twelve-month implied correlations of $/DM with $/Lit, and DM/Lit exchange rate

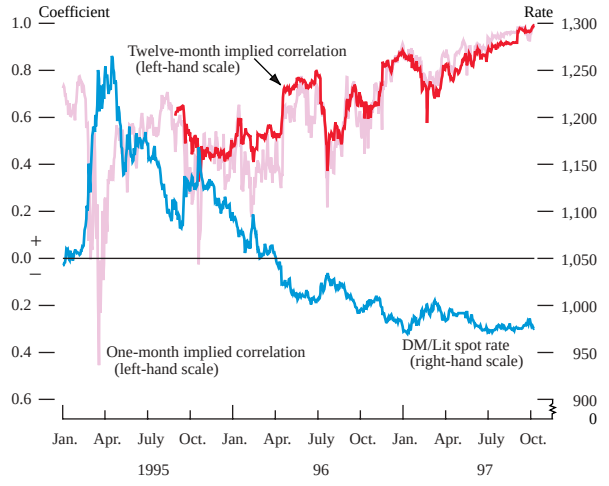
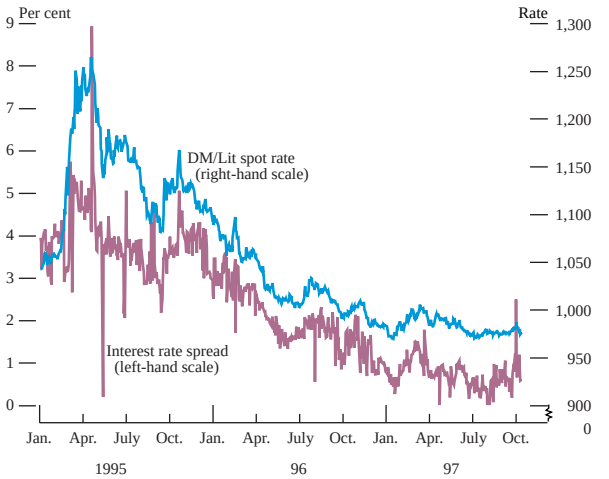


Chart 6
DM/Lit exchange rate vs spread between ten-year forward interest rates in Italy and Germany



(1) In this article we do not try to model what the implied correlation between the two exchange rates would have been in the absence of EMU. But such an extension should be possible, using similar techniques to those already employed with yield spreads. In some cases, this might provide a more precise estimate of the probability of two countries joining EMU. But in the case of the Mark and French franc, the implied correlation is so high that any extension of this kind would produce a probability very close to one.

Implied exchange rate correlations for sterling

A number of factors have contributed to sterling's appreciation and subsequent fall in the past 15 months. These include news about the relative stance of monetary and fiscal policy in the United Kingdom and other countries; the impact of changes in the oil price; and shifts in the demand and supply curves for UK goods and services. At the same time, market comment in the period suggests that another important additional factor has been shifts in international investors' portfolio preferences for sterling-denominated assets, as a result of changing perceptions about EMU. A range of possible rationalisations for such preference shifts has been put forward. We analyse these below, and see how the predictions compare with the evidence from implied exchange rate correlations and other financial market information.(1) This approach cannot prove that a particular scenario underlies sterling's behaviour during the period, but it does help to distinguish those scenarios that are consistent with the way other financial assets have been priced, and those that are not. We mainly focus on the twelve-month implied correlation in this section. In the next section we turn to implied correlations up to shorter time horizons.

Scenario (i): portfolio diversification

In this scenario, investors become increasingly confident that EMU will proceed on schedule. Those holding what they expect will shortly become euro-denominated assets face a reduction in the extent to which their wealth is diversified against demand shocks. This creates an incentive for them to transfer some of their wealth into assets denominated in currencies that are expected to remain outside the euro area. The demand for diversification may be enhanced by the growing belief that the euro will have a broad initial membership, since more investors will then be affected by the arrival of EMU. As the market becomes more confident that sterling will not join EMU at an early date, it begins to strengthen as a result of this demand. Moreover, while the likelihood of the United Kingdom's participation in EMU is changing, the impact on sterling's value of increased demand for diversification is likely to be proportionately greater than for other currencies that are also potential homes for these funds, but which have never been candidates for membership, such as the US dollar.(2)

Scenario (ii): weak euro

In this scenario, investors also come to expect EMU to proceed on schedule with a broad initial membership. But this leads them to expect that the initial monetary policy stance of the European Central Bank (ECB) will be excessively lax, reflecting the average of the historic behaviour of the different participating states. Sterling strengthens on this concern, the more so the more confident the market is that it will remain outside the euro.

Scenario (iii): euro uncertainty

In this scenario, the market's increasing belief that EMU will proceed with broad initial membership leads it to become more uncertain about what kind of monetary policy will operate in the euro-zone countries after monetary union. On the one hand, the market perceives the risk of an excessively lax monetary policy as discussed above, but it also sees a risk that the ECB might be forced to adopt a very tight monetary stance to establish its credibility. This uncertainty in turn creates uncertainty about the levels of euro interest rates and the euro exchange rate that will hold after 1 January 1999. As long as sterling is expected to remain outside the euro, the effect is to increase investor preferences for sterling assets.

Scenario (iv): pre-EMU uncertainty

This final scenario differs from the first three insofar as the market becomes increasingly uncertain in the run-up to 1 January 1999 about whether EMU will actually happen and who will join. As a result of this uncertainty, investors have an increased preference for sterling assets, and this is stronger the more confident they are that sterling will remain outside the euro.

Scenarios (ii), (iii) and (iv) could be characterised as safe-haven stories. Other possible scenarios include those in which the market is increasingly confident that sterling will stay outside the euro, but does expect it to participate in ERM2, a successor to the ERM. But market comment along these lines has been patchy, making it unlikely that this scenario has been sustained for any length of time. Moreover, unless the market expects sterling to participate in an ERM2 with very tight effective margins of variation, it may make little difference to the scenarios already presented.

Any of the four scenarios listed would explain how changing investor perspectives on EMU could have contributed to sterling's appreciation since August 1996. But are they consistent with what we observe from implied correlations?

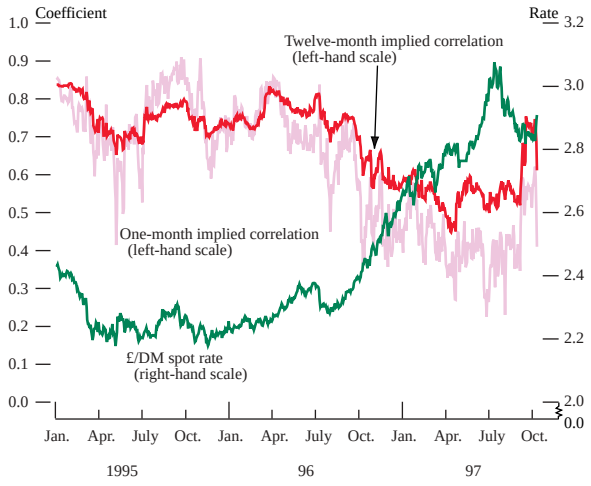
The evidence presented in the third section on implied correlations between continental European currencies does not appear to be consistent with scenario (iv). Increasing uncertainty about whether EMU will go ahead and who will join means that future news should be expected to cause divergent movements (lower correlation) between the dollar/Mark and dollar/French franc exchange rates, or between the dollar/Mark and dollar/lira exchange rates. But in practice, all the currency pairs examined now have very high absolute expected future correlations. On the other hand, the evidence in the third section is consistent with

(1) All of these scenarios assume that the market can be modelled as a representative agent. In a model with heterogeneous beliefs, another class of outcomes would be possible.
(2) In contrast with the argument made in this scenario, Alogoskoufis *et al* (1997) have argued that the creation of the euro could lead to portfolio inflows to the euro zone, as the euro begins to share the role of international reserve currency and medium of exchange with the US dollar.

scenarios (i) to (iii) insofar as the rising implied correlations for the peseta and the Mark, and the lira and the Mark, are consistent with a growing market expectation that EMU will have a broad initial membership.

Chart 7 shows the one-month and twelve-month implied correlations between sterling and the Mark, using the dollar as numeraire plotted against the £/DM exchange rate. The path of the twelve-month implied correlation falls into four distinct phases. In the period up to August 1996, it averaged close to 0.8. During this period the £/DM exchange rate was reasonably stable. Through the next nine months, the twelve-month implied correlation declined progressively, reaching 0.45 in May 1997. At the same time sterling rose sharply against the Mark, and stood 24% higher on 6 May 1997 than on 6 August 1996. During the next four months, the implied correlation fluctuated at around 0.55, as sterling first rose by another 9% against the Mark and then fell by about the same amount. Finally, in mid September this year, the twelve-month implied correlation rose sharply to 0.75, and remained there for a month before falling back to 0.6 at the time of writing (21 October). There was no sustained move in sterling in mid September, but the rate against the Mark rose sharply as the implied correlation fell on 20–21 October. During the period as a whole, the one-month implied correlation has been much more volatile than the twelve-month implied correlation, though since March 1996 it has fallen below the twelve-month implied correlation by an increasing margin. We discuss the possible interpretation of this in the next section.

Chart 7
One-month and twelve-month implied correlations of $/DM with $/£, and £/DM exchange rate



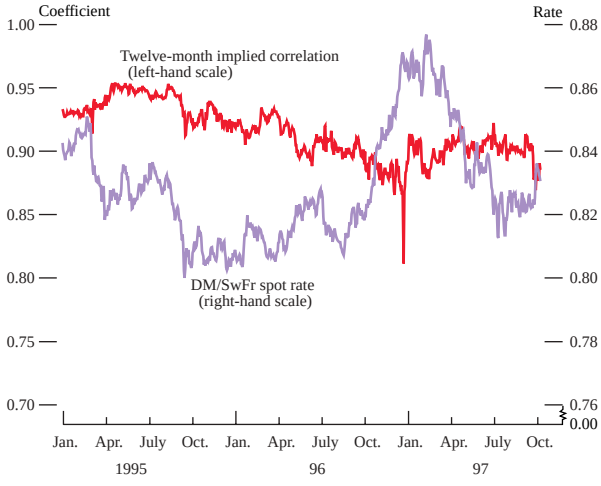
Scenarios (i) to (iii) are consistent with the fall in implied correlation between the Mark and sterling between August 1996 and May 1997. In all three scenarios, sterling's attractiveness to investors increases because they become increasingly confident that it will not be affected by certain kinds of economic and political shock that are expected to affect the prospective members of EMU.

A similar analysis would suggest that, from May 1997 to August 1997, there was no change in how the market expected future news to differentiate between sterling and the Mark, since during that period the twelve-month implied correlation between sterling and the Mark was broadly stable. But it is still possible that shifts in the level of concern about EMU of the kind outlined in scenarios (i) to (iii) contributed in part to the sharp appreciation and then depreciation in sterling during the period. This is because heightened EMU concerns may lead investors to value the already distinctive behaviour of sterling more highly, alongside other safe-haven currencies.

Finally, the sharp rise and then fall in the twelve-month implied correlation between sterling and the Mark between mid September and 21 October is consistent with a rise and then fall in the probability attached by the market to sterling participating in EMU on or fairly soon after 1 January 1999. This is because with heightened expectations of EMU participation, the market should expect the impact of future news—whether EMU-related or economic—on the Mark and sterling to be more similar. The fact that sterling's exchange rate against the Mark remained broadly unchanged during the initial rise in implied correlation in mid September suggests that other influences may have offset the effect of a declining EMU factor during that period.

To compare market perceptions of sterling with other possible diversification or short-term safe-haven currencies, Chart 8 shows the implied correlation between the Swiss franc and the Mark using the US dollar as numeraire, and Chart 9 shows the implied correlation between the US dollar and the Mark using the Japanese yen as numeraire. The expected correlation between the Swiss franc and the Mark has fallen slightly since the start of 1996, but is still nearly 0.9. This may reflect the interdependence between the Swiss and German economies, and may partly explain why the Swiss franc has not experienced trend appreciation in the past 18 months as the start date for EMU has approached. By contrast, the implied twelve-month correlation between the dollar and the Mark has remained roughly constant at around 0.55 since the start of 1996. This means that unlike

Chart 8
Twelve-month implied correlation of $/DM with $/SwFr, and DM/SwFr exchange rate



Forward implied correlations

In the previous box on deriving implied correlations, we showed how it was possible to extract market expectations of the average correlation between two exchange rates for a given horizon using volatility quotes with a matching maturity. Typically, we can observe these quotes for maturities of one week; one, two, three and six months; and one year. Market practitioners call this the term structure of implied volatility. From this term structure we can construct a term structure of implied correlation simply by using equation **(9)** at each maturity. But we may want to know what the short-term correlation is expected to be at some point in the future, rather than an average in the period from now to the future date. In other words, we are interested in 'forward' correlations. Here we describe a method for deriving forward correlation curves that give us this information.

