Credibility and monetary policy: theory and evidence

Mervyn King, an Executive Director of the Bank and its Chief Economist, looks[1] *at the concept of credibility in monetary policy, why it is important and how it can be measured.*

A monetary strategy is credible if the public believes that the government will actually carry out its stated plans; if their strategy is not credible, monetary authorities will find they have an incentive to accommodate inflation expectations. By creating a 'penalty' for failure, an announced inflation target—like that at the centre of the UK monetary framework—can enhance monetary policy credibility.

He explains how information about expectations of future inflation—and so about credibility—can be derived from the prices of government bonds. And he suggests that part of the increases in bond yields in 1994 reflected a reappraisal of the long-term credibility of the monetary policies of the different countries.

Introduction

It is a great honour to be invited to deliver the first Scottish Economic Society/Royal Bank of Scotland Lecture. In the very first issue of the Scottish Journal of Political Economy in March 1954, Sir Alec Cairncross, writing about the reconstitution of the Scottish Economic Society, referred to the consequences of putting oneself at the mercy of a Scottish audience which 'has an extremely limited appetite for any lengthy analysis of general economic and social issues unless it has an obvious and immediate bearing on his personal affairs'. I have taken this advice to heart. I shall try to be brief and I shall talk about interest rates.

Since the beginning of this year, bond rates in the United Kingdom have risen by about 200 basis points. The increase over the past 12 months has been less—some 140 basis points. Nevertheless, the rise has been considerable and has occurred, to varying degrees, in all industrialised countries. What does this tell us about monetary policy in the United Kingdom? In that same article, Alec Cairncross wrote that Scottish economists rejoiced in 'the old-fashioned description "political economy", with its concrete approach and canvas'. I want tonight to relate these increases in interest rates to the credibility of monetary policy in the United Kingdom—a subject which, because it relates to the interaction between government and the private sector, does, I believe, qualify as political economy.

Few words trip more readily off the lips of central bankers than 'credibility'. Words are important. Every profession has them, and central banking is no exception. Indeed, a journalist recently described credibility as the 'new mantra of the mandarins', and argued that credibility dominates official thinking in the United Kingdom to such an extent that other objectives have been relegated to second place. This view does, I believe, misrepresent not only the role of credibility in monetary policy but also the ability of monetary stimulation to solve the structural problems of the UK economy. As my newsagent said the other morning, 'newspapers, you can't trust them—they're in the hands of the media'.

But is credibility any more than a word or a mantra? As the King of Denmark put it in *Hamlet*, 'words without thoughts never to heaven go'. So I want to organise my lecture around three questions. First, what is credibility? Second, why does it matter? And third, is it possible to measure it?

The concept of credibility

The *Oxford English Dictionary* describes 'credibility' as a mid-sixteenth century word meaning the quality of being credible or believable, or having a good reputation. In the context of monetary policy, credibility has a precise meaning. A monetary strategy—a plan of future policy actions contingent upon events—is credible if the public believes that the government will actually carry out its plans. Credibility is, therefore, a question of whether announced intentions are believable.

This could be a matter of trust. But markets, and for that matter voters, are naturally suspicious. The announced intentions are much more credible if there are incentives to pursue the stated course of action. A future monetary policy action is credible if it is in the interest of the monetary authorities to enact this policy when the time comes. Hence policy is credible when the authorities' actions are, as economists put it, 'time consistent', that is the authorities have no incentive to deviate from their original intentions. This is not a question of trust—read my lips: no more

(1) In the first annual Scottish Economic Society/Royal Bank of Scotland lecture in Edinburgh on 24 October 1994. The lecture was published in the *Scottish Journal of Political Economy*, February 1995.

inflation—but of whether the monetary authorities face an incentive to pursue low inflation.

One way of trying to achieve time consistency is to precommit to a fixed rule—for example, set interest rates so that some measure of the money supply grows at a constant rate each year. It is well known that such rules are sub-optimal. From time to time, shocks occur which mean that the optimal growth rate of the money supply changes. To refuse to respond to those shocks may enhance credibility in the policy rule, but only at the expense of sensible policy adjustments. When the shocks are sufficiently frequent and large, as they have been in most countries, the rule becomes discredited and is literally incredible. No rule for monetary policy has been discovered which could credibly be followed. It is inevitable therefore that, as Henry Simons argued in 1936, monetary policy 'must rely on a large element of discretion'.

