Gradualism in the Adjustment of Official Interest Rates: Some Partial Explanations

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A. Central Bank Reaction Functions

After many decades during which mainstream economic theorists posited that Central Banks either did, or certainly should, fix the monetary base, with interest rates being subsequently determined endogenously (the famous IS/LM diagram), realism has finally triumphed (Bindseil 2004, Goodhart 2002). It is now accepted that, not only do Central Banks set official interest rates, (which would be hard to deny given the publicity surrounding the meetings of FOMC, MPC in UK, ECB, BoJ for just that purpose), but that such procedures can be (nearly) optimal so long as Central Banks adjust interest rates appropriately and endogenously in response to foreseen developments in the economy (Woodford 2003).

Most empirical research on the question of how Central Banks actually do, and also should, set official interest rates have been based on (what have become known as) Taylor-type reaction functions, whereby the Central Bank adjusts its interest rate in response to current deviations of inflation from target and of output from its estimated equilibrium, i.e. the output gap, (Taylor 1993, 1999). Although the preference function is usually set out in quadratic form, the empirical studies have usually examined a linear equation of the form:-

$$i_t = a + b_1(\pi_t - \pi^*) + b_2 x_t + \varepsilon_t \quad (1)$$

where i_t is the current level of the interest rate, a is a constant equal to the equilibrium real rate of interest plus the target rate of inflation, π_t is current inflation, π^* is the target rate, x_t is the output gap, and ε_t a stochastic error term.

It was soon discovered, however, that such estimated equations did not fit well unless a lagged dependent variable was added, extending the equation to the following form:-

$$i_t = a + b_1(\pi_t - \pi^*) + b_2x_t + b_3i_{t-1} + \varepsilon_t \qquad (2)$$

In such regressions the value of b_3 was usually found to be quite close to, but somewhat lower than, unity, often around 0.8 or 0.9. This was generally ascribed to a tendency for the short run official response to a shock likely to affect the output gap and/or inflation to be much smaller than the ultimate long-run full equilibrium; such behaviour was usually attributed to the reasons for cautious gradualism first identified by Brainard (1967).

Further work on the statistical characteristics of the time paths of official interest rates (see Sack, 1998, 2000; Sack and Wieland, 2000; Goodhart, 1999) revealed that their particular feature was long series of small interest rate changes of the same sign, continuations of similar signed (small) rate changes being far more, and strongly significantly so, likely than reversals.

It was, and remains, far from clear that such a gradualist time path is optimal. As I wrote in my 1999 paper, (pp 235-6),

> `The key point is that the MPC should choose an appropriate future horizon at which to aim to return to the inflation target set by the Chancellor. By doing so, they should come close to minimising the variance of both output and inflation. Given that horizon, how then should the monetary authorities operate, according to the principles that flow from our models of the economy, always remembering, and I really want to emphasise this, that in most of these models the only uncertainty in the system is

additive and stochastic?

The answer to that conditional question is fairly clear. We should each month alter interest rates so that the expected value of our target, the forecast rate of inflation at the appropriate horizon about 18 months to two years hence, should exactly equal the desired rate of 22%. Lars Svensson has written several papers (e.g. 1997a, 1997b, 1999) on the optimality of such a procedure. If we start from an initial position in which the predicted forecast value of inflation is already close to the objective, then as a first approximation we should expect interest rates to respond to the unanticipated element in the incoming news. Since this is by definition a martingale series, often somewhat loosely termed a `random walk', then, on these assumptions, an optimally conducted interest rate path also ought to be nearly random walk. This is, broadly, what the generality of our economic models imply.'

Neither I, nor I believe most of my colleagues, notably Willem Buiter, consciously aimed at gradualism, in the sense that we regularly voted to change interest rates by less than the amount we considered necessary to return inflation to target. Moreover my subsequent, and still continuing, work on the publicly available data on MPC forecasts supports the claim that the MPC's objectives were, indeed, to change interest rates so that inflation at the forecast horizon, two years, i.e. eight quarters t + 8 ahead, would be driven back to the target level, RPIX at 2.5%. Thus in my paper `What is the Monetary Policy Committee Attempting to Achieve', (2004a), I conclude that,

`What I claim to have established is that the MPC has indeed aimed to drive the inflation forecast into line with target at a two-year horizon, with this latter horizon being well determined empirically.'

Subsequently I have been exploring how regressions, of the general form of equation 2, for Taylor-type reaction functions alter if these were run against the relevant forecasts (for inflation and output[i]) rather than actuals. The key result for me, (readers can find all the results set out in Goodhart (2004c)), was that at an horizon of t + 8, the MPC appeared to act almost exactly so as to drive the forecast deviation of inflation from target[ii] back into line with the 2.5% target.

The key equation was:-

$$i_t = -0.12 + \underset{(0.43)}{2.29}\,(\pi_{t+8} - 2.5\%) - \underset{(0.27)}{0.18}\,(dy_{t+8} - 2.25) + \underset{(0.09)}{1.01}\, i_{t-1} \quad : R^2 = 0.92,\ DW = 2.39 \qquad (3)$$

where dy_{t+8} is the rate of growth of output at t + 8 over the same quarter one year ago, i.e. at t + 4, and 2.25 is the assumed sustainable trend rate of growth. Note that this suggests that the MPC changes the level of interest rates (n.b. the coefficient on the lagged dependent variable is exactly unity) by a large amount (2.29) for every unit of deviation of inflation from target. In the MPC's pamphlet on `The Transmission Mechanism of Monetary Policy', the effect of a 1% change of interest rates on inflation after eight quarters is close to 0.3%. Multiply 0.3 by 2.29, and the implication is that the MPC acted immediately to offset almost all the foreseen deviation of inflation from target, i.e. no hint of any evidence of any intended gradualism, or of long-run responses being a multiple of short run responses.

Since the coefficient on the lagged dependent variable (at the horizon of t + 8) was almost exactly unity, this suggested that the proper specification would be in first difference; this had the advantage that we could test whether lagged (quarterly) changes in interest rates entered the reaction function. The results were:-

$$di_t = \underset{(0.46)}{2.32}(\pi_{t+8} - 2.5) - \underset{(0.16)}{0.28}(dy_{t+8} - 2.25) + \underset{(0.19)}{0.02}di_{t-1} - \underset{(0.15)}{0.17}di_{t-2} \quad : R^2 = 0.74,\ DW = 2.45 \qquad (4)$$

Note that there is no sign of auto-correlation of interest rate changes, nor of gradualism in this framework.

What, however, I find remarkable is that, although there is considerable evidence that the MPC was not behaving in a gradualist fashion, still the actual outcome for the time path of interest rates appears to have been just as auto-correlated, with similar long-runs of continuations (and few reversals) in interest rate changes, as in earlier years or as in other countries. This can be seen in Figure 1, where the frequency of reversals is, if anything lower, and the number of continuations, higher in recent years than before, (whether you take the break date as occurring in 1993 with the adoption of Inflation Targetry, or in 1997 with the adoption of Operational Independence).

So what is going on?

B. Arguments for Gradualist Behaviour

The central paradox of Section A is that the available evidence is that the MPC did not act in a gradualist fashion, and yet the outcome in the UK looked like gradualism. So on this reading of the evidence, arguments that gradualist behaviour is inherently desirable are beside the point. There was no prior intention to act in a gradualist fashion; something else caused that to occur.

Even so, it may be of some interest to list some of these arguments. The oldest established argument is that related to Brainard uncertainty, whereby uncertainty about the strength of the transmission mechanism, (of the coefficient on real interest rates in the IS curve), leads to caution in the exercise of that instrument. Indeed so, but uncertainty about the extent of persistence (coefficients on lagged inflation or lagged output gaps in either the IS or AS curve) and so-called `robust' policy responses (to minimise the likelihood of the worst possible outcome) can by the same token make policy more aggressive (Schellekens, 2002; Sargent, 1998; Svensson, 1997c).

Next, assume that the transmission mechanism operates via long rates of interest, and that long rates are determined by expected future short rates. Then a given immediate effect on long rates can equivalently be achieved by an immediate spike in short rates, expected to last only a short period, or by a much smaller change in short rates expected to last for a long period, (see Figure 2). If there are reasons to lessen the volatility of the level of short rates (e.g. for reasons relating to the non-payment of interest on cash and hence an effect on the demand for money, or because of the zero-bound on nominal interest rates, see Woodford (2003), Chapter 4), then you want to keep the change in short rates, following some observed shock, small but persistent, as in Figure 2. Note, however, that there is only one change in interest rates there; the Woodford argument in its basic form is for persistence, not gradualism. The two are contrasted in Figure 3.