Our approach works in two stages. First we calculate 'instantaneous' forward volatility curves for the three relevant currency pairings. These tell us what the instantaneous volatility of each pairing is expected to be at each point in the future up to one year. Then we use the implied correlation equation—equation **(9)**—in the box on page 414 at each maturity, using the forward volatilities as inputs. This gives us the instantaneous forward correlation curve. This curve should be interpreted as the market's expectation of the instantaneous correlation at each point in the future.

But how do we calculate the forward volatility curves? What is needed is a way to disentangle the implicit volatilities for each sub-period from the volatility quotes we observe. Since volatility changes with time, we need a model that incorporates uncertain time-varying volatility. Here we follow an approach used by Campa and Chang (1995), based on the Hull and White (1987) stochastic volatility model.

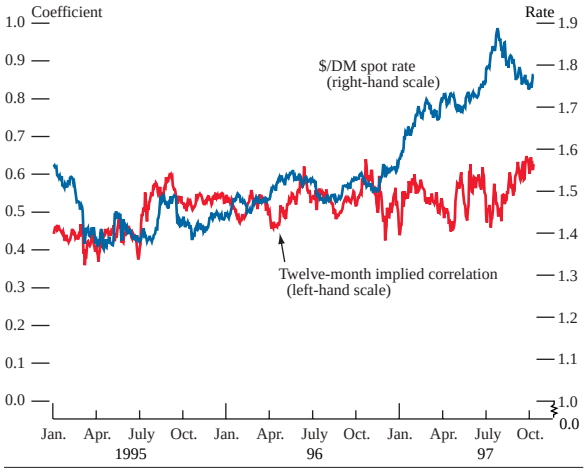
Campa and Chang derive the following linear relationship between per-period expected variances:

$$V_{0,km} = \left(\tfrac{1}{k}\right) E_0 \left[\sum_{i=0}^{k-1} V_{im,(i+1)m} \right].$$

Here, future time is divided up into k sub-periods, each of length m. For example, if we are looking at expectations of volatilities in the next twelve months, and we divide that time up into twelve single-month periods, then $k = 12$ sub-periods and $m = {}^{1}/_{12}$ of a year. $V_{0,km}$ then represents the twelve-month squared volatility and the $V_{im,\,(i+1)m}$ terms represent the individual future one-month squared volatilities. So in this example, the current twelve-month squared volatility equals the average of current and expected future one-month squared volatilities. Now, if we knew what the eleven and twelve-month volatility quotes were, we could infer the expected future (or forward) one-month volatility in eleven months' time simply by rearranging the equation and plugging in the appropriate values.

In practice, we only observe a limited number of maturities for implied volatilities in the OTC market. We do not see, for example, eleven-month volatility quotes. So to exploit this relationship, we first need to interpolate across the term structure of volatility. We do this by employing a cubic spline. Once we have a continuous term structure we extract a virtually instantaneous (rather than a one-month) forward curve by dividing up the

Chart 9
$/DM exchange rate and twelve-month implied correlation of $/¥ with DM/¥



for sterling, there has been no change during this period in the US dollar's safe-haven or diversification characteristics as regards the Mark. But it is also consistent with the dollar appreciating against the Mark in response to a general shift in investor preferences towards currencies offering diversification or safe-haven potential.

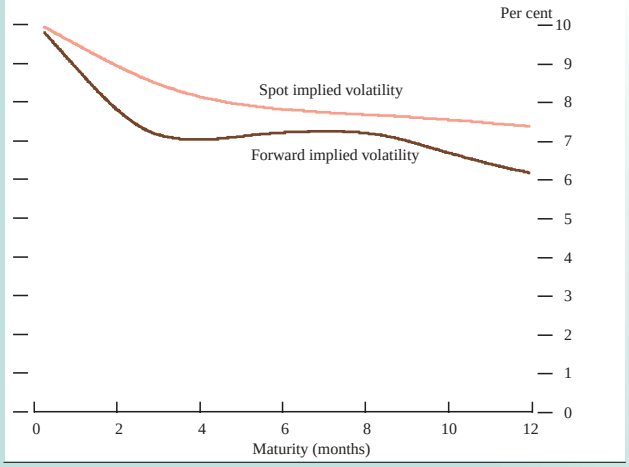
One cannot readily use the information from implied correlations to distinguish between scenarios (i) to (iii). But other market information can help. Chart 10 shows implied forward interest rates in Germany and the United States ten years ahead. Under scenario (ii), weak euro, long-term inflation expectations in Germany (representing the future euro zone) should rise relative to the world level (represented by the United States). But the chart shows that implied forward interest rates in Germany have fallen both in absolute terms and relative to those in the United States since the start of 1996. So it seems very unlikely that long-term inflation expectations for the euro zone have risen.

Under scenario (iii), euro uncertainty, one might also expect some rise in ten-year implied forward interest rates in

future into a very large number of sub-periods—a very high *k*—and employing this relationship recursively across maturities up to one year.

Chart A above plots both the interpolated term structure of volatility (the spot volatility curve) and the forward curve derived from it for £/DM on 2 October 1997. The difference between these curves is that the spot curve gives us the average expected volatility up to a point in the future, whereas the forward curve gives us the instantaneous volatility expected at a given point in the future. This difference is, at least in part, analogous to the difference between zero coupon and implied forward interest rates. And for the same reasons, we should look at the implied forward volatility curve if we want to examine expectations of future volatilities.

Chart A
Term structure of £/DM volatility on 2 October 1997



To generate the implied forward correlation curve, we first need to construct the implied forward volatility curves for the three appropriate currency pairings. For example, if we want to derive the implied forward correlation of sterling and the Mark with the dollar as numeraire, we need the forward volatility curves for the £/US$, US$/DM, and £/DM. Once this is done, all that is needed to generate the forward correlation curve is to use equation **(9)** at each maturity, using the forward volatilities as inputs.

Chart B portrays the implied forward correlation for sterling and the Mark with the dollar as numeraire calculated on 2 October 1997. Of course, it is also possible to calculate a spot correlation curve by using the spot volatilities as inputs. This latter curve should be interpreted as the average expected correlation between the beginning of October and alternative points in the future. The forward correlation curve, on the other hand, tells us what the instantaneous correlation is expected to be at different horizons. It therefore gives us a more easily interpreted measure of how the market expects the correlation between two exchange rates to change over time.

Chart B
Implied correlation of $/£ with $/DM on 2 October 1997

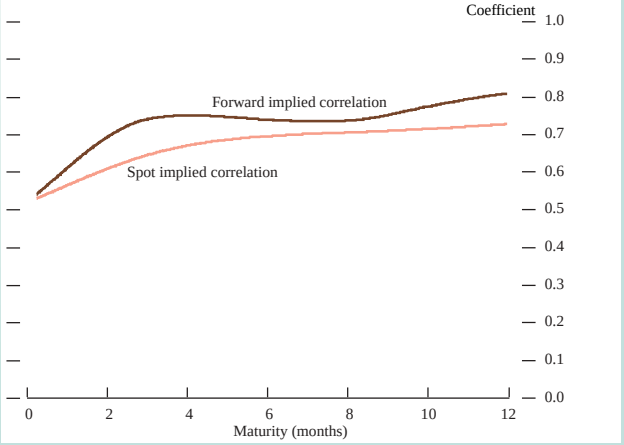
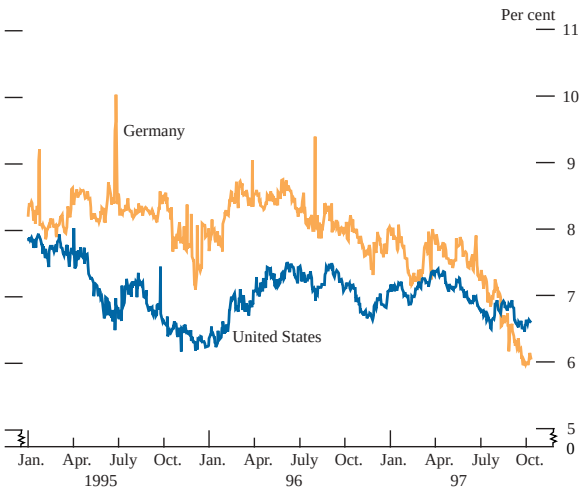


Chart 10
Ten-year forward interest rates for the United States and Germany



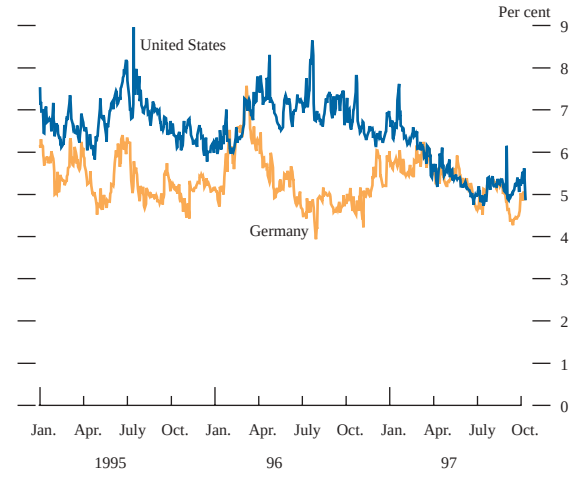
(1) Varying between one and three months.

Germany, to reflect an increased inflation risk premium in euro interest rates. But the size of the change could well be small, and other factors will also be at work. So Chart 10 is less conclusive evidence against this scenario. But one would expect the uncertainty about the future monetary regime for the euro to show up in greater uncertainty about long-term interest rates in Germany. Yet Chart 11, which shows the implied volatility for German Bunds up to a short-term time horizon,(1) suggests that short-term uncertainty about German long-term interest rates has changed little since 1995 and is now at about the same level as in the summer of 1996. In the same period, uncertainty about US long-term rates has fallen somewhat relative to that for German long-term rates, but this does not suggest any significant relative increase in uncertainty about German long-term rates.

Taken together, the evidence from implied forward interest rates and implied volatilities argues against scenarios (ii)

and (iii), leaving scenario (i) as the most likely of the four scenarios proposed above.

Chart 11
Implied volatility of long-term interest rates in the United States and Germany(a)



(a) Derived from front contracts.

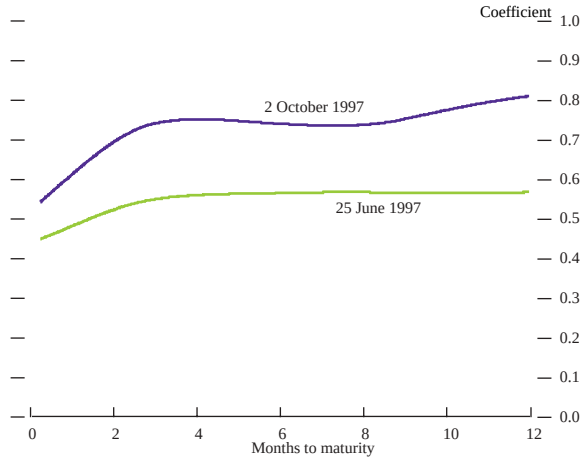
Implied forward correlations

The discussion so far has focused on twelve-month implied correlations. These contain less noise than one-month correlations and also provide more information on market expectations about what will happen near to 1 January 1999. But it is clear from Chart 7 that the relationship between the one-month and twelve-month implied correlations for sterling and the Mark has changed significantly. At the start of 1996, the two measures were equal. But since then, the one-month implied correlation has tended to fall more sharply than the twelve-month implied correlation. What does this mean? Intuitively, the relationship between the two should tell us something about how the short-term implied correlation is expected to evolve. This is because the twelve-month implied correlation reflects the expected average of the one-month correlation during the twelve-month period.

The box on page 420 describes how one can estimate an implied forward correlation curve, showing the expected path of the very short-term correlation between two exchange rates. Chart 12 shows the shape of this curve for the dollar/sterling and dollar/Mark exchange rates on two dates: 25 June 1997 and 2 October 1997. On the first date, the curve has a slight upward slope for the first three months before flattening out. This suggests that future news is expected to have a more divergent impact on sterling and the Mark in the short term than in the longer term. On the second date, the curve has shifted up at all time horizons, but has also acquired a much steeper slope in the first three months.