But there is a problem with a purely discretionary monetary policy. The ability of the authorities to spring monetary surprises on an unsuspecting public allows them to exploit the short-term trade-off between inflation and output to achieve temporarily higher output. Anticipating this reaction, economic agents in the private sector come to expect inflation and to build such expectations into their wage and price-setting behaviour. Inflation will rise to a level beyond which the authorities will not choose to spring further inflation surprises, and the result of this 'game' between public and private sectors is an inbuilt inflation bias to policy.

At this equilibrium inflation rate, the marginal cost of additional inflation is equal to the marginal gain from higher output in the short term resulting from the inflation surprise. Although the recent analysis of the inflation bias, as in the pioneering work of Robert Barro and David Gordon (1983), is based on developments in game theory for which the Nobel Prize was awarded two weeks ago, the idea can be found in the writings of the mentor of the Scottish Economic Society, Adam Smith. He wrote:

'Princes and sovereign states have frequently fancied that they had a temporary interest to diminish the quantity of pure metal contained in their coins; but they seldom have fancied that they had any to augment it. The quantity of metal contained in the coins, I believe of all nations, has, accordingly, been almost continually diminishing, and hardly ever augmenting. Such variations therefore tend almost always to diminish the value of a money rent' (Smith 1776, Vol. I, page 38).

Economists have recently started to analyse ways of limiting the inflation bias of discretionary monetary policies. Kenneth Rogoff (1985) suggested that monetary policy be placed in the hands of an independent central bank run by a 'conservative' central banker who, by definition, would have a greater aversion to inflation than that of the public at large. This would help to reduce the inflation bias inherent in discretion. But it is not a perfect solution because the 'conservative' central banker will not respond to shocks as rapidly as might a more representative central banker. Output and employment will be excessively volatile.

For this reason, Canzoneri (1985), Walsh (1992) and Persson and Tabellini (1993) have analysed alternative ways of allowing discretionary use of monetary policy with an incentive to achieve low inflation on average. One suggestion is to create a penalty on either government or central bank if the average inflation rate over a period exceeds the level consistent with price stability. This allows the monetary authorities to respond to shocks without triggering expectations of an inflation bias to policy. One form which such a penalty could take is the announcement in advance of an explicit inflation target. There would be a penalty—political, reputational or, as in New Zealand, loss of tenure of the central bank governor—were the target not to be achieved. In the United Kingdom, there is now an explicit inflation target. It does, I believe, enhance the credibility of monetary policy by recognising the implausibility of basing policy on a pre-announced rule, yet at the same time limiting the inflation bias of pure discretion by creating a penalty for failure to hit the target. So credibility is an important part of any strategy to maintain low inflation.

The measurement of credibility

By its nature, credibility is not directly observable. But if credibility is important then a measure of credibility at different times, and its response to policy actions, is a useful piece of information. Can we, therefore, find indirect measures of credibility? The credibility of monetary policy is naturally measured by the difference between the official target for inflation and the private sector's expectations of inflation. But the future is uncertain. Hence both the government and the private sector have subjective distributions over the possible outturns for inflation at any future date. Credibility is a measure of how close are these two distributions. When we come to examine data, I shall summarise the distribution of inflation in terms of its mean—the expected inflation rate—and the spread of possible outturns around the mean as represented by the risk premium required by investors to accept inflation risk.

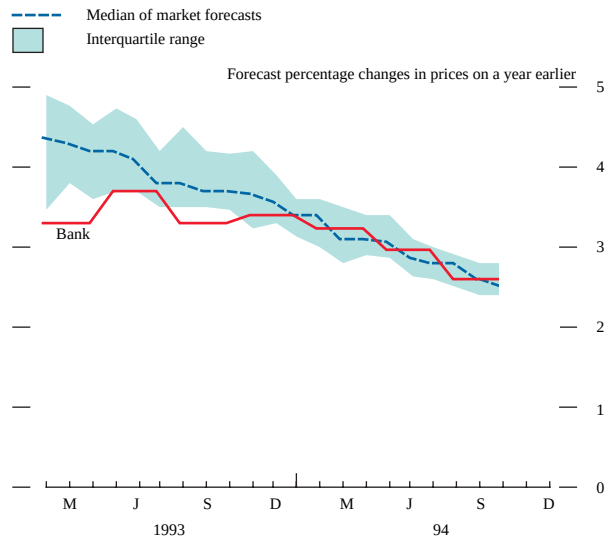
To measure credibility, therefore, it is necessary to observe both the official target range for inflation and private sector expectations of inflation. The United Kingdom is unique in affording estimates of both. First, there is a quantified official target range for the annual inflation rate of 1%–4%, with a narrowing of the range to below $2^1/_2$% by the end of this parliament. Second, the existence of both nominal and index-linked bonds means that it is possible to calculate a term structure for expected inflation.