This example, however, relates only to a single shock. Assume, instead, that there are a sequence of shocks, and that the authorities can distinguish between major and minor shocks after they have hit. Then with large shocks hitting at A and B, and small shocks at intervening dates, a policy of a single step change (held for a long persistent period), gives a pattern with a lot of reversals as in Figure 4. It is difficult to see what the authorities are doing, so the response of long rates to any change in short rates may be muted. If, on the other hand, the authorities combine persistence with gradualism, as in Figure 5, then the longer-run policy stance of the authorities becomes far more easily discernible. Martin Ellison (2003) has written on `The Learning Cost of Interest Rate Reversals' and this is, in some part, a diagrammatic exposition of that.

A related problem facing the authorities is that it is difficult, perhaps impossible, for outsiders to distinguish between a random walk path for policy that <u>perfectly</u> offsets the martingale path of shocks, (and if `shocks' do not follow such a martingale are they properly described as shocks?), and a policy of indecision and lack of grip. Let me repeat a section from my 1999 paper, (pp 236-237):-

> `I want to contrast the normative theory inherent in our basic models with the public perception that such random walk behaviour is not optimal in practice. Thus, in The Times on Thursday, 11 June, under the headline `Anger grows at Bank's U-turn' (p. 29), Janet Bush and Anne Ashworth state that,
>
> > "Critics of the increase described the Bank=s apparent shift in policy as `almost laughable'. One said: `It is like a drunk staggering from side to side down the street'."
>
> You will appreciate that this latter is an almost perfect description of a random walk path. Similarly, the Sunday Business main leader of 7 June was entitled "The fickleness of hawks today and doves tomorrow"; the unnamed writer commented,
>
> > "Where the committee lost credibility last week lies in its inconsistency.... What is the outside world meant to make of members who can change their view so readily? It suggests a fickle committee, influenced by the latest anecdotal or statistical evidence, swaying its opinions one way or the other and back again."
>
> One of the arguments used by Wim Duisenberg, the President of the ECB, in rejecting the publication not only of individual voting records but also of minutes for some long duration is apparently (and this passage is in direct quotes in Robert Chote's

Financial Times article on 1 June (p. 10) that:

> "Publication of the minutes soon after decisions have been taken or meetings have taken place will - and this is only human - make it more difficult for individual participants in the discussion to change their minds and be convinced of the arguments of others."

Now this struck a particular chord with me; for example, yet another commentator, Jonathan Loynes, writing in Greenwell Gilt Weekly on 18 May, wrote,

> "Of course, this does not mean that Professor Goodhart cannot switch *back* to the Hawks. If his change of heart was driven by recent softer earnings numbers then the latest pick-up could cause him to think again. But an immediate about-turn is most unlikely, if only for reasons of credibility."

Wim Duisenberg presumably now doubts my humanity, Jonathan Loynes my credibility. Yet let me reprise once again. If policy is roughly on course to deliver the desired objective, then policy should be finely balanced, and should react to incoming unanticipated news in an approximately random walk fashion. A committee, or an individual within that, who consistently votes the same way for month after month either has got the balance of policy seriously wrong, or individually must think that that balance is seriously wrong.'

And I went on to conclude, (pp 256/257),

`There is an absolute yawning gap between the general perception of non-economist outsiders that reversals of policy, changes of mind, are to be deplored and castigated

> as evidence of error, irresolution and general incompetence, and the apparent findings from our economic models that such reversals should optimally occur some four, or so, times more frequently than they do in practice. Maybe our models are missing something important. If not, we have then singularly failed to explain to the world at large how policy should be carried out. Either way, there is still an enormous amount of work to be done.'

There are, therefore, plenty of reasons why a Monetary Policy Committee might adopt gradualism as a preferred policy. The problem is that the evidence indicates that the MPC did not do so. Whenever the forecasts suggested that future inflation would deviate from target at the chosen two-year, eight quarter horizon, interest rates were immediately adjusted to eliminate that deviation. So why were interest rate changes auto-correlated?

C. The Constant Interest Rate Assumption

One candidate explanation is that this arises quasi-automatically from the forecasting and decision-making procedures hitherto espoused by the MPC. Partly for historical reasons, (owing to the unwillingness of the Bank to be thought to be infringing on the Chancellor's prerogative to set interest rates in the period 1993-1997), the Bank has traditionally done its main forecast on the conditioning assumption that interest rates are to be held constant at the level set at the latest previous decision date. As is well-known, constant nominal interest rates, beyond some horizon, will generate Wicksellian instability. Thus, except in rather rare cases, the trend (upwards or downwards) in the rate of inflation after the published horizon is likely to continue, and indeed often to become more exaggerated.[iii] An example is given in Figure 6.

It is easy to see from this that simply rolling the forecast forward one quarter is likely to re-create the prior deviation of inflation from its target. Even if the MPC at each occasion thought that it was eliminating the deviation, a similar deviation was likely to recur at the next forecasting round. So auto-correlation of interest rate adjustments, whether for good or for ill, was, in a sense, built into the methods used by the MPC.

Undoubtedly there have been instances when the inflation forecast beyond the two-year horizon did show a continuing (occasionally even a worsening) trend. This might then well suggest a continuing future path of interest rate changes of the same sign. Although now an outsider to such decisions, my impression is that the forecast/decision-making round in February 2004 has been a case in point. This syndrome is one of the reasons why critics have criticised a constant-interest-rate (CIR) path as a conditioning assumption for the forecast, and would prefer instead some kind of explicit path, as done in New Zealand.[iv]

Nevertheless the question of how far the CIR assumption necessarily induces auto-correlation into the MPC's decision-making process is, at least in part, an empirical issue. One way of trying to get a quantitative handle on this is to note that inflation at time t is associated with higher output (growth)[v] at time t - 4. Thus if it was the case that auto-correlations in interest rates was due to rolling forward trended inflation between t + 8 and t + 12, then one might expect to see that accompanied with above average growth in output forecasts from t + 4 to t + 8. In Table 1 we show the forecasts (modal) for output growth, compared in column 2 with contemporaneous estimates of output growth, (see Goodhart 2004 b for derivation and detail).[vi] This table is arranged so that consecutive forecasts for the same date are plotted horizontally. Thus for 2002 Q1, the contemporaneous estimate of output growth was 1.37%. The forecast of output growth made in February 2002 (t=0) was also 1.37%; the forecast made for 2002 Q1 in February 2001 (t=4) was 2.10%; and in February 2000 for 2002 Q1 (t=8) was 2.39%. This implies, however, that the forecasts for subsequent quarters at each quarterly decision date appear diagonally. Thus in 1998 Q1, the forecast in February for the contemporaneous quarter (t=0) was 3.04%, the forecast for 1998 Q2 was 2.33%, for 1998 Q3 was 1.76%, for 1998 Q4 was 1.64%, and so on down diagonally. In order to show more clearly what the forecasts for output growth for subsequent quarters were at each quarter's date, we rotate this table, also showing in column 1 the interest rate decision.

This is shown in Table 2. The associated forecasts for inflation shown in Tables 3 and 4.

These tables, however, reveal that there appears to be a common feature of the forecasts for output growth. At short horizons these forecasts tend to underestimate outcomes, even more so when one uses the latest available data rather than those estimated contemporaneously. The most pessimistic forecasts are those for t + 0 and t + 1. At longer horizons the forecasts have tended to become steadily more optimistic on average, so that by the longest horizon, t + 7, t + 8, growth has been generally expected to be slightly above trend, (as contrasted with expectations of below trend growth around t + 0 till t + 4). Owing to the short sample, and the variance of the forecasts, such differences are, however, barely significant.

Nevertheless these, possibly systematic, tendencies for the output growth forecasts to change as the horizon lengthens raises the question whether one should compare each run of forecasts to the overall forecast average, or to the average forecast at each horizon. I have chosen to do the latter. Table 5 then reports the deviation of each forecast from actual <u>after</u> adjusting for the average bias in the forecast at that horizon, (i.e. the sum of deviations in each column adds to zero). Somewhat arbitrarily, we have given equal weight to each deviation between t + 4 and t + 8, and the resulting sum of these deviations is given in Column 9.

The basic hypothesis is that strongly positive deviations (actual greater than forecast), implying low expected growth in the second year, would be associated with downwards trending inflation, and so under CIR would suggest a decline in interest rates in the next quarter, and vice versa for negative deviations. Again, somewhat arbitrarily, we assume that the sum of deviations is too low to influence a potential change in policy when it falls between +1 and -1. The resulting implied sign of interest rate effect is shown in Column 10, and the actual sign of the change in the final Column.

There is a strong concordance between the implied signed direction of effect and the actual interest rate changes between Q3 1998 and Q2 1999. From Q3 1998 until 1999 Q2, the forecasts for output growth in the second year were consistently gloomy, and each subsequent quarter there were successive downwards adjustments in interest rates. Then in Q3 and Q4 1999 there were more buoyant forecasts for output growth in the second year, and upwards increases in interest rates in Q4 1999 and Q1 2000.

But for the rest of the period that can be examined in this way, the relationship is not strong. In eight cases, either there was no change in actuals when the deviation implied a change, or vice versa; in one case both indicated no change; and four instances when the output forecast suggested the opposite change to that undertaken, e.g. low expected growth but an interest rate increase in Q3 1998, and the reverse combination at the start of 2001.