A possible interpretation for the upward-sloping portion of the curve on both dates is that the market expected euro news to be more significant in the first two to three months than subsequently. In June, when the market

Chart 12
Implied forward correlation curves of $/£ with $/DM on 25 June and 2 October 1997



appeared very confident that sterling would not join EMU at an early stage, the news expected in the near term could have been related to the likelihood of other EU members joining the euro. But on 2 October, in the period of heightened speculation that the United Kingdom might participate in EMU relatively early, the news might also have related to clarification on the United Kingdom's position. At the time, the two to three-month time horizon fitted the Maastricht Treaty requirement for the United Kingdom to decide by the end of 1997 whether or not to exercise its opt-out.

But the main advantage of the implied forward correlation curve as we get closer to 1 January 1999 is that it will soon enable us to estimate the market's expectation of the short-term correlation between two exchange rates for a period starting beyond 1 January 1999. This could then provide the most accurate reading available about which countries are expected to participate in EMU.

Conclusion

In this paper we have described a technique for deriving the expected future (or implied) correlation between two exchange rates up to a twelve-month time horizon. We use this information to obtain a new perspective on market expectations about whether particular EU members will join EMU. This suggests that since the start of 1996, the market has become increasingly confident that EMU will proceed on a broad basis. We also use the technique, together with other information, to derive insights on how speculation about EMU may have contributed to the appreciation in sterling since August 1996. This suggests that a desire for diversification on the part of investors holding what they expect will shortly become euro-denominated assets is the most plausible of the various possible EMU scenarios which have been proposed. Though the technique cannot provide conclusive evidence that one particular scenario or sentiment underlies market expectations, implied correlations can help to pin down more accurately the underlying nature of these expectations.

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The Bank’s regional Agencies

By John Beverly, the Bank’s Agent for the West Midlands.

In this article, John Beverly describes the role of the Bank’s Agencies. He first sets out a brief history of the Bank’s regional representation; the rest of the article outlines the present work of the Agencies within the new monetary policy framework.

The Bank’s early regional representation

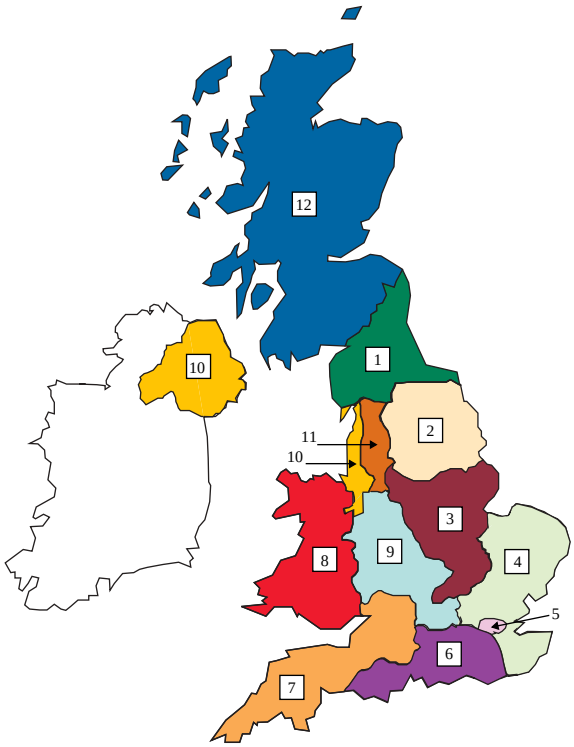
The Bank’s regional representation, which has evolved into the current network of Agencies, began when the first Branches were established in 1826–28 to deal with problems caused by the failure of local banknote-issuing banks.(1) The network of Branches grew and changed during the nineteenth century, but their basic responsibilities were still to provide a banking and banknote distribution service in their areas. An Agent and a Sub-Agent, men of private means with position and influence in the local business community, were appointed by the Governors and Directors to liaise with local industry and commerce on the Bank’s behalf within each Branch area. From early in the twentieth century, Agents and Sub-Agents were drawn from Bank staff. From 1930 onwards, the Agents were required to send Head Office reports drawn from local industrial and commercial contacts. In recent years these reports and the use to which they are put have developed considerably. The Wilson Committee Report of 1980 led, *inter alia*, to the establishment of the Bank’s Industrial Finance Division (now called the Business Finance Division), which was given specific responsibility for the Bank’s industrial liaison activities, including those of the Branches. When the Bank was restructured in 1994, the industrial liaison work was integrated with the Monetary Analysis Divisions of the Bank.

During the 1980s the Glasgow Office(2) and the Liverpool and Southampton Branches were closed, but in each place an Agent and a small team were left in place to continue the industrial liaison work. After a thorough review of the Bank’s regional coverage in 1995–96, it was decided to terminate banking in the remaining five Branches—Birmingham, Bristol, Leeds, Manchester and Newcastle—and to concentrate banknote distribution from London (Head Office and the Printing Works in Debden, Essex) and Leeds. The closure of the Birmingham, Bristol, Manchester and Newcastle Branches was completed at the end of October 1997; each has been replaced with an Agency. Leeds is also now an Agency, with banknote business run as an entirely separate operation.

The present Agencies

The current network of twelve Agencies was completed early this year, when the Agency for the East Midlands based in Nottingham was established. This followed the creation in 1996 of the Agency for Wales based in Cardiff and that for Greater London based in the City of London.

Bank of England’s new Agency network



1 The Agency for the North East and Cumbria.
2 The Agency for Yorkshire and the Humber.
3 The Agency for the East Midlands.
4 The Agency for the South East and East Anglia.
5 The Agency for Greater London.
6 The Agency for Central Southern England.
7 The Agency for the South West.
8 The Agency for Wales.
9 The Agency for the West Midlands.
10 The Agency for the North West (Liverpool) and Northern Ireland.
11 The Agency for the North West (Manchester).
12 The Agency for Scotland.

Each Agency now consists of an Agent, a Deputy Agent and up to two additional team members providing support,

(1) The Branch Banks Committee minuted on 13 January 1826 that the establishment of Bank of England Branches would ‘. . . increase the circulation of Bank Notes, give the Bank much more complete control over the whole paper circulation, and protect the Bank against the competition of larger banking Companies’.
(2) Strictly, the Bank’s representation in Glasgow was an office, rather than a branch, as it never conducted banking operations. It was involved in exchange control work until 1979.

though the South East and East Anglia and Wales Agencies each have two Deputy Agents. The supporting teams are responsible for making appointments, organising events and maintaining a substantial database of contacts. The Agencies are now all linked to London and to each other by an IT system that for the first time gives them direct access to the Bank's Monetary Analysis database. The system has substantially improved the Agencies' access to information and has helped to integrate them more fully with the Monetary Analysis Divisions, assisting them to discharge their economic analysis and representational work. It has already increased the flow and timeliness of briefing material in both directions.

The precise area covered by each Agency reflects economic and geographic considerations. Some of the Agency areas in England are consistent with the official standard planning regions. Agencies are centred on the principal metropolitan and business centres, and there has been an attempt to ensure a reasonable coverage for each Agency in terms of a proportion of UK GDP. The map shows the areas currently covered by each of the twelve Agencies.

Work of the Agencies

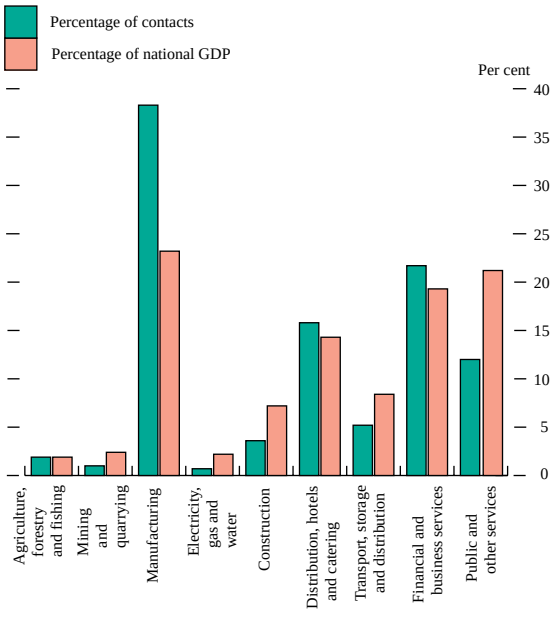
The role of each Agency is to maintain contact with industry and commerce and to report on the economy as seen by those based in its area. In doing this, the Agencies also represent the Bank and explain the Bank's work and policies. The economic intelligence role is developing, not least in the context of the new Monetary Policy Committee, as outlined later in this article. The Agencies play an important part in enabling the Bank to collect 'proper regional and sectoral information for the purpose of monetary policy formation' (as required by the Chancellor's letter to the Governor of 6 May 1997,(1) which sets out the Bank's role in the new monetary policy framework).

The Agencies report monthly on economic conditions. Their reports are not restricted to regional information, as their contacts' business is often national and international. The Agencies' reports are used by the Monetary Analysis Divisions to provide an up-to-date account of economic activity, complementing information from aggregate statistics and surveys. The reports cover demand, both domestic and export, costs and prices, labour and pay issues and investment and financial matters, and are based on discussions with a wide range of those active in the economy, covering manufacturing and services in both the private and public sectors.

The Agencies carry out most of their economic intelligence work through face-to-face contact with individual companies, who know that the confidentiality of sensitive information will be protected. The Bank's new independent role in monetary policy has further encouraged contacts to welcome dialogue with Agencies. This contact is supplemented by involvement with a range of business organisations—regional CBI Councils (many Agents attend meetings), Chambers of Commerce, Training and Enterprise Councils, Business Links—and other sources of information, including universities and the press. Every month each Agency makes direct contact with around 50 firms, either through company visits or at various functions, in addition to numerous telephone calls. Agencies maintain standing panels of business people whose views about the economy are regularly canvassed. These can serve as control groups, whose discussions help to identify changes in trends.

The Agencies aim to maintain a contact base that is broadly representative of the regional economy, working to profiles based on the standard planning regions most relevant to their areas. This is a benchmark rather than a constraint, and the Bank's contacts do not fully mirror the sectoral breakdown of UK economic activity. There is of course interdependence between the various economic sectors; coverage of, for example, manufacturing may provide information about spending on business services. Some of the historical under-representation in the service sector (now being addressed) is attributable to the limited contact that Agencies have had with some of the public services such as public administration and health, which account for around 20% of GDP. (A number of Agencies do have contact with, for example, NHS health trusts.) Many firms in the service sector are multi-establishment businesses, and contact with one establishment or regional office will give effective coverage of a large part of the business, defined in terms of contribution to GDP. Some service sector areas are dominated by very small firms where direct contact is either difficult or impractical and where Agencies seek information from various business groupings.

The Agencies' contact base



A great deal of contact is with large and medium-sized companies. All Agents also have a significant number of contacts with small companies. It is often most efficient to contact small firms via Chambers of Commerce, small-firm

(1) Reprinted in the August 1997 *Quarterly Bulletin*.

associations and enterprise agencies; banks and accounting firms are also a good source of information about small company trends.

The Agencies' confidential monthly reports are based on contact with a cross-section of companies in terms of sector, location and size. The reports set out the Agencies' general assessment of economic conditions, together with points of interest to illustrate or widen understanding of particular topics highlighted by Head Office. The Agencies also provide numerical values for trends in output, export demand, costs and prices etc. In addition to this, Agencies provide ad hoc information (including reports on wage settlements) to assist economic analysis in Head Office. This work has now been developed significantly in the context of the Monetary Policy Committee.

Agencies' surveys

Since the Monetary Policy Committee was established in May 1997, the Agencies have contributed information on particular topics in addition to their monthly reports.

After discussion with the economists in Head Office, a topic of current importance on which the Monetary Policy Committee would welcome detailed information is identified each month. Specific questions are agreed and all the Agencies approach contacts to seek their insights. The questions may be posed as part of planned meetings, special meetings may be arranged, questionnaires may be sent to a number of contacts, or the topic may be discussed on the telephone. Though the numbers vary from survey to survey, well over 100 responses are obtained each month—nearly 150 for the survey on trends in imports. In this way, during a period of a couple of weeks, systematic information is obtained on a national basis. The results are then analysed by one Agent who, accompanied by two other Agents, makes a presentation to the Monetary Policy Committee at the briefing meeting that begins the monthly round. The Agencies rely on co-operation from their contacts and this has been readily given. At the same time, Agencies are conscious of the need not to make excessive demands for information. Surveys to date have covered trends in business margins, in export orders, in investment, in import penetration and in pricing. The topic for the November Monetary Policy Committee is service sector growth.

These arrangements have given the Monetary Policy Committee access to an additional source of regional and sectoral information, and have integrated the Agencies more fully into the process of formulating monetary policy.

Each month, Monetary Analysis produces a confidential Agents' National Summary, which provides an assessment of the real economy based on the twelve Agencies' reports but without identifying contacts. Since 1996, a quarterly Agents' Summary of Business Conditions has also been published,(1) but with any confidential material removed. This document contributes to greater transparency of policy-making and demonstrates to Agency contacts how their information is used.