If credibility is to be measured by private sector expectations of inflation, then it is natural to ask how such expectations might themselves reasonably be measured. There are two main ways—direct and indirect. The direct way involves asking agents in the private sector about their expectations.

The indirect way is to infer from observable market behaviour what those expectations might be.

Direct measures of inflationary expectations can be observed in a number of surveys. These are summarised regularly in the Bank's *Inflation Report*. Such forecasts are available for only a short period ahead—typically 18 months or so. Chart 1 plots the median forecast, out of a sample of 36 private sector forecasts, of inflation (measured excluding mortgage interest payments) for the end of 1994 made at different points in the past. This series can be plotted back to the beginning of 1993. Also shown in Chart 1 are the Bank's own central projections published in the *Inflation Report*.

Chart 1
Distribution of RPIX inflation forecast for 1994 Q4(a)



(a) Distribution of market forecasts taken from an average sample of 36 private sector organisations.

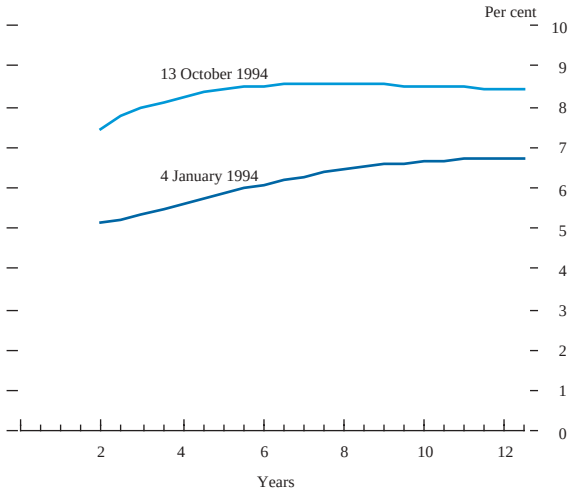
Both series show that forecasts have been revised downwards over time. This reflects a combination of learning about the magnitude of the disinflation resulting from the monetary tightening of the late 1980s and early 1990s, and a growing belief that the inflation target will be met, at least in the short term. I cannot resist pointing out that the Bank's projections have been consistently lower than the median private sector forecast, which makes it hard to understand why the Bank has been accused of whipping up inflationary fears.

There are two major problems with the forecasts implied by survey or private sector projections. The first is that they are available only for very short time periods ahead, often less than the average time lag between changes in monetary policy and their subsequent effects on inflation. Hence their ability to tell us about the credibility of monetary policy is extremely limited. The second is that they are available at only low frequencies, often no more than quarterly. Hence it is difficult to judge the impact of a change in policy, or some other event, on the credibility of the monetary regime. Both problems can be overcome by using the indirect approach to the measurement of expectations of inflation.

The basic idea is very simple. The stock of government debt in conventional gilts and the market prices at which they are bought and sold make it possible to construct a yield curve for nominal interest rates over a continuous time horizon. Equally, the existence of a stock—albeit smaller—of index-linked government securities, amounting to some 15% of total government debt, means that a yield curve for real interest rates can also be calculated. From these yield curves we may derive estimates of expected inflation at any future date—an inflation term structure curve in fact.

How can we do this? There are three steps in the calculation. First, it is necessary to convert observations of the yield on bonds of different maturities into a true yield curve. A 'true' yield curve relates the interest rate which must be paid to someone who invests money today, and receives nothing until the date when the loan is repaid, to the maturity of the loan. A claim on a loan of this kind is known as a zero-coupon bond. In practice, government bonds pay coupons each year. In effect, part of the loan is repaid each year. So the observed market interest rate on, say, ten-year bonds is an average of interest rates on money lent for one year, two years, three years and so on. Using the observed interest rates on bonds of all maturities, we can unravel the interest rates that correspond to pure loans of any given maturity. The interest rate on synthetic zero-coupon bonds can be computed because any actual bond is composed of several different zero-coupon bonds. The 'true' yield curve is that for zero-coupon bonds. Chart 2 shows two such zero-coupon yield curves, one for the beginning of the year and one for a week ago. The upward shift in the yield curve during this year is evident.