A further, and essentially, similar test is to take the difference between the forecasts for both output and inflation, between t + 4 and t + 8, at the time that the forecast was first made (i.e. in 1997 Q3 for 1999 Q3), and compare it with the unanticipated changes in the inflation and output forecasts between t + 8 and t + 0 in successive forecasts. The question that this asks is whether the trends seen in output and inflation in the second year when the forecast was first made could be used to indicate the likely subsequent direction of forecast revisions on subsequent forecasting occasions. The data are shown in Table 6. We regress these subsequent revisions (for derivation see Goodhart 2004b) against the earlier perceived second year trends, columns 4 and 7.

The results in Table 7 show that the second year forecast trends in inflation and output had no relationship with subsequent revisions to the output forecast. However, there are signs that an upwards trend in inflation in the second year was positively associated with subsequent upwards revisions to the forecast for inflation. This latter is consistent with the quasi-automatic CIR hypothesis.

Thus the evidence provides some support for the CIR hypothesis, but the relationship appears sporadic rather than continual, and at best of moderate strength and explanatory power.

D. Systematic Forecast Errors

We turn next to the final potential cause of gradualism that we shall propose here, (though we cannot rule out the possibility that we may have failed to consider other causes).[vii] This is that the forecasters tended to make systematic, auto-correlated errors.[viii]

On each forecasting occasion, as reported earlier and in more detail in Goodhart (2004c), the MPC normally acted to drive forecast inflation back close into line with target, (n.b. ex post forecast inflation at t + 8 was throughout the period very close to 2.5 with little variance, see Goodhart 2004a). Thereafter, however, the errors tended to be in same direction, i.e. inflation (and output growth) was systematically under (over) predicted, despite successive changes (gradualism) to offset this. Similarly, if inflation (or output growth) at any particular horizon was under (over) predicted at any particular horizon, it would tend to be similarly under (over) predicted on the next occasion. This is shown in Tables 8 and 9 where we report the prediction errors for inflation and output growth, (relative to contemporaneous actuals). The average values, standard errors and first order auto-correlations of the columns and rows of these deviations are also reported in these Tables.

Let us now use these Tables for a simple description of events. It is probably easiest to start with the forecasting errors in output growth, Table 8, (positive implying actual greater than forecast). Initially, in 1997 and early 1998, the forecasters predicted steady output growth, but this became increasingly overtaken by the arriving Asian crisis, which was not (unsurprisingly) foreseen, so that initially we see negative deviations in 1997/98. But the pessimism about that crisis shortly became overdone, and (again) the effects of the dot.com boom in 1999/2000 were not foreseen. So from end 1998 to early 2001, there are persistent strong positive deviations. By Q1 2001 the forecasters had caught up with the ongoing boom, just in time to miss the extent of decline caused by the bust of the bubble. So from

2001 Q3 to 2003 Q3 there is a sea of negative deviations, forecasts greater than outturn. The evidence from Table 8 is very clear; there is strong auto-correlation in the errors forecasters made in predicting output.

This picture, of auto-correlation in forecasting errors, is not quite so strong in the forecasts for inflation (Table 9). Here what seems to have happened in the initial years of our period is that the forecasters gave more weight to the presumptive effects of major exchange rate fluctuations on domestic inflation than was in practice justified. Thus there was a major devaluation of sterling in 1992, and inflation was over-predicted (negative deviations) in 1993 and 1994. From 1995 and 1997 Q2, there is no clear pattern of deviations. Then in 1997 (especially Q2 and Q3) there was a rapid, and historically large, appreciation of sterling. From 1997 Q3 until 1999 Q1 the forecasts systematically underpredict inflation. Perhaps because the forecasters initially failed to see the deflationary effects of the Asian crisis, inflation became overestimated in 1999 (negative residuals); but after that the patterns in the forecast errors are neither as clear, nor as auto-correlated, as with output growth.

In my earlier paper, (Goodhart 2004b), I decomposed the changes in the forecasts, for a particular end-date (and either inflation or output growth), e.g. the forecast for Q3 2001, from the longest horizon forecast at t + 8, (e.g. made in Q3 1999 for Q3 2001) to the shortest horizon forecast at t = 0 (e.g. made in August 2001 for Q3 2001) into the unanticipated change in the forecast and the official response in the form of interest rate adjustments. This showed that policy, in the form of interest rate adjustments, was used systematically to offset such unanticipated changes to the forecasts.

So, what we have sought to establish is:-

(1) forecasting errors are auto-correlated, strongly so for output growth, less so for inflation.

(2) interest rate adjustments are used to offset such auto-correlated errors.

Hence, by conclusion, the gradualism in interest rates derives in some large part from the autocorrelated errors of the forecasters. That this has been an important cause of gradualism, at least during this short sample period, seems patently clear.

Conclusion

The evidence, largely taken from Goodhart 2004c, indicates that the MPC was not seeking to behave in a gradualist fashion during our (short) data period, 1997-2003. So arguments in favour of such gradualist behaviour being consciously undertaken, though of themselves interesting, are somewhat beside the point.

Yet, ex post, the actual path of interest rate changes did seem as gradual, with consecutive small steps, as previously or in other countries. Why? We examine two hypotheses. The first was that this was a quasi-automatic consequence of adopting the constant interest rate (CIR) forecasting method. There, almost certainly, have been occasions where this played a role (1998/99 and 2004 being cases in point), but the tests used here suggested that this effect was sporadic rather than regular and persistent.

What did, instead, seem systematic in this period was for forecasting errors to be auto-correlated, strongly so for output, weakly for inflation. We also document (primarily in Goodhart 2004b) the tendency of policy-determined interest rate changes to be applied to offset such series of auto-correlated forecast errors, but only partially so. Hence I claim that gradualism, the auto-correlation in interest rate changes, has been, at least in this short time period, primarily a function of auto-correlated forecasting errors.

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[i] Note, however, that, owing to data limitations, we had to use data on (forecasts and

actuals of) output growth, rather than the output gap.

[ii] N.B. The Inflation Report forecasts are presented after the associated interest rate decisions have been taken. To assess what the ex ante forecasts would have looked like, we had to make adjustments to remove the effects on the ex post forecast of those interest rate changes themselves. We could do this by using the MPC's pamphlet (1999) on `The Transmission Mechanism of Monetary Policy'. Details are given in Goodhart (2004 b and c).

[iii] Since such instability sets in seriously after this two-year horizon, simulations of longer term outcomes using the Bank model are done after the inclusion of some equilibrating Taylor-type reaction function into the model to take effect after t + 8.

[iv] There are a set of further arguments for, and against, the CIR assumption. For criticisms see Martijn and Samiei (1999), Mayer (2001), Svensson (2003). I have defended it, see Goodhart (2001, 2004).

[v] Of course, it would be much better if I could use data on forecasts for the output gap. Alas we do not have these in the public domain.

[vi] Note that in this case it is correct to use the ex post forecast, published in the Inflation Report, rather than the ex ante forecast on which the MPC's immediately previous interest rate decision had been based. For a further analysis of this, see Goodhart 2004c.

[vii] Rudebusch and Wu (2004) argue, p. 16, that,

> "The persistence in S_t [a slope factor capturing the cyclical response of the Fed] reflects the fact that the Fed adjusts the short rate promptly to various determinants -

> output, inflation, and other influences in the residual u_t - that are themselves quite persistent (e.g., $\rho_u = .975$). Thus, our estimate of ρ_S decisively dismisses the interest rate smoothing or monetary policy inertia interpretation of the persistence in the short rate. The persistent deviations of slope from fitted slope..... occur not because the Fed was slow to react to output and inflation but because the Fed responds to a variety of persistent determinants beyond current output and inflation."

But they never state explicitly what such other determinants may have been.

[viii] Such errors can also be due to failures to observe the correct current level of the output gap, see Rich (2003) and Orphanides (2001).