Agents and Deputy Agents have found that their work of explaining the Bank's policies has grown. The Bank's role in monetary policy changed with the adoption of an inflation target in late 1992, after sterling's withdrawal from the ERM. The Agencies have been responsible for explaining the objectives of the monetary policy actions taken to achieve the target, and their reports and analysis have been used in the process of compiling the quarterly *Inflation Report*, which has become a central part of the monetary policy process. In addition, they have taken on a major role in speaking about the development of the European single currency as part of the Bank's work to inform, explain and stimulate necessary preparation. This representational role is of considerable importance as part of the greater openness and transparency of monetary policy. It also helps to open up new sources of economic information. The Agencies can contribute most effectively to economic intelligence if they are, and are seen to be, significant and active members of their local communities. They have also continued to be involved in issues of industrial finance, particularly but not exclusively those affecting small firms, in support of work undertaken by the Business Finance Division. Agents have been involved in discussions leading to the formation of Regional Development Funds. Their discussions with contacts include coverage of issues relating to corporate finance and governance.

The Agencies' role in monetary policy

The Agencies' links with the Monetary Analysis Divisions of the Bank have helped to integrate their work more fully into the analysis that underlies monetary policy decisions. At the same time, they have ensured that their London colleagues receive a regular flow of information from their contacts about trends in their business ahead of the publication of official statistical evidence, and with insights clarifying, contrasting or contradicting available data. The two-way flow of information is essential to achieving understanding and acceptance of a monetary policy that is informed by a recognition of how business people are responding to economic conditions.

The role of the Agencies has been further enhanced by the establishment in May 1997 of the Bank's Monetary Policy Committee, which decides on the level of short-term interest rates. A few days before each of its meetings, the Committee holds a briefing meeting with Bank staff to review in depth all the available information about the

(1) Published with the *Quarterly Bulletin*.

economy, including material drawn from the Agents' reports. Three of the twelve Agents contribute to each briefing meeting; one of them presents information on a particular topic collected by all the Agencies (see the box opposite). The Agencies have undertaken particular surveys of the impact of sterling's strength on exports and imports, on trends in margins, on investment plans and on developments in the labour market. These exercises, which have been additional to the regular reporting, but which draw on the existing contact base, have materially added to the Bank's insights into particular aspects of economic performance. Clearly the Bank is dependent on its contacts and is anxious not to over-burden them. At the same time, contacts value the opportunity to make their views known to regionally based members of the Bank. The response rate to such Agency surveys is high, reflecting the Agencies' close relationship with their business contacts. In this way, the Committee is able to use up-to-date information in its interest rate policy review and can question the Agents about the economy and the impact of policy on their contacts' business.

Assessment of the Agencies' contribution

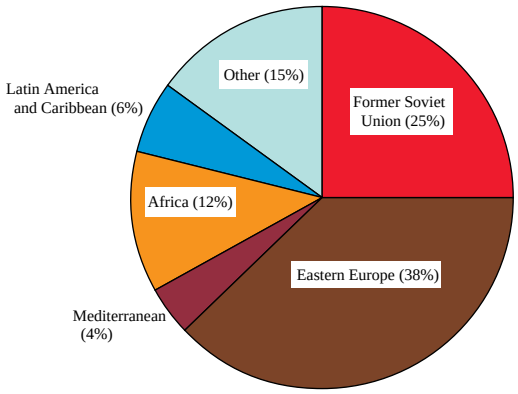
The distinctive contribution that the Agencies make comes from their first-hand contact with a wide range of business people. These contacts, carefully fostered over the years, provide the Bank with a regular flow of up-to-date economic news that complements the published statistics. The Agencies are able to pick up developments of local significance and, by comparing these local reports, Monetary Analysis is able to form a balanced picture of what is happening in the economy as a whole.

The Agencies' work is still evolving and efforts are being made to make reporting ever more useful to the Bank's analysis. A regular assessment of the Agencies' work is undertaken; a recent assessment showed that the Agents have been able to help explain economic trends and have provided additional insights, for example distinguishing between the trends in sales growth for large and small retailers. Improvements in the format of reporting have helped maintain consistency among Agencies. An apparent bias towards manufacturing contacts—which was evident a few years ago—is being addressed through the development of many more contacts in the service sector. This is taking time, but coverage now more closely reflects the weight of service sector activity in the economy. Manufacturing, of course, remains very important. It is clear that the Agencies may also be able to do more to draw out inter-regional comparisons. Comparisons of local trends with the overall national picture are helpful and may become more so in the context of the development of Regional Development Agencies.

The Bank's Centre for Central Banking Studies—an update

The Bank's Centre for Central Banking Studies (CCBS), established in 1990, offers technical assistance, training, workshops, seminars and comparative research on and for central banks throughout the world. Initially, the CCBS concentrated on the needs of Eastern Europe and the former Soviet Union (FSU) as they grappled with the early stages of market-based reforms; but though this region still accounts for perhaps half of its efforts, the CCBS has increasingly widened its 'target market'. The pie chart gives an indication of the regions covered by CCBS activities.

CCBS activities by region, 1996–97



The pie chart shows the regional breakdown of participants in CCBS London-based courses during the past two years. Some 900 participants have been on CCBS courses in this period; overseas courses organised by the CCBS account for a similar number of participants, with a similar regional breakdown.

The bulk of CCBS activities are funded by the Bank, but it does receive some financial support from the government's Department for International Development, in particular the Know How Fund, which targets Eastern Europe and the FSU; and from the European Union's TACIS and PHARE projects. The CCBS does not, of course, function in isolation: it co-operates with other donor central banks and with international institutions such as the IMF, in order to ensure complementarity and mutual support rather than overlapping of functions. It is also prepared to work with private sector and academic institutions.

1998 programme

In 1998, the CCBS will offer four distinct but related products: seminars in London, courses abroad, and technical assistance, all largely targeted at central bankers from transitional and developing economies; and academic workshops and projects that enable the Bank of England's own staff to work with central bankers throughout the world on comparative studies. Details of the London programme and of CCBS activities more generally can be found on the Bank of England's website (http://www.bankofengland.co.uk).

Aims of CCBS

The primary aims of the CCBS are to foster monetary and financial stability worldwide (thus promoting the Bank's core activities), in particular by working with developing and transitional economies; and to provide opportunities for Bank staff to obtain broader perspectives on their own areas of expertise. In fulfilling its goal to be recognised internationally as a leading centre of intellectual excellence for the study of central banking, the CCBS aims to attract first-rate individuals for short-term secondments both from within the Bank of England and from other central banks, for comparative and collaborative research on the unique issues and problems facing central banks in present and future environments.

Technical assistance: the CCBS endeavours to meet requests for technical assistance from central banks in transitional and developing economies. Its efforts are focused tightly on those areas in which it has a clear comparative advantage in terms of specialised knowledge and experience.

Training: the CCBS responds to requests from central banks in transitional and developing economies for training at home and abroad. Again, it screens requests and targets its efforts to maximise the effectiveness of its training in achieving its primary aims.

Studies: to provide first-rate technical assistance and training, the CCBS enhances its human capital through research activities. Again, the CCBS exploits fully the Bank of England's comparative advantages by concentrating on topics closest to specific central bank operations. It collaborates with other central banks to produce comparative analyses of such specific central bank activities in OECD, transitional and developing countries.

Though the Bank of England's responsibility for banking supervision is to be transferred to the Financial Services Authority, and that for debt management will be undertaken increasingly by the new Debt Management Agency responsible directly to the Treasury, the CCBS will for the immediate future continue to include these topics within its programme of teaching and technical assistance. The academic workshops will, however, be closely focused on monetary policy and operations, the Bank's key areas of responsibility.

Academic workshops and projects

The CCBS is inaugurating a series of academic workshops, starting in January 1998. It will invite 15–20 central bankers to prepare case studies on some specific, relevant and mutually agreed aspect of the chosen topic relating to their own country. The workshop participants will discuss these case studies within an analytical framework and draw lessons from the comparative experience. Three or four of those invited for the workshop will also be invited to participate in a three-month follow-up project, for which one or two Bank of England staff with relevant expertise will be invited to become team members on short-term secondment. The output from these projects will take the form of a monograph, *Handbook*, journal article or manual.

The planned topics for 1998 are:

- Payment and settlement systems: new developments, new problems, and their implications for financial stability and monetary policy implementation.
- Information content of secondary market activity for monetary policy purposes.
- Choice of intermediate monetary policy targets in industrial, transitional and developing economies.

Handbooks in central banking

In 1996 the CCBS initiated the publication of a series of *Handbooks* in central banking. There are now fourteen titles in the series; details, as well as the full text of the *Handbooks*, can be found on the Bank's website. In order to make these *Handbooks* more widely accessible, they have all been translated into Russian; the first ten have also been translated into Spanish.

Current titles are:

1 Introduction to monetary policy;
2 The choice of exchange rate regime;
3 Economic analysis in a central bank: models versus judgment;
4 Internal audit in a central bank;
5 The management of government debt;
6 Primary dealers in government securities markets;
7 Basic principles of banking supervision;
8 Payment systems;
9 Deposit insurance;
10 Introduction to monetary operations;
11 Government securities: primary issuance;
12 Causes and management of banking crises;
13 The retail market for government debt;
14 Capital flows.

Prospects for the City—in or out of EMU

*The **Governor**[1] reviews the outlook for the City in the context of EMU, stressing that whether or not the United Kingdom participates in the first wave, all EU countries have a strong collective interest in maintaining a constructive and co-operative environment throughout the European Union. The **Governor** notes that the City's current strength as a financial centre depends on a range of factors other than the national currency; nevertheless, he stresses the need for the City to be well prepared to take advantage of the opportunities that the euro will bring.*

Mr Chairman, you have asked me to speak specifically about 'the prospects for the City—in or out of economic and monetary union (EMU)'. You—very kindly, under recent circumstances—did not ask me to discuss the wider pros and cons, either of the project as a whole, or of UK membership. But perhaps I might nevertheless begin by making a more general point.

Perfectly reasonable people can legitimately disagree about EMU, both in principle and about the appropriate timing and pace of monetary integration. On the project as a whole, most analysts would acknowledge that there are real potential benefits, but that there are also real risks to be set against them; and most would acknowledge that these risks will increase if the politics of EMU are allowed to run ahead of the economics, so that countries are allowed, or even encouraged, to participate without first having achieved genuine and sustainable economic convergence—in substance and not just in some technical accounting form. On the question of British membership, the new Labour Government has spoken of 'formidable obstacles' to this country joining EMU in the first wave. But one thing is clear: everyone, 'in' or 'out', has an unambiguous interest, if EMU does go ahead, in doing everything we can to make it a success. And it is equally clear that those countries that participate in monetary union have a similar unambiguous interest in the economic prosperity of countries remaining, at least for the time being, on the outside.

Larry Summers, the Deputy Secretary of the US Treasury, writing about EMU in the *Financial Times* on Wednesday, said:

> 'The US is well served when Europe is vibrant economically and working to open its markets and strengthen its ties with the global economy'.

He might have been speaking for all of us here in Europe, 'in' or 'out', recognising that we have a mutual, and reciprocal, self-interest in each other's economic well-being. So my general point is this. Whatever the outcome on EMU, it is vitally important that we continue to maintain, and strengthen, positive and constructive relationships throughout the EU area—and indeed beyond—in our national and collective interests.

For the United Kingdom, in particular, if we were to opt out of the first wave, this certainly means that during our EU Presidency, during the critical first half of next year, we must—as I am quite confident we shall—do everything we possibly can to ensure that the procedures leading up to the historic decisions run smoothly, and that the decisions themselves are timely and harmonious. But beyond that, it certainly also means that 'outs', or potential 'pre-ins', should not attempt to exploit any perceived—and certainly short-term—advantage from the additional policy freedoms they might have on the outside, but should, for example, persist in macroeconomic, fiscal and monetary, discipline in parallel with the EMU countries. It also means that the 'in' countries, for their part, have an identical self-interest in maintaining an open and constructive relationship with the 'outs'/'pre-ins'. Otherwise we would all be cutting off our nose to spite our face.

I make this general point, Mr Chairman, because this context seems to me to be relevant to any assessment of the economic prospects, of the economy as a whole or of any particular sector, inside or outside the euro area. In the rest of my remarks I assume that, 'in' or 'out', we shall be operating within a constructive, co-operative, environment throughout the European Union, for the powerful reason that this is in everyone's interest.

Against that background, let me turn to the prospects for the City.