Chart 2
Nominal zero-coupon yield rates



The second step is to note that the yield curve describes the *average* interest rate over each maturity, denoted by *b*. Of more interest for our purposes is the implied short-term interest rate that is expected to hold in the future, denoted by *r*. The algebra of implied forward rates and the yield curve is given by equation **(1)**, which states that the terminal value of a portfolio invested in a *t*-period bond is equal to that of a

portfolio continually reinvested at the short-term interest rate:

$$\exp\{tb(t)\} = \exp\{\int_0^t r(\tau)d\tau\} \quad (1)$$

The interest rate on a *t*-year bond is an average of the short-term interest rates that will hold over the maturity of the bond:

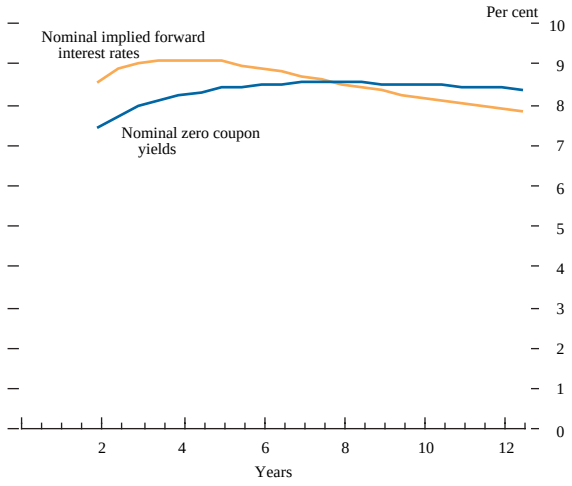
$$b(t) = \frac{1}{t}\int_0^t r(\tau)d\tau \quad (2)$$

The relationship between the forward rate and the bond yield is akin to that between marginal and average cost:

$$r(t) = b(t) + t\frac{db(t)}{dt} \quad (3)$$

It can be seen that the forward rate exceeds the bond yield when the yield curve is rising and is below it when the yield curve is falling. Chart 3 shows both curves for the United Kingdom at close of business on 13 October.

Chart 3
Nominal implied forward interest rates(a)



(a) As at close of business on 13 October 1994.

The third step is to calculate the implied forward rate curves for both nominal and real (index-linked) bonds. Chart 4 shows these two curves for 13 October. The difference between the curves measures the sum of the expected inflation rate and the inflation risk premium. The nominal forward rate equals the sum of the expected real rate, the expected rate of inflation, the inflation risk premium and the real rate risk premium:

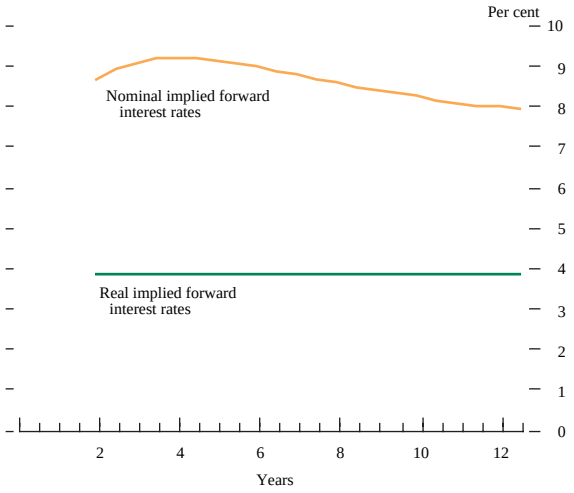
$$r_B = E(r) + E(\pi) + \rho_\pi + \rho_r \quad (4)$$

The real forward rate equals the sum of the expected real rate and the real rate risk premium:

$$r_I = E(r) + \rho_r \quad (5)$$

Credibility is about both the expected level of future inflation and the uncertainty associated with the inflation outturn. Hence the difference between the forward nominal

Chart 4
Nominal and real implied forward interest rates(a)



(a) As at close of business on 13 October 1994.

and real rate curves is not a bad empirical estimate of the credibility of monetary policy:

$$r_B - r_I = E(\pi) + \rho_\pi \quad (6)$$

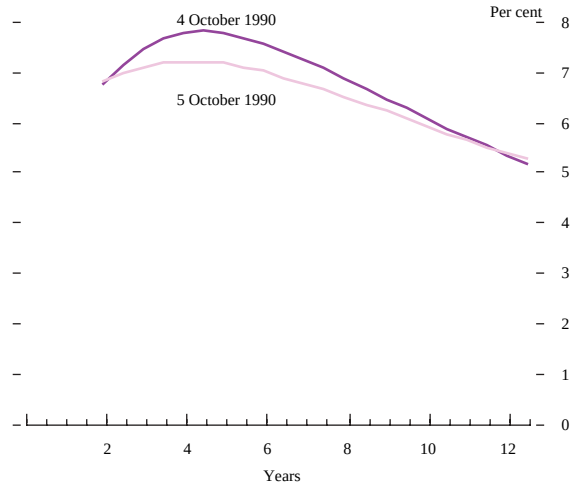
The Bank of England has been studying different technical methods of constructing the relevant yield curves and published in the November *Inflation Report* new estimates of inflation expectations based on modifications of methods suggested by Lars Svensson (1994). Other research suggests that most of the variation of the difference between the two curves comes from revisions to inflation expectations and not from changes in the inflation risk premium (Barr 1994, Brookes and Breedon 1994).

Credibility lost, credibility regained: an application of event studies

The methods which I have just described can be used to assess the impact of a number of different events on the credibility of monetary policy in the United Kingdom. I have chosen four *events*—entry into the ERM, exit from the ERM, the November 1993 Budget and the interest rate increase in September 1994. I do not mean to imply that these events were the most significant in their impact on interest rates. In many ways, the opposite is true. Changes in real interest rates, reflecting conditions in the world capital market, can be a far more important force than changes in the credibility of monetary policy, which is likely to evolve only slowly in the short run.

Consider now the four events. The first, Britain's entry into the ERM in October 1990, is shown in Chart 5. The chart shows the implied inflation term structure immediately prior to and following the announcement of entry into the ERM. Much of the impact of entry may well have occurred during the summer of 1990 as sterling appreciated, but the announcement itself led to a fall in implied forward inflation rates at almost all maturities. After the failure of several attempts to find a domestic anchor for the price level, it was

Chart 5
Implied forward inflation rates at the time of Britain's entry into the ERM

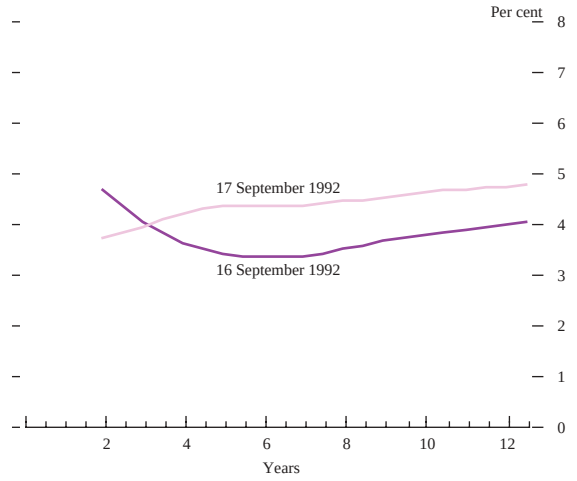


not surprising that markets gave more credibility to an external anchor than to those which had failed.

But the timing of Britain's entry coincided with the aftermath of German unification and the need for a real appreciation of the Deutsche Mark. There were only two ways in which this could be achieved—either a revaluation of the Deutsche Mark or a period of higher inflation in Germany than elsewhere. The failure of the European Monetary System to deliver an appreciation of the Deutsche Mark meant that the Bundesbank had little choice but to raise interest rates to a level sufficient to bring down inflation in Germany, thus requiring inflation elsewhere in Europe to be even lower.

For a country such as the United Kingdom, with high debt burdens inherited from the 1980s, this level of interest rates would, in all probability, have led to falling prices. Although departure from the ERM in September 1992 permitted a rebalancing of monetary and fiscal policy, it was clearly not sought by the authorities and its initial impact was a loss in credibility. This can be seen clearly in Chart 6,

Chart 6
Implied forward inflation rates at the time of Britain's exit from the ERM



which shows that departure from the ERM led to sharply lower expectations of nominal interest rates in the short run and higher inflation in the medium term.

The new monetary policy framework introduced in October 1992, and which has been extended subsequently through innovations such as the publication of the minutes of the monthly monetary meetings between Chancellor and Governor, gradually restored some of the lost credibility. And as shown in Chart 7, the tightening of fiscal policy begun in March 1993 and consolidated in the November 1993 Budget also led to some reduction in expected inflation rates in the medium to long run. Large budget deficits raise the probability that a future government will be tempted to inflate away the burden of debt, and the difficult—but vitally necessary—decision in 1993 to tighten fiscal policy has reduced either the expected inflation rate or the inflation risk premium, or both.