Figure 1

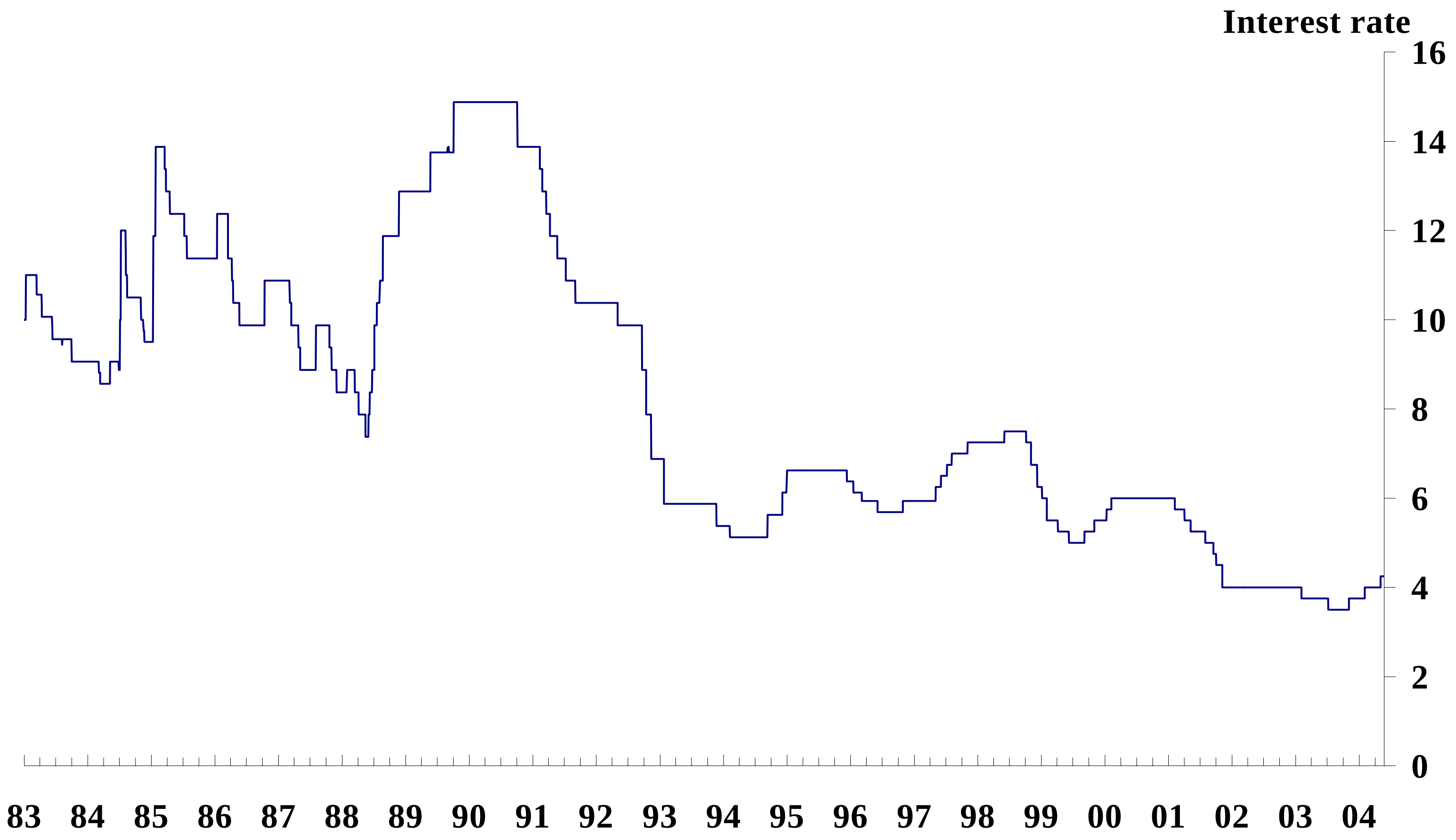

Interest rate
16
14
12
10
8
6
4
2
0
83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04

Figure 2

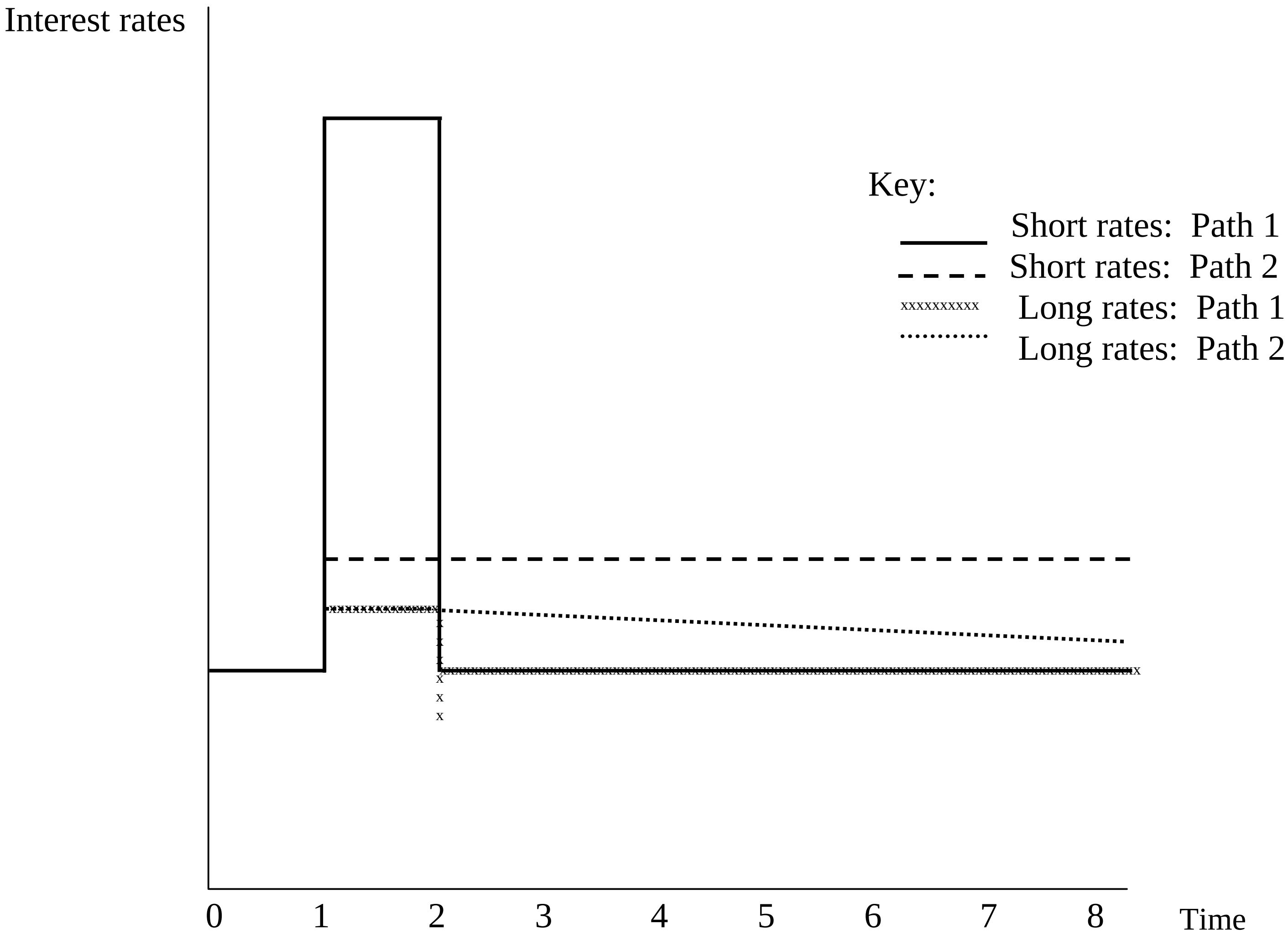

Interest rates
Key:
Short rates: Path 1
Short rates: Path 2
Long rates: Path 1
Long rates: Path 2
0
1
2
3
4
5
6
7
8
Time