I shall, in fact, concentrate on the case in which the United Kingdom does not participate in EMU in the first wave, because in the alternative case, the United Kingdom 'in' scenario, though there may be uncertainty about the overall macroeconomic implications, there is little reason to suppose that there would be any adverse implications for the

(1) In a speech at the Royal Institute of International Affairs Conference on Friday, 24 October 1997.

City in particular. The only possible disadvantage I see would result from the imposition of onerous regulatory or financial burdens—for example, onerous minimum reserve requirements—that might distort activity within the financial sector and/or drive it outside the euro area altogether.

So what then are the prospects for the City if the United Kingdom is, initially, 'out'?

The current strengths of the City—as a uniquely international, rather than simply a national or regional European financial centre—will be familiar to you. They include a vast, critical mass of markets and financial services in commercial and investment banking, securities and derivatives activity, investment and fund management, insurance and commodities and so on, involving an extraordinary concentration of the strongest financial businesses from all around the world. To give just one example, uniquely among the major countries we have more overseas-incorporated banks than domestic banks operating in our financial centre, and more than one half of the total deposits of the UK banking system is denominated in foreign currencies, worth more than £1 trillion—that's a one and twelve noughts—notwithstanding the current strength of sterling.

The particular strengths that have contributed to this massive concentration of international business are many and various. They include the English language; the convenient time zone; the ready availability of the relevant trading and other financial skills, as well as professional support services—in law, accountancy, tax, property, communications and so on. They include effective infrastructure. And they include importantly, too, an adaptive regulatory framework, which has in fact been remarkably successful in maintaining confidence in financial institutions and markets without stifling innovation and risk taking. All of these factors—and no doubt others—help to explain why some 600,000 people are estimated to be employed in finance and other business services in Greater London—a number that I believe is roughly equal to the total population of Frankfurt.

Now you will have noticed that none of these factors has anything to do with the question of the national currency used either here in the United Kingdom or in continental Europe.

The main impact of the advent of the euro on financial activity, as I see it, is that it will encourage the development of broader, deeper and more liquid markets in financial instruments of all kinds, where they are currently fragmented because they are denominated in the various individual national European currencies. The City of London thrives on liquid markets regardless of the currency —and it will thrive on the euro, whether the United Kingdom is 'in' or 'out'. Measured in these terms, the introduction of the euro represents an opportunity for London rather than a threat. I have no doubt whatever that there will be a vigorous euro-euro market in London, come what may, just as there is a vigorous market in euro-Deutsche Marks or euro-francs as well as eurodollars and euro-yen at present. The reality is that the location of financial activity does not depend upon the local currency. It will continue to be carried on wherever it can most conveniently, efficiently and profitably be carried on. And the fact that foreign-owned institutions—from Europe itself and from around the world—continue to build their presence here, despite the near-universal assumption that the United Kingdom will not in fact participate in EMU from the beginning, suggests that they share this perception.

I would hope that the rest of Europe would positively welcome the contribution that the City can, and I am confident will, make to the development of markets and other financial activity in the euro, because it is in their interest too. International or intra-regional trade and investment activity is not, at the macroeconomic level, a zero-sum game. It is a positive-sum game. And this is true of financial, just as much as of any other kind of economic activity. The prosperity of the City—whether the United Kingdom is 'in' or 'out'—is simply a particular case of the general point that I made at the outset. I welcome the prospect of increasing financial activity in Frankfurt, Paris, Milan or Amsterdam or wherever, because it will result in increased activity here too in London. And the converse is equally true. It is in this sense that the City is a major European, not simply a national asset.

Now some people may argue that 'offshore' markets in national or regional currencies complicate the conduct of national or regional monetary policy, with the implication that national or regional currencies should somehow be confined to their national or regional space. I must confess that this view seems to ignore the fact that it has in practice during the past 20 or 30 years proved perfectly possible for monetary policy to be conducted successfully despite the existence of the euro markets. And I do not see how one could realistically expect to contain the use of a major currency, which the euro will certainly be, within territorial borders.

But as I have made clear, the United Kingdom's interest—'in' or 'out'—lies unambiguously in doing all that we can to ensure that the single currency succeeds. And in this context we would, of course, co-operate with the ECB in any way we could, to avoid potential disturbance to European monetary policy, were this to occur.

Mr Chairman, London does not hold its pre-eminent position as Europe's major financial centre as of right. We must continue to earn it. If we are to take advantage—'in' or 'out'—of the opportunity that the euro will bring, then we must be technically well prepared.

We shall be.

There is increasing evidence that financial institutions in the United Kingdom are now taking the necessary steps to

ensure that they are ready for the introduction of the euro, whether or not the United Kingdom joins EMU. In the early summer, we invited a representative sample of firms to confirm whether their preparations were on track. The response we received was broadly reassuring, though some of their preparations are dependent on decisions about the euro markets that have yet to be taken, as I shall explain in a moment. But the key point is that the urgency of the need to prepare is now widely recognised.

The Bank of England is playing a substantive role in the preparations in two complementary ways. Through our very active participation in the work of the EMI, we aim to make sure that the design of EMU, at least so far as the operations of the ECB are concerned, is capable of being delivered in a technical sense. This is the test that we have applied, for example, to the work of the EMI on the implementation of monetary policy and on the so-called 'changeover scenario'.

Our other role is to co-ordinate the preparations for the introduction of the euro in the City of London, to the extent that co-ordination is required. The Bank's role in helping the financial sector to prepare for the euro was recognised and reaffirmed by the Chancellor this summer, when he launched his complementary initiative to begin preparing the business community for the euro. In addition to making our own internal preparations at the Bank, we play a co-ordinating role in the financial community in three main ways:

- First, our job is to ensure that the necessary infrastructure is developed in the United Kingdom to allow anyone who wishes to do so to use the euro in wholesale payments and across the financial markets in London from the first day of EMU.

- Second, we aim to promote discussion between the EMI, national central banks and market participants across Europe about practical issues on which the market is seeking a degree of co-ordination.

- And third, we provide information: for example, through our quarterly series of editions on *Practical Issues Arising from the Introduction of the Euro*,(1) which is distributed to around 32,000 recipients across the City and beyond, including 4,000 directly abroad. And following the successful symposium we held early this year, we are planning to hold a further symposium next January at the Bank, on London as the international financial centre for the euro. Our theme will be: 'London will be ready'.

I shall now turn to the steps that we are taking to ensure that London will be ready for the euro, whether the United Kingdom is 'in' or 'out'.

(i) Payments and settlement infrastructure for the euro

First of all, the payments and settlement infrastructure. We are constructing payments arrangements in euro in London that we intend to be at least as efficient and cheap as anywhere else in Europe, even if the United Kingdom stays 'out'. In the United Kingdom, the real-time gross settlement system that came into operation in the spring of last year is being developed so that it will operate in euro. If the United Kingdom joins, the UK sterling system will effectively become a euro system. And in case the United Kingdom is 'out', a parallel euro system is under construction to sit alongside the sterling system: it will enable the members of CHAPS to process euro payments as a foreign currency within the United Kingdom and across borders within the European Union, through its link to the pan-European RTGS system—TARGET—that is being developed.

The idea behind TARGET is to link together in euro the national RTGS systems of EU Member States, so that large-value payments can be made or received between Member States throughout the EU area, with finality in real time, in exactly the same way as they can at present be made and received within Member States with national RTGS systems denominated in their own national currencies. One of the main purposes of TARGET is to support closer European economic and financial integration by reducing the risks in pan-European payments—just as national RTGS systems reduce the risk in national payment systems. The other main purpose of TARGET is to integrate the euro money market so as to ensure that the same short-term euro interest rate—determined by the single monetary policy of the ECB—prevails throughout the euro area. TARGET is a project that we strongly support.

It has been agreed that all EU Member States may connect their national RTGS systems to TARGET, whether or not they join EMU. The main policy issue outstanding concerns the terms on which the European Central Bank will grant intraday credit to the 'outs'. We see no monetary—or other—grounds for any discrimination against the 'outs'. If intraday liquidity to the 'outs' were to be restricted, the effect would be to increase the cost of using TARGET, and to damage the efficiency of the system for both 'ins' and 'outs'. That would simply divert euro payments to alternative mechanisms, including correspondent banking and the EBA's net end-of day settlement system. It would be unlikely significantly to deter the international use of the euro—if that were the objective—any more than lack of direct access to national RTGS systems deters the international use of the dollar or yen or Deutsche Mark now. Its main impact would be to make intra-European payments less secure. We would regret that.

Besides payments systems, the preparation of securities settlement systems for the introduction of the euro is a complex task in its own right. One of the reasons for this is

(1) Available from Public Enquiries at the Bank of England on 0171-601 4012.

that there are different approaches to securities settlement between different Member States and financial institutions. Another is that different approaches may be required to meet issuers' requirements for re-denomination. Even in one market in one country, the introduction of major changes in securities settlement systems can lead to teething problems, both in the central IT infrastructure and for individual institutions, as they learn how to apply the changes. Yet in the case of EMU, a number of Member States will switch to the euro more or less simultaneously at the start. This carries considerable risks of confusion and error, unless there is an extensive programme across Europe to explain the changes required in detail first. This is not, of course, a problem only for the United Kingdom.

(ii) Market framework for the use of the euro

The second important aspect of preparation is the development of a comprehensive market framework for the use of the euro in London. The euro Regulations help to provide the legal part of the framework.

To make sure that the euro market in London, as elsewhere in Europe, is as deep and liquid as possible, we also need to harmonise market conventions on new issues of securities in the euro money and bond markets, and conventions in the foreign exchange markets. Market associations now agree on the basis on which conventions in these markets should be harmonised, and the Bank has encouraged their initiative. The problem has been to see how EU-wide decisions will be taken. Harmonised practices may develop spontaneously in the markets, but there is no guarantee of this. So it is very helpful that the EMI Council decided with our encouragement in September to 'welcome and support' harmonised market conventions on the basis proposed by the market associations. We also welcome the EMI Council's decision in September to prepare for the computation by the ESCB of an effective overnight reference rate for the euro area.

There remains, however, a good deal to be done everywhere—in co-ordinating price sources, for example, as methods of re-denomination. But in all of these respects, London is well up with the game.

Conclusion

Mr Chairman, it is sometimes suggested that a perceived threat to its activity if we were 'out' will cause the City to press for early UK membership of EMU, and that this will be an important factor in the Government's decision. I am bound to say that I see very little sign of this. Certainly there are those in the City who advocate our early participation, but there are equally those who are more hesitant—just as opinions are divided elsewhere within the country. But for the most part, my impression is that City attitudes to EMU, whether for or against, reflect a broader assessment of the respective pros and cons for the country as a whole, rather than strong views about the implications for the City in particular. On the whole, I find that City opinion is relatively optimistic about its future prospects, 'in' or 'out'. And provided that we do indeed operate within a co-operative framework, and provided that we are indeed well prepared, the City has good reason to be optimistic.

The inflation target five years on

The introduction of an inflation target was announced five years ago. In this speech,[1] *Mervyn King outlines the use of inflation targets since then, reviewing the experience of inflation-targeting countries, and discussing the charge that inflation targets ignore output. He explains the role of inflation forecasts and stresses the importance of transparency and accountability. Mervyn King concludes that inflation targets, the Bank's* Inflation Report *and other aspects of the new monetary policy framework represent significant and successful developments in central bank operations in the 1990s.*

Tonight we celebrate two birthdays. The first is the tenth birthday of the Financial Markets Group (FMG) here at the LSE. Its aim, then as now, was to promote research into the link between financial markets and the real economy. That is what central banks are about. When Charles Goodhart and I talked to David Walker in 1986 about setting up such a group, none of us envisaged the breadth and depth of the research that was to emerge over the subsequent decade. Comparing the first *Annual Report*, which I wrote, with the latest *Report*, it is clear that the FMG has never been in such good shape. Like most successful teams, its strength has been its ability to find outstanding young players who have come through their apprenticeship as research students and joined the first team as leading academics, both in the United Kingdom and abroad. This flowering of talent in the FMG is in large part because of the hard work and leadership of David Webb during the past six years. Throughout that time, David has been able to rely on the guiding hand of Charles Goodhart, and a series of outstanding chairmen of the Group's Steering Committee: David Walker, without whom the Group could not have been set up, Rupert Pennant-Rea and now Brian Quinn. The highly successful interaction between the private sector sponsors and the public sector researchers has provided a model which, prompted by the ESRC, has been followed by other groups.