Chart 7
Implied forward inflation rates at the time of the autumn 1993 Budget

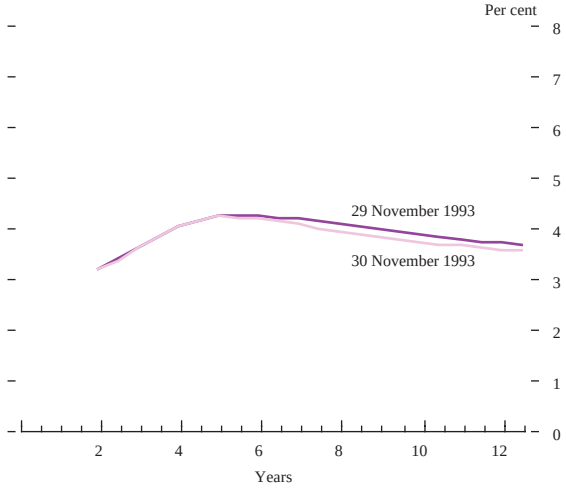
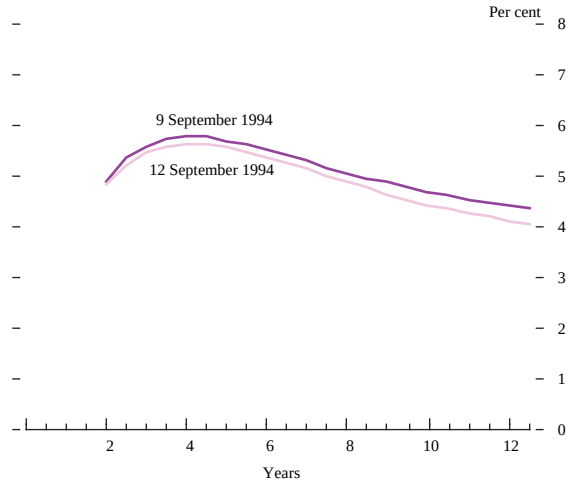


Chart 8
Implied forward inflation rates at the time of the September base rate rise



The final event, shown in Chart 8, demonstrates that the impact of the rise in interest rates in September 1994 was, as

hoped, a reduction in expected inflation and an improvement in the credibility of monetary policy. The chart shows also that there is still some way to go. Long-term credibility has not yet been established. Ten years from now the market is expecting either an inflation rate above the current target range (of below 2½% by the end of this parliament) or believes that there is sufficient uncertainty about the prospects for low inflation to require a significant inflation risk premium. Neither explanation is consistent with full credibility.

Evidence from other countries

The evidence presented in the previous section related solely to the United Kingdom. Can we find evidence of changes in credibility using data from other countries? Table A shows the levels of ten-year government bond yields in the G7 countries. Leaving Japan to one side for the moment, the ranking of countries is rather close to the ranking one would expect in terms of credibility of monetary policy. The two countries with long-established independent central banks, Germany and the United States, have the lowest bond yields. Yields in France have moved closer to those in Germany than for many years. And the United Kingdom, Canada and Italy—countries with rather poor inflation records over the past 25 years—follow on behind.

Table A
G7 ten-year government bond yields(a)

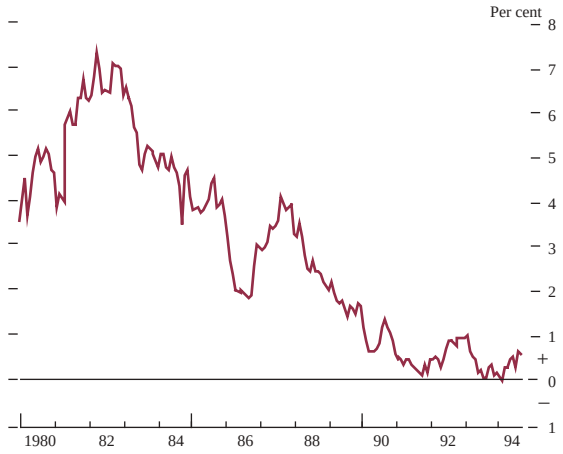
Japan	4.70
Germany	7.34
United States	7.61
France	8.02
United Kingdom	8.47
Canada	9.00
Italy	11.68

(a) Gross redemption yields on benchmark government bonds on 17 October 1994.

In a world of capital mobility, it would be reasonable to assume that the long-term real interest rate would be very similar across countries. Hence differences in bond yields would reflect differences in monetary credibility. There is one caveat to this conclusion. The assumption that real interest rates, measured in terms of domestic currencies, are likely to be similar in different countries depends upon the assumption that expected changes in real exchange rates over horizons as long as ten years are small. For most countries, that is a reasonable approximation. But in the case of Japan, with a history of a rising real exchange rate, it seems likely that the market is factoring into its calculations a further real appreciation of the yen. It is not easy to rationalise long-term interest rates in Japan otherwise.