Figure 3

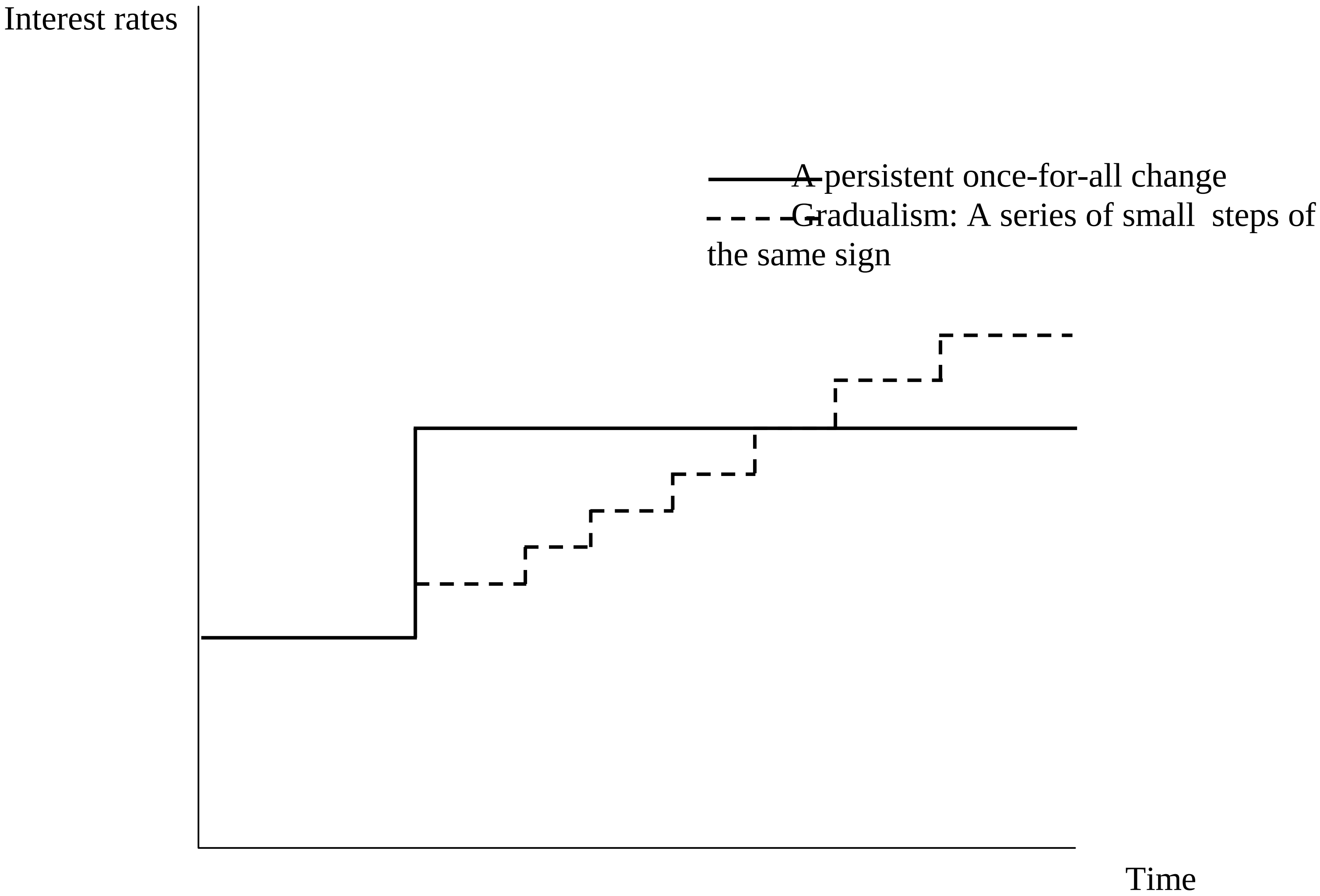
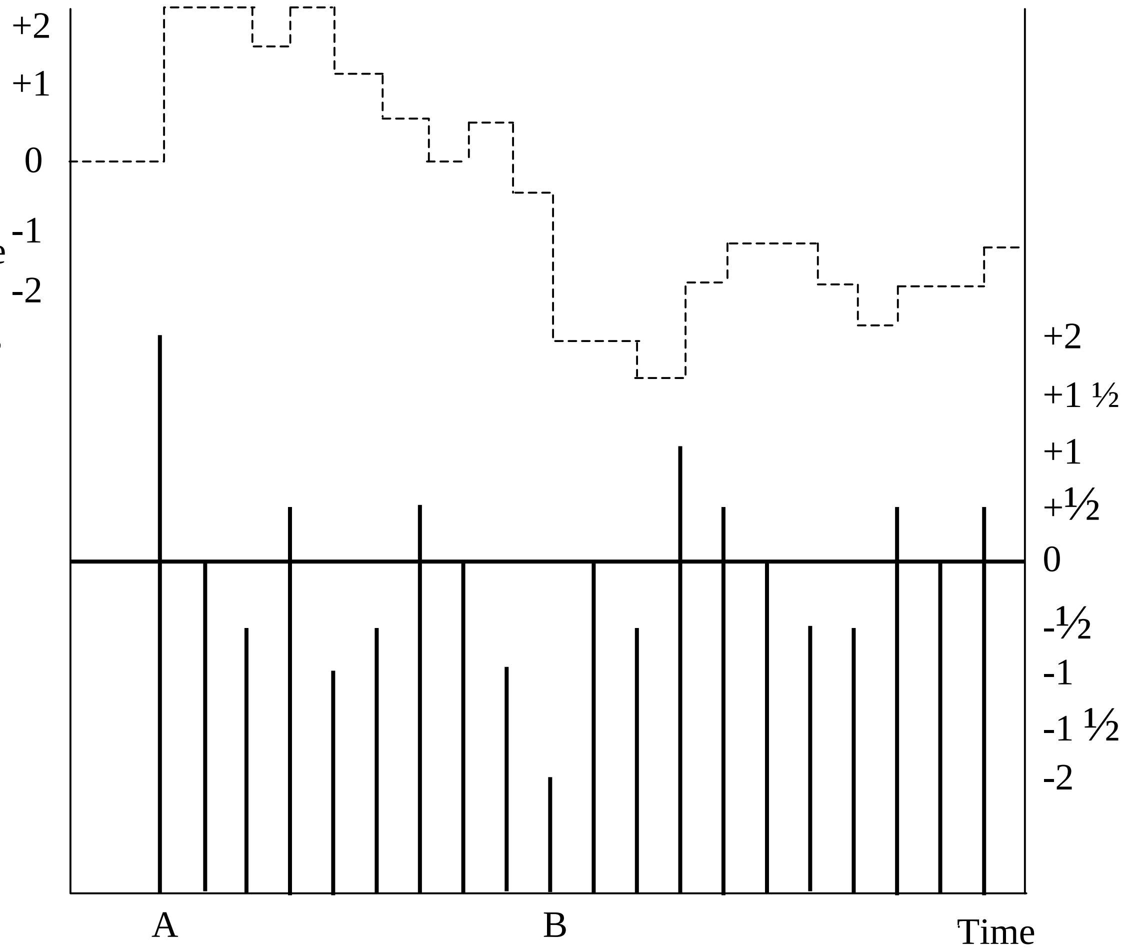

Interest rates
A persistent once-for-all change
Gradualism: A series of small steps of the same sign
Time

Figure 4

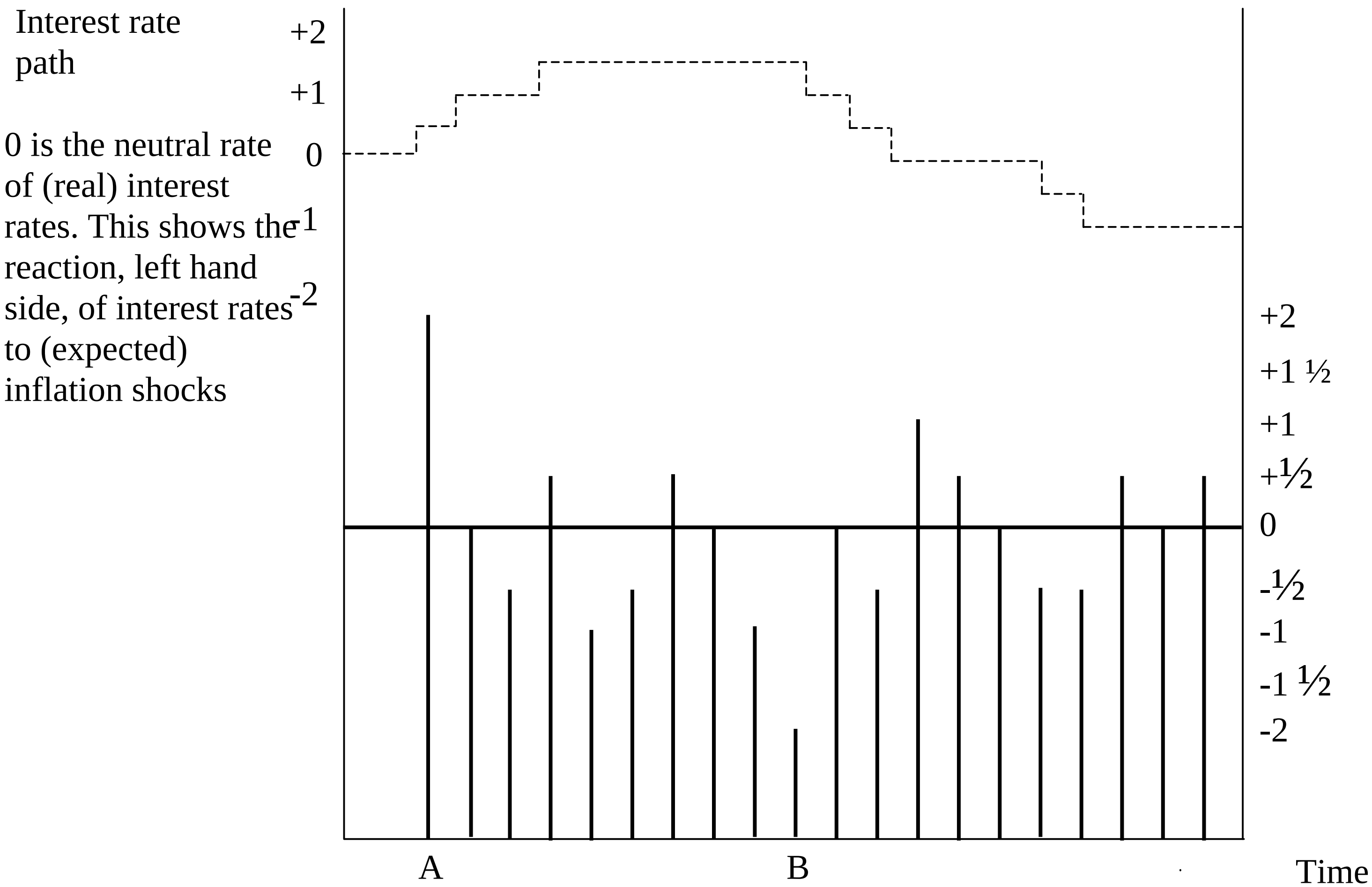
Interest rate path

0 is the neutral rate of (real) interest rates. This shows the reaction, left hand side, of interest rates to (expected) inflation shocks