Tonight, though, we celebrate another birthday. Five years ago this month, the then Chancellor, Norman Lamont, in the wake of our departure from the ERM, announced his intention to introduce an inflation target. In the weeks immediately following our departure from the ERM, Britain had a floating exchange rate and no nominal anchor for the price level. Such an anchor was urgently needed. In October 1992, the Chancellor wrote to the Chairman of the Treasury and Civil Service Committee setting out a new framework for monetary policy consisting of two features. The first was an explicit inflation target. Initially this was a range of 1%–4%, with the aim of bringing inflation down to within the lower part of the range by the end of the Parliament. The second was a much greater degree of openness and transparency in the conduct of monetary policy. And it is five years to the day since substance was given to this idea, when Mr Lamont announced in his Mansion House speech that the Bank would be asked to publish an independent *Inflation Report* in order 'to make the formation of policy more transparent and our decisions more accountable'. So the *Inflation Report* was launched publicly five years ago tonight.

The further radical changes to the Bank of England and the monetary policy framework announced by Gordon Brown in May this year draw a clear distinction between the Chancellor's responsibility for setting the inflation target and the responsibility of the Bank's new Monetary Policy Committee (or MPC for short) for ensuring that interest rates are set so as to hit that target. In the jargon, this distinction is between goal independence and instrument independence. The government sets the goal and the MPC sets the instrument. This division of labour is embodied in the Bank of England Bill, which was laid before Parliament yesterday afternoon.

The inflation target remains firmly at the centre of the monetary framework. In his letter to the Governor on 6 May, the Chancellor wrote that 'the monetary policy objective of the Bank of England will be to deliver price stability (as defined by the Government's inflation target)'. The Chancellor subsequently set the inflation target at 2½%, as measured by the increase in the RPI excluding mortgage interest payments over the previous twelve months—known as RPIX inflation. The inflation target will be reviewed by the Chancellor annually at the time of the Budget, though the presumption is that it will not be changed during the present Parliament.

The painful experience of the transition from the strict rules of the gold standard to the discretionary management of inconvertible paper money—described by Marvin Goodfriend of the Richmond Fed as a '20th century odyssey'—has led to the modern consensus that price stability is the overriding objective of monetary policy. An explicit recognition of this consensus is the move in the 1990s towards formal inflation targets. Such targets were first introduced as an anchor for monetary policy in New Zealand in March 1990, and in Canada in February

(1) Given at the London School of Economics on Wednesday 29 October 1997 to mark the tenth anniversary of the LSE Financial Markets Group.

1991. But it is over the past five years that the idea has not only been adopted more widely, with some eight countries now basing their monetary policy on an explicit inflation target, but has been seen as an alternative intellectual framework for monetary policy. There are conferences on inflation targets. There has been an increase in the number of academic papers on inflation targets. And it has become a popular recommendation by the IMF to countries in need of advice. In fact, inflation targets have been all the rage in the 1990s and they are as fashionable now as the idea of monetary policy credibility was in the 1980s. An analysis of the number of articles published with the phrase 'monetary policy credibility' in their title shows an increase from 4 to 48 articles between the first and second half of the 1980s. A similar phenomenon has occurred with inflation targeting. Prior to 1992, only 13 academic articles had been published that included the phrase 'inflation target(ing)' in the title. In the subsequent five years, that number increased fivefold to 68.(1)

Why has the popularity of inflation targets spread, how do they work, will they survive, or is this just a fad? In this lecture I shall try to answer six questions:

1 Is inflation targeting new?

2 What has been the experience of countries with inflation targets?

3 Does an inflation target mean that monetary policy ignores output?

4 What is the role of inflation forecasts?

5 Why is openness and transparency important?

6 How will the new Bank of England be accountable?

Is inflation targeting new?

Though inflation targets have been the fashion of the 1990s, the idea that policy should explicitly target the price level has a long and respectable pedigree. Both Irving Fisher and John Maynard Keynes advocated targeting a price index, and in the 1930s, following the earlier writings of Wicksell, Sweden adopted a price target, thus avoiding the worst of the depression when the gold standard collapsed.

The benefits of price stability—the avoidance of both inflation and deflation—have long been well understood, if overlooked for much of the post-war period. Inflation targets have the great advantage of focusing attention on the objective that monetary policy can achieve in the long run, namely price stability. The benefit of increasing the transparency of monetary policy is an issue to which I shall return later. But in a deeper sense, an inflation target is no more than a way of restating the fact that any monetary policy faces two tasks. The first, and overriding, objective is to hit the desired level of inflation in the medium to long run. The second is to avoid damaging fluctuations to output and employment—the 'boom and bust' syndrome—by adjusting interest rates in the face of unexpected shocks to the economy.

It is possible to show rigorously, within the context of a simple model of aggregate demand and supply, that any monetary policy can be expressed as a 'monetary policy reaction function' that describes policy in terms of two variables.(2) The first is an *ex ante* inflation target, defined as the value of the inflation rate that the central bank would like to achieve in the absence of any shock to the economy. The second is the discretionary response by the central bank to the observed shock. In this sense, an inflation target is not a particular way of setting monetary policy; rather, it should be seen as a generic form encompassing different monetary policy regimes as special limiting cases.

To see this, compare an inflation-targeting regime with a regime based on monetary targeting. Both regimes incorporate an inflation target (either implicitly or explicitly) as the ultimate objective of policy. And given the transmission lags in monetary policy, both rely on a forward-looking assessment when responding to shocks. The difference between the two regimes rests on the weights assigned to different information variables when forming that assessment. An inflation-targeting regime exploits the widest set of information variables possible—the policy-maker optimally weights together any variable that helps to predict inflation in the future. In contrast, the policy-maker in a (pure) monetary-targeting regime considers only money and ignores the potential information contained in non-monetary variables. In this sense, monetary targeting is simply a limiting case of inflation targeting in which the policy-maker assigns a weight of unity to money and of zero to all other variables.

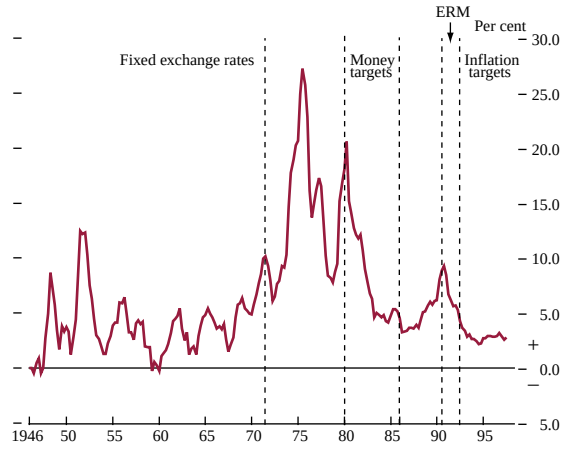
Put another way, in a world where the velocity of money was entirely predictable and there was a one-to-one mapping between the growth of money and inflation, the inflation-target regime would collapse to that of monetary targeting. Unfortunately, we do not live in such a world, we never have, and nor are we ever likely to. Inflation targeting allows the discretionary use of information other than money when velocity is unpredictable. For this reason, I think that inflation targeting is here to stay.

What has been the experience of countries with inflation targets?

Chart 1 plots the path of UK inflation since the Second World War, and shows the different monetary policy regimes in place during this period. It is a sad reflection of the transparency of monetary policy during much of this period that the dating of policy regimes is somewhat imprecise. Indeed, there are periods, notably in the 1970s and the late 1980s, when the nominal anchor was not at all clear. These problems highlight the importance of a clear and transparent

(1) Based on citations in the *Journal of Economic Literature*.
(2) Such a model is discussed in King, M (1996) 'How Should Central Banks Reduce Inflation?—Conceptual Issues' in *Achieving Price Stability*, Federal Reserve Bank of Kansas City.

Chart 1
Annual UK inflation 1946–97(a)



(a) Inflation is measured as the annual increase in the retail price index from 1946–74, and in the retail price index excluding mortgage interest payments from 1974–97.

framework for monetary policy. The large increases in inflation in the 1970s and, to a lesser extent, in the late 1980s both occurred in periods when the framework for monetary policy was, at best, opaque. Conversely, the introduction of clear and transparent monetary regimes, be it monetary targeting, the ERM or direct inflation targeting, have often coincided with sustained falls in inflation. It is not possible to distinguish between cause and effect here, but the experience suggests the benefits of a clear nominal anchor. Some anchors, however, are more effective than others.

In the five years since the inflation target was introduced, the annual rate of inflation in Britain has averaged 2.8% a year. In the same period, the annual growth rate of GDP averaged 2.9%. To a large extent, that reflects a cyclical recovery. Nevertheless, the last sustained period in which GDP growth exceeded inflation was in the first half of the 1960s. A fifth birthday is clearly far too early to judge the likely long-term success of the new approach. What is clear, however, is that the birth of the inflation target coincided with one of the most successful episodes of the United Kingdom's post-war economic performance.

A similar story can be told from the experience of other inflation-targeting countries. Table A looks at average inflation among a set of inflation-targeting countries in the periods before and after the introduction of the targets in each country.(1) In nearly all cases, inflation has more than halved from the preceding decade. Indeed, the level of inflation in these countries now compares favourably with that in non inflation targeting countries. Again it is important not to confuse correlation with causation—the 1990s have seen a global disinflation. But it is encouraging that, as Table B indicates, this reduction in inflation has not come at the expense of either average output growth or, as some commentators feared, greater variability in output. Indeed, in a period in which average output growth in the rest of the G7 has fallen in every country except Germany,

Table A
Average inflation performance in inflation-targeting and non inflation targeting countries

	Decade preceding inflation target		Period following introduction of inflation target (a)	
	Average rate of inflation	Variance	Average rate of inflation	Variance
Inflation-targeting countries				
Australia	6.2	8.41	2.7	1.71
Canada	5.8	7.90	2.0	2.51
Finland	5.2	3.37	1.1	0.51
Sweden	6.6	6.65	2.3	2.29
New Zealand	11.6	25.70	2.5	2.70
United Kingdom	5.2	2.21	2.8	0.09
Average	**6.8**	**9.0**	**2.2**	**1.6**
	1980s		1990s	
	Average rate of inflation	Variance	Average rate of inflation	Variance
G7 non inflation targeting countries				
France	7.4	18.86	2.3	0.56
Germany	2.9	4.69	3.1	2.01
Italy	11.3	35.85	5.2	0.94
Japan	2.5	5.14	1.4	1.67
United States	5.6	12.52	3.4	1.13
Average	**5.9**	**15.4**	**3.1**	**1.3**

(a) Inflation targets were introduced in: Canada in February 1991, Finland in March 1993, Sweden in February 1993, New Zealand in March 1990, and the United Kingdom in October 1992. The date of the introduction of the inflation target in Australia is not altogether clear. It is taken here to be April 1993.

Table B
Average GDP growth in inflation-targeting and non inflation targeting countries

	Decade preceding inflation target		Period following introduction of inflation target (a)	
	Average rate of GDP growth	Variance	Average rate of GDP growth	Variance
Inflation-targeting countries				
Australia	3.2	10.18	4.2	0.96
Canada	2.8	9.99	1.9	3.09
Finland	1.4	17.33	3.2	6.49
Sweden	1.6	4.73	1.9	5.09
New Zealand	1.8	6.95	2.4	7.78
United Kingdom	2.4	5.76	3.0	1.04
Average	**2.2**	**9.2**	**2.8**	**4.1**
	1980s		1990s	
	Average rate of GDP growth	Variance	Average rate of GDP growth	Variance
G7 non inflation targeting countries				
France	2.3	1.95	1.4	2.33
Germany	1.8	3.18	2.1	4.67
Italy	2.4	2.52	1.2	2.11
Japan	3.8	1.49	2.2	3.79
United States	2.8	6.91	2.1	2.30
Average	**2.6**	**3.2**	**1.8**	**3.0**

(a) See Table A for details of when inflation targets were introduced in each country.

the average rate of growth in inflation-targeting countries has increased from a little over 2% to nearly 3%, while the variance of GDP has more than halved. Again, cyclical effects explain part of these changes. But the inflation target countries have experienced a recovery in output without losing control over inflation.

Does an inflation target ignore output?

A common charge against an inflation target is that it ignores output. An inflation target, the critics would argue, is not enough. But, as the saying goes, it all depends on what you mean by an inflation target.

(1) The two inflation-targeting countries omitted from Tables A and B are Israel, where comparisons are dominated by its recovery from hyperinflation, and Spain, which only introduced its inflation target at the end of 1994.