Apart from the case of Japan, changes in relative bond yields do tell us something about changes in credibility. A good example of this is the experience of France. Chart 9 shows the differential between ten-year bond yields in France and Germany from 1980. At the beginning of the period, France was a country with low credibility in monetary policy and a poor inflation record. From 1983, it embarked upon a transformation of its monetary policy through membership

Chart 9
French-German long-term bond rate differentials(a)

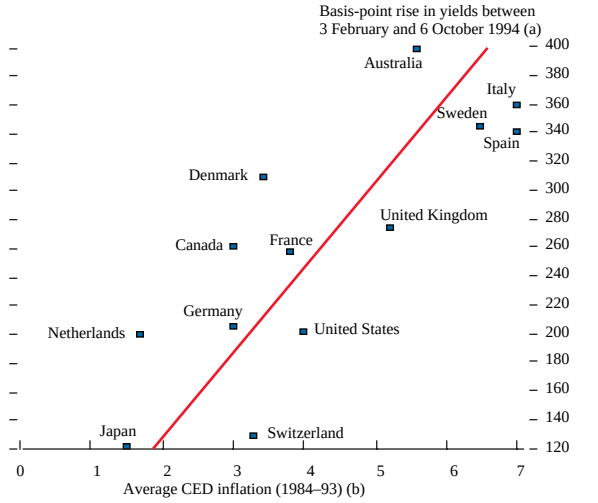


(a) Yield derived from average of secondary market prices of government bonds with over seven years to maturity; end-month observations.

of the ERM and a growing commitment across the political spectrum to price stability, and now an independent central bank. The effect of this is clear. The differential between French and German bond yields has virtually disappeared.

In addition to a comparison of levels of bond yields across countries, it is instructive to compare changes in bond yields over the past year—the stylised fact with which I began this lecture. Chart 10 plots the change in ten-year bond yields since the beginning of February 1994, immediately prior to the rise in US interest rates, against the average inflation rate in each country over the previous ten years for the major

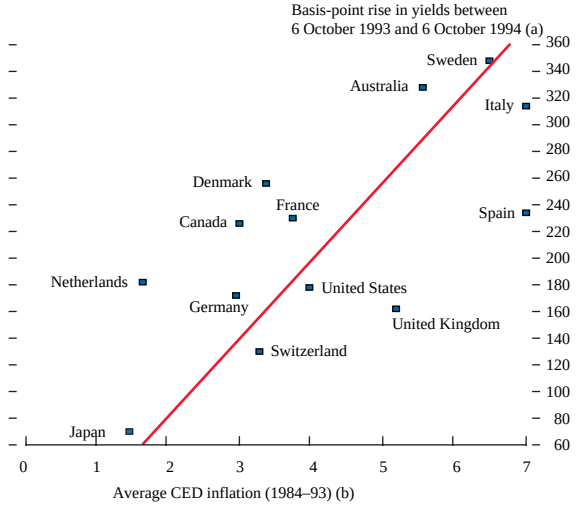
Chart 10
Rise in bond yields and past inflation



(a) Ten-year benchmark bond redemption yields. Source: Datastream.
(b) Inflation measured by the consumption expenditure deflator. Source: *OECD Economic Outlook*, June 1994.

industrial countries. The better the inflation record, the smaller the rise in interest rates this year. Nor is this simply a product of changes in rates since February. Changes in yields over the past 12 months show a similar pattern—see Chart 11. Part of the rise in bond yields over the past year is almost certainly a correction from the unusually low level of long-term interest rates reached after the bond rally of 1993.

Chart 11
Rise in bond yields and past inflation



(a) Ten-year benchmark bond redemption yields. Source: Datastream.
(b) Inflation measured by the consumption expenditure deflator. Source: *OECD Economic Outlook*, June 1994.

The re-appraisal of long-term rates which has taken place during 1994 reflects, in part, judgments about the long-term credibility of monetary policy in different countries which, inevitably, reflects recent history. This demonstrates that credibility is not something which can be acquired overnight; it has to be built up slowly over time. That is why, in the analysis of monetary policy, credibility is often equated with the reputation of the monetary authorities for their commitment to price stability.