The bars at the bottom measure shocks to (expected) inflation, with scale on the right hand side

Figure 5



The bars at the bottom measure shocks to (expected) inflation, with scale on the right hand side

Figure 6

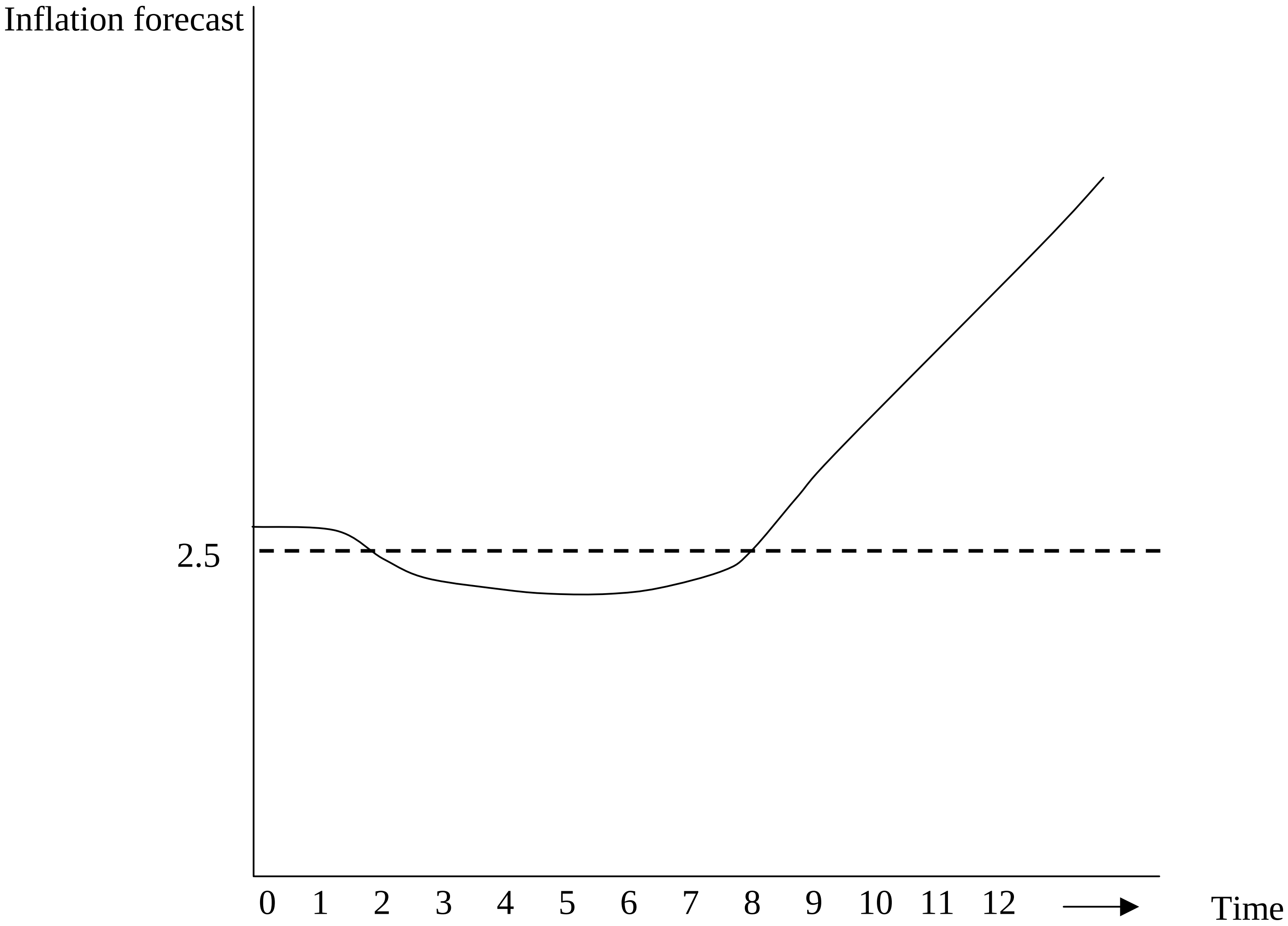


Table 1
Bank Forecast of GDP

	Output % growth 2003 estimate	Output % growth contemp-oraneous	Forecast t = 0	1	2	3	4	5	6	7	8
1997 Q3	3.19	3.89	3.39								
Q4	3.36	3.93	4.02	2.82							
1998 Q1	3.38	2.88	3.04	3.54	2.37						
Q2	2.79	2.47	2.41	2.33	2.84	1.85					
Q3	3.51	2.40	1.99	1.86	1.76	2.11	1.80				
Q4	2.82	2.02	1.95	1.66	1.71	1.64	1.33	1.83			
1999 Q1	2.72	1.70	1.16	1.28	1.41	1.76	1.59	1.41	2.03		
Q2	2.61	1.64	0.79	0.77	1.00	1.19	1.83	1.79	1.64	2.38	
Q3	2.60	2.30	1.32	0.99	0.68	0.84	1.29	2.11	2.15	1.93	2.63
Q4	3.26	2.75	2.50	1.90	1.20	0.83	1.01	1.54	2.27	2.41	2.33
2000 Q1	3.96	3.11	2.92	2.82	2.41	1.49	1.36	1.33	1.69	2.39	2.61
Q2	4.30	3.36	2.94	2.70	2.80	2.58	1.72	1.82	1.65	2.09	2.56
Q3	3.94	2.98	2.56	2.58	2.47	2.51	2.73	1.99	2.24	2.02	2.44
Q4	2.93	2.72	2.73	2.48	2.45	2.24	2.42	2.80	2.58	2.61	2.48
2001 Q1	2.56	3.01	2.86	2.76	2.50	2.57	2.27	2.61	2.92	2.97	2.83
Q2	2.23	2.65	2.25	2.30	2.39	2.51	2.61	2.35	2.70	3.01	3.11
Q3	1.80	2.24	1.62	2.03	2.07	2.31	2.53	2.65	2.38	2.82	3.02
Q4	1.95	1.71	2.09	1.82	2.46	2.22	2.40	2.63	2.70	2.39	2.83
2002 Q1	1.44	1.37	1.37	1.92	1.98	2.68	2.10	2.48	2.81	2.74	2.39
Q2	1.55	1.75	1.35	1.48	1.97	2.26	2.72	2.37	2.51	2.79	2.70
Q3	1.93	2.26	1.82	1.62	1.78	2.05	2.42	2.71	2.62	2.50	2.76
Q4	1.99	2.31	2.29	2.34	2.32	2.43	2.27	2.33	2.48	2.81	2.48
2003 Q1	1.84	2.10	2.53	3.06	2.91	2.95	2.76	2.49	2.24	2.42	2.89
Q2	1.98	1.84	2.38	2.58	3.18	2.75	2.95	2.79	2.66	2.15	2.42
Q3	1.89	1.89	1.59	2.00	2.33	3.17	2.94	3.15	2.69	2.70	2.11