There are two dimensions to this question—long-run and short-run. If one believes that in the long run, there is no trade-off between inflation and output, then there is no point in using monetary policy to target output. Most central banks believe—and there is growing evidence to support this view—that low inflation is, if anything, more conducive to productivity growth than high inflation. But you do not have to accept this proposition, only the view that printing money cannot raise long-run productivity growth, in order to believe that inflation rather than output is the only sensible objective of monetary policy in the long run.(1)

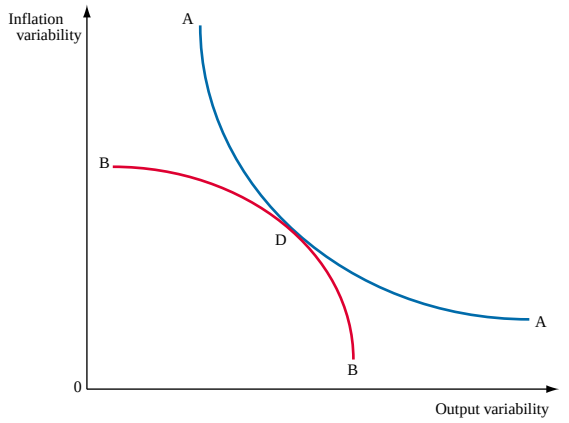
The interesting dimension of the question is in the short run. And it is here that the critics do have a point. I argued earlier that any monetary policy can be described in terms in two policy variables—a medium-term inflation target and a response of interest rates to shocks that create fluctuations in inflation and output. The overriding objective of monetary policy is to ensure that on average inflation is equal to the target. But such a target is not sufficient to define policy. There is a subordinate decision on how to respond to shocks as they occur.

As is well known, the significance of that discretion depends on the nature of the shocks hitting the economy. Where such shocks take the form of unexpected increases or decreases in demand, output and inflation tend to rise or fall together. These shocks pose no dilemma for the MPC. There is, of course, a difficult technical problem of identifying such shocks, but the way in which policy should respond is, in principle, clear. But there are other types of shock—usually captured by the portmanteau description 'supply shocks'—that tend to shift output and inflation in opposite directions. Sometimes these are the results of government policy at home (changes in indirect taxes for example) or in policy overseas, resulting in movements in the exchange rate. On other occasions, such shocks reflect unexpected developments in the world economy.

Faced with supply shocks, central banks have a choice. They can either try to bring inflation back to the target level as soon as possible, possibly exacerbating the initial impact of the shock on output. Or they can accommodate the inflationary consequences of the supply shock in the short run, bringing inflation back to the target level more slowly and reducing the impact on output. Hence, in the short run, there is a trade-off between inflation and output. And the choice between these two means that there is a permanent trade-off between the volatility of inflation and the volatility of output. A strategy of returning inflation to its target as rapidly as possible leads to lower inflation volatility and higher output volatility than a strategy of bringing inflation back to target at a longer horizon.

The trade-off between output volatility and inflation volatility has been popularised by the work of Taylor.(2) Studies typically find evidence that very short or very long targeting horizons deliver extreme outcomes. This type of trade-off is illustrated by the curve AA— the 'Taylor curve'—in Chart 2. Moving up the curve is equivalent to lengthening the implicit targeting horizon (reducing the speed of disinflation following a shock), thereby lowering output variability.

Chart 2
The Taylor curve



Confronted with a trade-off between the volatility of inflation and the volatility of output, how should policy-makers respond? How quickly should we try to return inflation to its target? That depends upon the relative costs of inflation volatility, on the one hand, and output volatility, on the other. To determine the optimal targeting horizon, it is necessary to confront the menu of output/inflation variability choices described by the trade-off curve AA with the authorities' preferences about output/inflation variability. These preferences are embodied in curves such as BB, which show combinations of output and inflation variability that result in the same cost to the central bank. The optimal targeting horizon is given by the point D, where the cost is lowest, that is where the two curves, AA and BB, are tangents.

In theory, once a central bank has decided how to react to a shock, interest rates or money growth are adjusted to respond to the shock while remaining consistent with meeting the inflation target in the medium term. The behaviour of the central bank can be described as a monetary policy reaction function; others talk in terms of 'feedback rules', such as the well-known Taylor rule.

Chart 2 highlights two important points concerning the targeting horizon. First, the optimal targeting horizon depends critically on the rate at which the central bank is prepared to accept more variability in inflation to reduce variability of output. Second, the optimal targeting horizon is likely to vary depending on the nature and persistence of shocks. In terms of Chart 2, different types of shock will be associated with difference output/inflation variability curves. Simple rules such as the Taylor rule, which set interest rates

(1) The cost-benefit analysis of low inflation is not discussed here—see King, M A (1996), 'Monetary Stability: Rhyme or Reason', *Economic and Social Research Council Seventh Annual Lecture*, and Bakhshi, H, Haldane, A G and Hatch, N (1997), 'Quantifying some Benefits of Price Stability', *Quarterly Bulletin*, August, pages 274–84.
(2) See Taylor, J B (1983), *Macroeconomic Policy in the World Economy: From Econometric Design to Practical Operations*, W W Norton and Company, New York.

according to deviations of output and inflation from their desired levels, do not distinguish between shocks.

Many supply shocks are price level effects. For example, changes in indirect taxes or commodity prices often affect the domestic price level, but do not in themselves change the underlying rate of inflation. An appropriate monetary response is to accommodate the first-round price level effect, while ensuring that changes in the inflation rate do not alter inflation expectations and lead to second-round inflationary or deflationary changes in wages and prices. Price level effects of this kind remain in the official inflation rate for at least a year. This is because the measure of inflation for the target is the increase in prices over the previous twelve months. Since shocks may take several months to have their full effect, a horizon of about two years is a reasonable one at which to try to bring inflation back to its target. But if shocks are sufficiently large—in either direction—then it may be sensible to extend the horizon at which inflation returns to its target level. Indeed, one of the main purposes of the open letters that, under the new arrangements, the Bank will be required to send to the Chancellor if inflation deviates by more than 1 percentage point from its target, is to explain, as the Chancellor wrote to the Governor on 12 June, 'the reasons why inflation has moved away from the target . . . and the period within which you [the MPC] would expect inflation to return to the target'.

It is striking that central banks have been reluctant to acknowledge openly that monetary policy has two components, an inflation target and a response to shocks. Provided that an inflation-target framework is interpreted to include these two distinct elements of monetary policy, then the charge of the critics that inflation targets mean ignoring output is false. Moreover, by allowing the horizon at which inflation is brought back to its target level to depend upon the nature and size of the shocks hitting the economy, such a policy reaction is superior in principle to either rigid monetary targets, or rigid nominal demand or GDP targets, or Taylor rules. Of course, the advocates of monetary targets, or nominal demand or GDP targets, would not advocate that they be used rigidly. Equally, however, the advantages of these other targets in terms of maintaining stability in the growth of nominal demand can certainly be achieved by inflation targets.

There is one final and very important caveat. Despite my description of an optimal monetary policy reaction function, it is important for any central bank to realise the limitations to its ability to engage in counter-cyclical policy. Inadequacies of data, policy lags between changes in interest rates and their effect on inflation and, most important of all, inadequate knowledge of how the economy behaves, all mean that it is impossible to fine-tune the economy. As Milton Friedman pointed out in 1968, the 'most important lesson that history teaches about what monetary policy can do—and it is a lesson of the most profound importance—is that monetary policy can prevent money itself from being a major source of uncertainty'.(1) The Monetary Policy Committee is under no illusion that it can abolish the business cycle. Over a number of years, monetary policy can ensure that inflation averages the target of 2½%. But it cannot fine-tune output, and it would be a mistake to try to do so. If we can avoid the more extreme fluctuations of output that we have seen in the past, then monetary policy will have made a major contribution to stability in Britain.

What is the role of inflation forecasts?

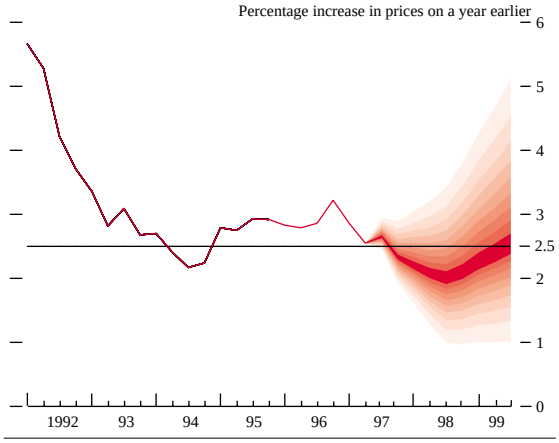
Because of the infamous long and variable lags between changes in monetary policy and their effects on inflation, policy must be forward-looking. That requires the use of a forecast. An inflation target does not mean setting policy according to the current rate of inflation. Rather, the MPC responds to movements in expected inflation. To raise interest rates only after inflation itself had started to rise would usually be too late to prevent a further rise in inflation, and would lead to instability in both inflation and output.

But forecasting, more than any other aspect of the discipline, brings economics into disrepute. The main reason for that is that forecasts are too often presented as a single number—as point forecasts. And prizes are awarded to those whose forecasts turn out to be correct in a single year, rather than close to the outturn over a number of years. Indeed, some newspapers give 'golden guru' awards on an annual basis. This is rather like awarding the Fields Medal for mathematics to the winner of the National Lottery for their understanding of number theory.

It is possible to conceal the fact that policy must be based on a forecast, by relying on intermediate target variables that have a relatively stable relationship with inflation, but there would be little point in using such an approach unless the intermediate variable was itself a reasonable forecast of future inflation. So in the Bank, we have come to the view that it is better to be explicit about the forecast that underlies policy decisions than to conceal the forecasting judgment in a form of words that requires careful deconstruction by professional 'Bank watchers'. And such a forecast cannot be a single number. It must be presented for what it is, namely a probability distribution. Since February 1996, the Bank has published a probability distribution of inflation in the *Inflation Report* in the form of a fan chart. Chart 3 shows the fan chart from the August *Inflation Report*. The chart shows the relative likelihood of possible outcomes. The central band, coloured deep red, includes the most likely outcome and is chosen to be the narrowest band that contains 10% of the distribution: there is a 10% probability that inflation will be within this central band at any date. The next deepest shade, on both sides of the central band, takes the distribution out to 20%; and so on, in steps of 10 percentage points. The more uncertainty there is about the inflation outcome at any particular time horizon, the wider the bands, and the more gradually the colour fades. And if the risks are more on one side than the other, then the

(1) Friedman, M (1968), 'The Role of Monetary Policy', *American Economic Review*, Vol LVIII, No 1, pages 1–17.

Chart 3
August *Inflation Report* forecast



bands will be wider on that side of the central band. It looks, and is, rather like a conventional contour map.

The process by which the forecast is constructed is a lengthy one. It involves all the members of the MPC discussing and agreeing a set of assumptions on the basis of which the forecast is constructed. This involves discussions not only of the exogenous assumptions (about world trade for example), but also about the shocks that have occurred and the monetary transmission mechanism. As a result, the forecast published in the *Inflation Report* is agreed by the MPC. If some members of the MPC were to disagree with the forecast, then the dissenting minority would be entitled to insert an alternative forecast into the *Inflation Report*.

The publication of the inflation fan chart is one of the Bank's contributions to the analysis of monetary policy in recent years. And we are considering publishing fan charts for output as well as inflation in future *Inflation Reports*. A fan chart emphasises that, as in other areas of public policy, decisions should be based on probabilities. In other words, policy should reflect the balance of risks.

What role does the fan chart play in the setting of interest rates? For a given profile of interest rates, it shows the most likely outcome for inflation in the next two years or so and the risks around this central view. Since policy is a question of balancing risks, it summarises the information relevant to the MPC's decision of whether or not to change interest rates. But it does not provide a mechanical guide to policy. There are two difficulties in mapping directly from the fan chart to a decision on interest rates.

First, the appropriate response to a supply shock is to bring inflation back to its target level at a horizon that may, in principle, depend on the size and nature of the shock. For many purposes, a horizon of two years is a reasonable period within which to bring inflation back to target. But there may be circumstances, as I discussed earlier, where such an horizon would be inappropriate—if the shock was sufficiently large for example. If the profile for inflation were rising or falling at the two-year forecasting horizon, then the optimal level of interest rates would depend on the horizon at which it was felt appropriate to bring inflation back to the target level.

Second, when there is uncertainty about the impact of an interest rate change on the economy, then, as Bill Brainard showed 30 years ago, it may be sensible to move cautiously to the level of interest rates that would be necessary to equate expected inflation at the appropriate horizon with the target level, rather than move rates abruptly and so risk injecting volatility into the economy.(1) We do not know how significant this 'Brainard uncertainty' is, but in practice central banks often move cautiously. Whether this is fully justified by the existence of such uncertainty, or is the product of excessive caution is a subject that merits further research. But it should be clear that, though the forecast provides a basis for decisions, it cannot be used mechanically. In the jargon of economists, the optimal policy reaction function cannot be defined simply over the expected inflation rate irrespective of the shocks hitting the economy.