Evidence from the foreign exchange market

Another source of information about credibility comes from the foreign exchange market. For given expectations about the exchange rate at some terminal date, changes in the yield curve will give rise to offsetting changes in the exchange rate. Denoting the T-year bond yield for country i at time t by b_{it}, the exchange rate between currencies i and j at time t by e_t, and the differential in T-year bond rates by d_t, then under the assumption of uncovered interest parity:

$$E(e_{t+T}) = e_t + d_t \qquad (7)$$

For example, if dollar interest rates are below Deutsche Mark interest rates, then the dollar would be expected to appreciate in order to yield the same expected return on both dollar and Deutsche Mark investments. Of course, exchange rates will also change because of revisions to beliefs about the terminal exchange rate. This is shown in Table B, which gives the changes in exchange rates for a number of currency pairings. For example, the first row shows that the dollar has fallen by almost 8 percentage points against the yen since the first US interest rate rise in February. But the change in the yield curves in the United States and Japan over the same period should have led to an appreciation of the dollar of about 8% for a given expected dollar/yen exchange rate in ten years' time. Hence the 'news' about the dollar during this year has been equivalent to roughly a 16% fall in its value against the yen some ten years from now.

Table B
Exchange rates and 'news'

Change between 3 February and 13 October 1994

	Actual percentage change (1)	Predicted percentage change (2)	'News' per cent (1)–(2)
¥/$	-7.7	8.2	-15.9
DM/$	-11.1	1.2	-12.3
£/$	-6.0	0.3	-6.3
FFr/$	-10.5	-3.1	-7.4

Notes:
(a) Calculations based on ten-year government bond yields.
(b) A positive sign represents an appreciation of the dollar.
(c) The predicted value is calculated by taking the change in the bond yield differential between two dates and compounding it over a ten-year period, given an uncovered interest parity condition.

This might reflect a change in the expected real exchange rate or a change in expected relative inflation rates over the same period. Since the 'news' about the dollar against the Deutsche Mark over the same period is about 12%, it seems likely that a good part of the fall in the dollar represents either a belief about the real effective exchange rate of the dollar or changes in the expected inflation rate in the United States. Similar, though slightly smaller, falls in the dollar can be observed in its exchange rates against sterling and the French franc. These numbers suggest that when assessing changes in nominal exchange rates it is important to take into account changes in the yield curves in the respective countries over the same time horizon.

Conclusions

I want to draw three conclusions from my talk.

First, credibility is important because the current behaviour of economic agents depends upon expectations of future actions of the monetary authorities. Talk is cheap, and to obtain the economic benefits of policies aimed at price stability means that those policies must be credible, in the sense that the authorities would face real costs if they were to allow inflation to rise. Without credibility, the monetary authorities will find they have an incentive to accommodate inflationary expectations. The adoption of an explicit inflation target provides reassurance to firms and households that the authorities would face a cost of deviating from their stated objective—provided that to hit the target implies a low average inflation rate. In other words, the target range must be neither too high nor too wide.

Second, credibility is not an all-or-nothing matter. Policy is neither credible nor incredible. It is, as we say in economics, a continuous variable. For that reason, we should place it in context and remember, as Stanley Fischer has reminded us, that 'credibility is a slippery concept which should not be overvalued' (Fischer 1994). Nevertheless, credibility can be increased by the patient pursuit of policies directed toward price stability which, over time, will create a reputation. Credibility can be enhanced by a policy framework based on an inflation target, and by institutional changes such as the degree of openness and transparency embodied in the Bank's *Inflation Report* and in the publication of the minutes of the monthly monetary meetings

between Governor and Chancellor. The key to building credibility lies in the maxim, 'Say what you do, and do what you say'.

Third, the financial data which I have presented—the 'message from the markets'—constitute evidence on the credibility of monetary policy over the medium term. They are not a judgment on the policy of the past year, nor even that of the next year, but on the commitment to price stability which all of us in the electorate will show in the next five to ten years. The credibility of the Bundesbank derives, in part, from the collective commitment to price stability in Germany. Over the past 30 years in Britain, the experience of inflation has altered our own attitudes and demolished the belief that inflation can buy permanently higher output. The test of our commitment will come over the next decade. In the Bank of England, our task is to persuade people of the value of price stability. We may persuade only a few, but from these small acorns may grow oaks of stability.

Credibility is about beliefs on the factory floor, just as much as on the trading floor. The performance of the monetary authorities may be judged day by day in the financial markets but ultimately what matters are the views of employers and employees, and of savers and shoppers. As the Americans would say, it is Main Street not Wall Street which will determine the inflation rate.

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