Table 2

			GDP	Forecast t =									
			Actua	0	1	2	3	4	5	6	7	8
Date	IR	IR Change											
1997	7	0.75	3.89	3.39	2.82	2.37	1.85	1.8	1.83	2.03	2.38	2.63
Q4	7.25	0.25	3.93	4.02	3.54	2.84	2.11	1.33	1.41	1.64	1.93	2.33
1998	7.25	0.00	2.88	3.04	2.33	1.76	1.64	1.59	1.79	2.15	2.41	2.61
Q2	7.25	0.00	2.47	2.41	1.86	1.71	1.76	1.83	2.11	2.27	2.39	2.56
Q3	7.50	0.25	2.4	1.99	1.66	1.41	1.19	1.29	1.54	1.69	2.09	2.44
Q4	6.75	-0.75	2.02	1.95	1.28	1	0.84	1.01	1.33	1.65	2.02	2.48
1999	5.50	-1.25	1.7	1.16	0.77	0.68	0.83	1.36	1.82	2.24	2.61	2.83
Q2	5.25	-0.25	1.64	0.79	0.99	1.2	1.49	1.72	1.99	2.58	2.97	3.11
Q3	5.00	-0.25	2.3	1.32	1.9	2.41	2.58	2.73	2.8	2.92	3.01	3.02
Q4	5.50	0.50	2.75	2.5	2.82	2.8	2.51	2.42	2.61	2.7	2.82	2.83
2000	6.00	0.50	3.11	2.92	2.7	2.47	2.24	2.27	2.35	2.38	2.39	2.39
Q2	6.00	0.00	3.36	2.94	2.58	2.45	2.57	2.61	2.65	2.7	2.74	2.7
Q3	6.00	0.00	2.98	2.56	2.48	2.5	2.51	2.53	2.63	2.81	2.79	2.76
Q4	6.00	0.00	2.72	2.73	2.76	2.39	2.31	2.4	2.48	2.51	2.5	2.48
2001	5.75	-0.25	3.01	2.86	2.3	2.07	2.22	2.1	2.37	2.62	2.81	2.89
Q2	5.25	-0.50	2.65	2.25	2.03	2.46	2.68	2.72	2.71	2.48	2.42	2.42
Q3	5.00	-0.25	2.24	1.62	1.82	1.98	2.26	2.42	2.33	2.24	2.15	2.11
Q4	4.00	-1.00	1.71	2.09	1.92	1.97	2.05	2.27	2.49	2.66	2.7	
2002	4.00	0.00	1.37	1.37	1.48	1.78	2.43	2.76	2.79	2.69		
Q2	4.00	0.00	1.75	1.35	1.62	2.32	2.95	2.95	3.15			
Q3	4.00	0.00	2.26	1.82	2.34	2.91	2.75	2.94				
Q4	4.00	0.00	2.31	2.29	3.06	3.18	3.17					
2003	3.75	-0.25	2.1	2.53	2.58	2.33						
Q2	3.75	0.00	1.84	2.38	2							
Q3	3.50	-0.25	1.89	1.59								

Table 3
Bank Forecast of RPIX

	RPIX % change over 12 months	Forecast t =								
		0	1	2	3	4	5	6	7	8
1993 Q1	3.50	3.50								
Q2	2.80	3.40	3.40							
Q3	3.30	2.90	3.40	3.00						
Q4	2.70	3.30	3.00	3.20	3.10					
1994 Q1	2.40	2.80	3.60	3.20	3.20	3.40				
Q2	2.40	2.70	3.00	3.50	3.30	3.50	3.40			
Q3	2.00	2.30	2.90	3.10	3.50	3.30	3.60	3.40		
Q4	2.50	2.10	2.60	3.00	3.20	3.40	3.30	3.70	3.30	
1995 Q1	2.80	2.90	1.90	2.70	3.10	3.40	3.40	3.50		
Q2	2.80	2.70	2.80	2.00	3.00	3.40	3.30	3.40	3.60	
Q3	3.10	2.90	3.00	3.10	2.30	3.20	3.40	3.20		
Q4	3.00	3.20	3.00	3.10	3.20	2.40	3.20	3.30	3.20	
1996 Q1	2.90	2.80	3.30	3.20	3.40	2.70	2.80	3.40	3.30	
Q2	2.80	2.70	2.70	3.50	3.50	3.80	2.70	2.40	3.10	
Q3	2.90	2.70	2.50	2.40	3.20	3.40	3.70	2.60	2.40	
Q4	3.10	3.10	2.40	2.30	2.20	3.00	3.20	3.40	2.50	
1997 Q1	2.70	2.70	2.90	2.30	2.30	2.30	2.70	2.90	3.00	
Q2	2.70	2.60	2.40	2.80	2.30	2.20	2.30	2.70	2.80	
Q3	2.70	2.65	2.40	2.20	2.70	2.40	2.40	2.30	2.70	2.80
Q4	2.70	2.60	2.32	2.20	2.20	2.40	2.50	2.40	2.40	2.70
1998 Q1	2.60	2.60	2.51	2.19	2.20	2.30	2.40	2.60	2.40	2.40
Q2	2.80	2.83	2.63	2.42	2.06	2.20	2.50	2.50	2.70	2.50
Q3	2.50	2.51	2.35	2.42	2.27	1.99	2.30	2.70	2.60	2.80
Q4	2.60	2.54	2.56	2.35	2.41	2.19	2.08	2.50	2.80	2.70
1999 Q1	2.70	2.49	2.56	2.69	2.41	2.44	2.18	2.24	2.70	2.90
Q2	2.20	2.48	2.53	2.71	2.82	2.37	2.39	2.25	2.36	2.90
Q3	2.10	2.31	2.40	2.55	2.74	2.86	2.30	2.47	2.37	2.50
Q4	2.20	2.20	2.28	2.36	2.61	2.59	2.77	2.26	2.55	2.42
2000 Q1	2.00	1.93	2.12	2.09	2.20	2.52	2.56	2.69	2.27	2.64
Q2	2.20	1.88	1.98	2.06	1.99	2.23	2.49	2.51	2.56	2.35
Q3	2.20	2.38	1.93	1.95	2.02	1.88	2.25	2.47	2.48	2.47
Q4	2.00	2.36	2.28	2.10	2.05	1.84	1.92	2.23	2.47	2.45
2001 Q1	1.90	1.94	2.33	2.26	2.20	2.32	1.72	2.08	2.35	2.56
Q2	2.40	1.90	1.92	2.22	2.39	2.47	2.48	1.80	2.28	2.43
Q3	2.30	2.31	1.90	1.87	2.19	2.48	2.53	2.53	2.19	2.59

Q4	1.90	2.00	2.17	1.91	1.87	2.19	2.62	2.53	2.56	2.53
2002 Q1	2.30	2.14	2.03	2.17	1.91	2.09	2.18	2.68	2.53	2.58
Q2	1.50	2.02	1.87	1.85	1.91	1.94	2.18	2.37	2.70	2.56
Q3	2.10	1.84	2.08	1.96	2.06	1.96	2.03	2.27	2.46	2.72
Q4	2.70	2.64	2.25	2.24	2.11	2.06	2.13	2.16	2.42	2.56
2003 Q1	3.00	2.77	2.73	2.25	2.18	2.13	2.08	2.32	2.39	2.55
Q2	2.80	3.09	2.90	2.72	2.25	2.05	2.13	2.15	2.41	2.53
Q3	2.80	2.85	2.90	2.98	2.72	2.31	2.09	2.18	2.23	2.45

Table 4

RPIX					Forecast				
Actua	0	1	2	3	4	5	6	7	8
2.70	2.65	2.32	2.19	2.06	1.99	2.08	2.24	2.36	2.50
2.70	2.60	2.51	2.42	2.27	2.19	2.18	2.25	2.37	2.42
2.60	2.60	2.63	2.42	2.41	2.44	2.39	2.47	2.55	2.64
2.80	2.83	2.35	2.35	2.41	2.37	2.30	2.26	2.27	2.35
2.50	2.51	2.56	2.69	2.82	2.86	2.77	2.69	2.56	2.47
2.60	2.54	2.56	2.71	2.74	2.59	2.56	2.51	2.48	2.45
2.70	2.49	2.53	2.55	2.61	2.52	2.49	2.47	2.47	2.56
2.20	2.48	2.40	2.36	2.20	2.23	2.25	2.23	2.35	2.43
2.10	2.31	2.28	2.09	1.99	1.88	1.92	2.08	2.28	2.59
2.20	2.20	2.12	2.06	2.02	1.84	1.72	1.80	2.19	2.53
2.00	1.93	1.98	1.95	2.05	2.32	2.48	2.53	2.56	2.58
2.20	1.88	1.93	2.10	2.20	2.47	2.53	2.53	2.53	2.56
2.20	2.38	2.28	2.26	2.39	2.48	2.62	2.68	2.70	2.72
2.00	2.36	2.33	2.22	2.19	2.19	2.18	2.37	2.46	2.56
1.90	1.94	1.92	1.87	1.87	2.09	2.18	2.27	2.42	2.55
2.40	1.90	1.90	1.91	1.91	1.94	2.03	2.16	2.39	2.53
2.30	2.31	2.17	2.17	1.91	1.96	2.13	2.32	2.41	2.45
1.90	2.00	2.03	1.85	2.06	2.06	2.08	2.15	2.23	
2.30	2.14	1.87	1.96	2.11	2.13	2.13	2.18		
1.50	2.02	2.08	2.24	2.18	2.05	2.09			
2.10	1.84	2.25	2.25	2.25	2.31				
2.70	2.64	2.73	2.72	2.72					
3.00	2.77	2.90	2.98						
2.80	3.09	2.90							
2.80	2.85								