The forecast provides a basis for making and explaining decisions. But its value lies mainly in raising questions, in a systematic manner, about where policy might go wrong. As Sir Samuel Brittan has pointed out, a debate between rival forecasts 'is likely to be barren. Even more barren would be an attempt to argue about demand components, eg whether investment would rise by 5% or 10%'.(2) So the MPC have no ambition to be gurus, golden or otherwise; merely to be competent economists working together to assess the balance of risks to the inflation target.

What is the role of transparency?

An inflation target framework is more than a medium-term target for inflation. As I argued earlier, it must also include a strategy for reacting to economic shocks. In this sense, it does not represent a radical departure from other monetary frameworks. But perhaps the most important distinguishing characteristic of inflation-target regimes is the emphasis that they place on transparency and accountability. Let me start with transparency.

Paper money creates the temptation for governments to spring inflation surprises on an unsuspecting public as a hidden form of taxation. This 'time inconsistency' problem for monetary authorities has led to a search for credible monetary frameworks. The most popular among academics is a monetary rule that would bind the authorities to create money according to a predetermined criterion consistent with long-run price stability. Unfortunately, no such simple—or for that matter complicated—rule exists. Our understanding of the economy is inadequate. Any proposed rule would soon be made redundant by the results of new research. No sooner would the authorities have adopted a rule than improvements to the rule would appear. Knowledge increases over time, and it would be intellectual pig-headedness to stay with a sub-optimal rule. For any rule

(1) Brainard, W (1967), 'Uncertainty and the Effectiveness of Policy', *American Economic Review*, 57, pages 411–25.
(2) Brittan, S, 'Memorandum of accountability of the Bank of England', submitted to the Treasury Select Committee, August 1997.

to be feasible, there would have to be a rule for updating the rule itself. And I suppose that one could go further and argue that we would need a rule to update the rule that was used to update the rule, and so on.

But if simple rules are infeasible, we should not accept that the only alternative is the use of unfettered discretion by central bankers operating in secret. Rule-like behaviour is an advantage in monetary policy. It introduces predictability and helps to ensure that expectations are consistent with the objective of price stability, thus lowering the cost of achieving the inflation target. A more predictable monetary policy—not in the sense of stable interest rates, but rather a predictable reaction of interest rates to developments in the economy—reduces the 'noise' injected into the system by policy itself. As Friedman pointed out in the earlier quotation, monetary policy should avoid exacerbating fluctuations of output and employment by introducing unnecessary uncertainty. An explicit inflation target has the aim of reassuring economic agents that the Bank's MPC will not allow money to increase at a rate that allows inflation to exceed the target on average over a number of years, and also that the MPC cannot pursue its own views about where inflation should be in the long run. An inflation target means that the central bank operates with 'constrained discretion', in the words of Bernanke and Mishkin (1997), rather than unfettered discretion.(1)

A transparent monetary policy implies that announcements of changes in interest rates by the MPC might come as rather little surprise. The news would not be in the outcome of the meetings of the MPC, but in the economic statistics published during the month. Markets would be able to anticipate the likely reaction of the MPC, and the decisions by the MPC would follow a predictable policy reaction function. In contrast, an opaque monetary policy means that the news is the outcome of the deliberations of the MPC and not developments in the economy. In the extreme case, when monetary policy decisions were random, news about the economy would have rather little impact on short-term market interest rates, and more of the news would come from the monetary meeting itself. It is of course tempting for central banks to make their own meetings the main story. But transparency should lead to policy being predictable. It is all part of the view that a successful central bank should be boring, a referee whose success is judged by how little his decisions intrude into the game itself.

Some recent work by Andrew Haldane and Victoria Read at the Bank of England suggests that there is some evidence that boredom is starting to set in.(2) They examined the extent to which forward market interest rates at different points of the yield curve jumped in response to changes in official interest rates. In the limiting case of perfect transparency, where the authorities' reaction function is known with complete certainty, market rates would not respond to changes in official interest rates. There would be no news in official interest rate announcements.

Over the sample period January 1985 to March 1997, Haldane and Read found that changes in forward interest rates along the entire yield curve were systematically related to changes in official interest rates. But the average response of market rates to changes in official interest rates has fallen significantly since 1992. The introduction of the inflation-targeting framework appears to have made British monetary policy less exciting—and a good thing too.

How will the new Bank be accountable?

Independence and accountability go hand in hand. They are opposite sides of the same coin. An effective system of accountability is essential in order to give legitimacy to an independent central bank with delegated powers to set interest rates. Accountability is the precondition for independence in a democratic society.

At first sight, accountability might seem straightforward. But it raises the questions of to whom the Bank is accountable and for what. The Bank is accountable to the Chancellor of the Exchequer for implementing his inflation target, to Parliament through the Treasury Select Committee (TSC), to the Court of the Bank for the proper conduct of the MPC and, more widely, to the public at large. There are now five ways in which the Bank is accountable:

(i) The decisions of the MPC itself are announced immediately following the monthly meeting at 12 noon on a Thursday. The minutes of those meetings are published on the Wednesday following the subsequent meeting—approximately five weeks later. These minutes contain not only an account of the discussion of the MPC, and the issues that it thought important for its decisions, but also a record of the voting of each MPC member.

(ii) The *Inflation Report* will continue, and may well form the basis for accountability to Parliament. The original objective of the *Inflation Report* was, it is fair to say, to act as a disciplining device on Government. The Bank's *Report* would set out its views of the likely implications for inflation of decisions taken (or not taken) by the Chancellor. Now that the power to set interest rates has been delegated to the MPC, the *Inflation Report* plays a rather different role. It is now an instrument of accountability. It is one of the principal ways in which the explanations of the MPC can be assessed and subjected to scrutiny by outside commentators.

(iii) Appearances before the TSC by one or more members of the MPC will be more frequent than hitherto. It will be natural for the MPC to be asked to appear before the TSC following each *Inflation Report*, as suggested by the Chancellor. Hitherto, the Bank has typically appeared before the TSC twice a year following the Budget and the Summer Forecast. The rationale for this was not entirely clear. The Bank had

(1) Bernanke, B S and Mishkin, F S (1997), 'Inflation Targeting: A New Framework for Monetary Policy?', NBER Working Paper, No 5893, *mimeo.*
(2) Haldane, A G and Read, V (1997), *Central Bank Secrecy and the Yield Curve*, Bank of England, *mimeo.*

no responsibility for either the Budget or the Treasury forecast, and there was a danger of such appearances providing an opportunity for Committee members to focus on alleged differences between the Bank and Treasury. Now it is possible for TSC to hold the Bank to account for its own actions. This should greatly improve both the accountability of the Bank and the focus of TSC hearings. The TSC has been considering how it will fulfil its new role, and their report on this was published this morning. It contains a number of important recommendations, which we shall study carefully.

(iv) The MPC is required to send an open letter to the Chancellor if inflation is more than 1 percentage point on either side of the target of 2½%. Given past experience of inflation volatility, it is likely, even allowing for the change in policy regime, that the MPC will have many opportunities to restore the lost art of letter-writing to British life. And it is important to stress that avoiding the need to write such a letter is not the objective of monetary policy. The inflation target is not a range of 1½% to 3½%, it is a target of 2½% on average. Indeed, one of the main purposes of the open letters is to explain why, in some circumstances, it would be wrong to try to bring inflation back to target too quickly. In other words, the MPC will be forced to reveal in public its proposed reaction to large shocks.

(v) Finally, the MPC is accountable to the Bank's Court for the procedures it adopts and the proper conduct of its business. The 16 non-executive members of the Bank's reconstituted Court will be required to report annually to Parliament on the conduct of the Committee, and the Bank's *Annual Report* will be debated in Parliament.

How these forms of accountability will work in practice is at this stage hard to say. Doubtless we shall learn a good deal as we go along. But if any of you were in any doubt as to how monetary policy could possibly be a full-time job, let me assure you that these provisions for accountability will take up any time remaining from our activity of analysing the economy and making decisions on interest rates.

The complexity of the 'to whom' part of accountability surely contrasts with the simplicity of 'for what'. The inflation target is 2½%, and, at first sight, it might seem easy to compare the outturn for inflation with the target. In practice, however, matters are less simple for two, by now familiar, reasons. First, unpredictable shocks affecting both inflation and output mean that inflation will deviate from the Bank's central projection. Second, long lags between changes in interest rates and their effect on inflation mean that it takes time to offset the effects of such shocks. Taken together, those two reasons imply that, looking backwards, over a short period, or even over a few years, it would be impossible for the MPC to hold inflation at exactly 2½%. So the test is whether inflation averages 2½% over a number of years. But it is unlikely that the public, or at least the TSC, will wish to wait that long. And looking forward, the combination of uncertainty and policy lags means that it is rarely possible to say that a decision was clearly right or wrong.

So there is a need to devise a form of accountability that goes beyond the simple comparison of outturn and target. One possibility is to compare the distribution of inflation outturns with the Bank's *ex ante* probability distribution for inflation. But this changes each quarter. A more promising avenue is to require the MPC to explain its actions and the reasons underlying them clearly and openly to outside scrutiny. In this way, the explanations of why inflation deviated from target can be assessed by outside commentators and a judgment made about the quality of the MPC's decisions. This indeed is the focus of the TSC report.

There is one further advantage of an explicit inflation target. Central bank councils that operate without an explicit target given to them by government are subject to speculation about which members are 'hawks' and which are 'doves' on inflation. For the new MPC, such speculation is beside the point. Each member has been appointed to achieve the inflation target of 2½%. Of course, there are differences of views and emphasis on the monetary transmission mechanism, but we are all striving to achieve the same inflation target.

Conclusions

The guiding principle of monetary policy is to look ahead and act early. If interest rates are left unchanged until inflation itself starts to rise or fall, then it will be too late to prevent swings in both inflation and output that will be damaging to our economic performance. The experience of the 20th century has shown that there are many opportunities and temptations for discretionary monetary policy to create inflation. Simple, or for that matter, complicated, rules for setting interest rates do not exist. They would be undermined by new research on better and improved rules that got rid of the bugs in the first rule, as frequently as software packages are released. Taylor rule 1.0 would quickly become Taylor 1.1, followed by Taylor 2.0 and I think we have probably already reached Taylor 6.0. Inflation targets are a practical response to the fact that knowledge increases over time. They are a form of 'constrained discretion'. Although inflation is assuredly a monetary phenomenon in the medium term, to restrict one's attention only to the money numbers would be to throw away a great deal of important information in other indicators. Equally, it is important to listen to a variety of views. One of the contributions of the new Monetary Policy Committee is to provide a forum in which ideas and information can be pooled. This is the optimal response to decision-making under uncertainty in a world in which no one individual has a monopoly of wisdom nor of information. And the new MPC has led to a sea-change in our discussions on inflation. Now that the buck stops with

the MPC, and it has, in that popular expression, to make ‘hard choices’, there is a seriousness of discussion that was not always present before.

But if the MPC adds to the quality of decision-making, there is also an additional requirement for transparency and accountability. This is crucial to the democratic legitimacy of an independent central bank. The distinction between goal independence (in which the central bank chooses both the target and the instrument) and instrument independence (in which the central bank sets interest rates and the elected government sets the target) is an important feature of our system, and is embodied in the Bank of England Bill. And since the inflation target is set by government, there is little point in speculating about the identity of ‘hawks’ and ‘doves’ on the MPC. Each member has been appointed to hit the government’s inflation target.

The inflation target and the *Inflation Report* represent successful innovations in the way central banks operate in the 1990s. The United Kingdom has been very much at the forefront of these developments. To borrow a phrase from a recent political speech, ‘The Bank of England may not be the biggest central bank in the world, nor any longer the mightiest, but it can be the best’. That is certainly a target at which we should aim.

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Monetary and Financial Statistics

A monthly publication, *Bank of England: Monetary and Financial Statistics* was launched in January 1997. This comprehensive publication (priced at £70.00 per annum in the United Kingdom for 1998) contains detailed data complementing the Bank's statistical releases, tables previously published in the monthly *Monetary Statistics* booklet and the statistical annex of the *Quarterly Bulletin,* and some new tables (on gilt repo and stock lending). If you would like more information please contact Daxa Khilosia, Monetary and Financial Statistics Division HO-5, telephone 0171–601 5353.

Financial Statistics Users Group (FSUG) seminar

In March 1997, the Bank of England and the ONS hosted a Financial Statistics User Group conference which was introduced by Mervyn King, Executive Director of the Bank of England. A full report of this seminar was published in July 1997; if you wish to receive a copy or would like to be on the mailing list of FSUG, please contact the Group secretary, Daxa Khilosia, Monetary and Financial Statistics Division HO-5, telephone 0171–601 5353.

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.

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