Table 5 - Differential between GDP and forecast

	0	1	2	3	4	5	6	7	8	Sum of Cols 4-8	Sign of implied interest rate change	Sign of actual interest rate change
Q3	**0.28**	**0.87**	**0.32**	**0.45**	**0.45**	**0.16**	**-0.26**	**-0.57**	**-0.08**	**-0.30**	**0**	**+**
Q4	**-0.31**	**-0.90**	**-0.56**	**0.12**	**0.54**	**0.26**	**0.07**	**0.54**	**0.67**	**2.08**	**-**	**0**
1998	**-0.38**	**-0.10**	**0.45**	**0.21**	**-0.04**	**-0.18**	**0.22**	**0.51**	**0.75**	**1.26**	**-**	**0**
Q2	**-0.16**	**0.30**	**0.12**	**-0.23**	**-0.34**	**0.16**	**0.55**	**0.89**	**1.05**	**2.31**	**-**	**+**
Q3	**0.19**	**0.12**	**0.10**	**0.28**	**0.86**	**1.18**	**1.49**	**1.44**	**0.79**	**5.76**	**-**	**-**
Q4	**-0.15**	**0.18**	**0.45**	**1.29**	**1.59**	**1.75**	**1.78**	**1.13**	**0.49**	**6.74**	**-**	**-**
1999	**0.32**	**0.63**	**1.43**	**1.75**	**1.60**	**1.51**	**0.81**	**0.28**	**0.43**	**4.63**	**-**	**-**
Q2	**0.63**	**1.07**	**1.36**	**1.45**	**1.49**	**0.96**	**0.21**	**0.21**	**-0.21**	**2.66**	**-**	**-**
Q3	**0.76**	**0.61**	**0.51**	**0.61**	**0.10**	**-0.11**	**0.16**	**-0.19**	**-0.53**	**0.57**	**0**	**+**
Q4	**0.03**	**0.05**	**0.37**	**0.30**	**0.15**	**0.37**	**0.02**	**-0.41**	**-0.87**	**-0.74**	**0**	**+**
2000	**-0.03**	**0.42**	**0.32**	**0.31**	**0.59**	**0.27**	**-0.07**	**-0.51**	**-0.77**	**-0.49**	**0**	**0**
Q2	**0.20**	**0.16**	**0.08**	**0.27**	**-0.11**	**-0.44**	**-0.92**	**-1.20**	**-0.70**	**-3.37**	**+**	**0**
Q3	**0.20**	**0.00**	**0.32**	**-0.03**	**-0.44**	**-0.95**	**-1.37**	**-0.87**	**-0.25**	**-3.88**	**+**	**0**
Q4	**-0.23**	**0.01**	**0.07**	**-0.24**	**-0.84**	**-1.14**	**-0.69**	**-0.07**	**0.08**	**-2.66**	**+**	**-**
2001	**-0.07**	**0.11**	**-0.02**	**-0.68**	**-0.88**	**-0.65**	**-0.29**	**-0.33**	**-0.54**	**-2.69**	**+**	**-**
Q2	**0.18**	**-0.03**	**-0.94**	**-1.48**	**-1.12**	**-0.48**	**-0.10**	**-0.15**	**-0.33**	**-2.18**	**+**	**-**
Q3	**0.40**	**-0.35**	**-0.80**	**-0.68**	**-0.31**	**-0.05**	**-0.07**	**-0.14**	**0.03**	**-0.54**	**0**	**-**
Q4	**-0.60**	**-0.79**	**-0.41**	**0.04**	**-0.11**	**-0.42**	**-0.75**	**-0.64**				
2002	**-0.22**	**0.03**	**0.29**	**-0.29**	**-0.81**	**-0.98**	**-0.73**					
Q2	**0.18**	**0.40**	**-0.20**	**-1.02**	**-1.26**	**-1.29**						
Q3	**0.22**	**-0.27**	**-1.00**	**-1.08**	**-1.20**							
Q4	**-0.20**	**-1.20**	**-1.53**	**-1.45**								
2003	**-0.65**	**-0.98**	**-0.63**									
Q2	**-0.76**	**-0.35**										
Q3	**0.08**											
average	**0.22**	**0.24**	**0.19**	**0.17**	**0.15**	**0.03**	**-0.07**	**-0.17**	**-0.25**			

Table 6
Forecast at time of initial forecast

	Output		Diff	Inflation		Diff		
	t+4	**t+8**		**t+4**	**t+8**		**Actual forecast change in output**	**Actual forecast change in inflation**
1999 Q3	1.80	2.63	+0.83	1.99	2.50	+0.51	-1.67	-0.11
1999 Q4	1.33	2.33	+1.00	2.19	2.42	+0.22	-0.87	-0.14
2000 Q1	1.59	2.61	+1.02	2.44	2.64	+0.20	-0.97	-0.94
2000 Q2	1.83	2.56	+0.73	2.37	2.35	-0.02	-0.31	-0.84
2000 Q3	1.29	2.44	+1.14	2.86	2.47	-0.39	-0.36	-0.70
2000 Q4	1.01	2.48	+1.47	2.59	2.45	-0.09	0.10	-0.50
2001 Q1	1.36	2.83	+1.46	2.52	2.56	+0.04	0.25	-0.60
2001 Q2	1.72	3.11	+1.39	2.23	2.43	+0.20	-0.65	-0.40
2001 Q3	2.73	3.02	+0.29	1.88	2.59	+0.71	-0.26	0.00
2001 Q4	2.42	2.83	+0.41	1.84	2.53	+0.69	-0.85	-0.38
2002 Q1	2.27	2.39	+0.12	2.32	2.58	+0.26	-1.42	-0.49
2002 Q2	2.61	2.70	+0.09	2.47	2.56	+0.09	-1.90	-0.66
2002 Q3	2.53	2.76	+0.23	2.48	2.72	+0.24	-1.58	-1.10
2002 Q4	2.40	2.48	+0.08	2.19	2.56	+0.37	-0.86	-0.44
2003 Q1	2.10	2.89	+0.79	2.09	2.55	+0.46	-1.01	-0.18
2003 Q2	2.72	2.42	-0.30	1.94	2.53	+0.59	-0.42	0.23
2003 Q3	2.42	2.11	-0.31	1.96	2.45	+0.49	-0.83	0.08

Table 7

Regressions

Actual forecast change in Output = B*(difference in output) + C*(difference in RPIX)

B p-value St. Er.	C p-value St. Er.	R Sq.	DW
-0.33 0.14 0.21	-1.51 0.00 0.47	-0.40	0.85

Actual forecast change in Output = A + B*(difference in output) + C*(difference in RPIX)

A p-value St. Er.	B p-value St. Er.	C p-value St. Er.	R Sq.	DW
-1.08 0.00 0.33	0.45 0.15 0.30	0.01 0.98 0.60	0.18	1.25

Actual forecast change in Inflation = B*(difference in output) + C*(difference in RPIX)

B p-value St. Er.	C p-value St. Er.	R Sq.	DW
-0.45 0.00 0.12	-0.10 0.70 0.26	-0.18	0.78

Actual forecast change in Inflation = A + B*(difference in output) + C*(difference in RPIX)

A p-value St. Er.	B p-value St. Er.	C p-value St. Er.	R Sq.	DW
-0.65 0.00 0.17	0.02 0.87 0.15	0.82 0.01 0.31	0.40	1.51

Table 8
GDP Bank

	GDP % change over 12	Diffferential between GDP and forecast											
		0	1	2	3	4	5	6	7	8	Average	St. Dev.	1rst. O.Autocorr.
Q3	3.89	0.5											
Q4	3.93	-0.09	1.11										
1998 Q1	2.88	-0.16	-0.66	0.51									
Q2	2.47	0.06	0.14	-0.37	0.62								
Q3	2.4	0.41	0.54	0.64	0.29	0.6							
Q4	2.02	0.07	0.36	0.31	0.38	0.69	0.19						
1999 Q1	1.7	0.54	0.42	0.29	-0.06	0.11	0.29	-0.33					
Q2	1.64	0.85	0.87	0.64	0.45	-0.19	-0.15	0	-0.74		0.22	0.58	0.48
Q3	2.3	0.98	1.31	1.62	1.46	1.01	0.19	0.15	0.37	-0.33	0.75	0.68	0.61
Q4	2.75	0.25	0.85	1.55	1.92	1.74	1.21	0.48	0.34	0.42	0.97	0.65	0.60
2000 Q1	3.11	0.19	0.29	0.7	1.62	1.75	1.78	1.42	0.72	0.5	1.00	0.64	0.60
Q2	3.36	0.42	0.66	0.56	0.78	1.64	1.54	1.71	1.27	0.8	1.04	0.50	0.56
Q3	2.98	0.42	0.4	0.51	0.47	0.25	0.99	0.74	0.96	0.54	0.59	0.26	0.11
Q4	2.72	-0.01	0.24	0.27	0.48	0.3	-0.08	0.14	0.11	0.24	0.19	0.17	0.14
2001 Q1	3.01	0.15	0.25	0.51	0.44	0.74	0.4	0.09	0.04	0.18	0.31	0.23	0.46
Q2	2.65	0.4	0.35	0.26	0.14	0.04	0.3	-0.05	-0.36	-0.46	0.07	0.31	0.52
Q3	2.24	0.62	0.21	0.17	-0.07	-0.29	-0.41	-0.14	-0.58	-0.78	-0.14	0.43	0.47
Q4	1.71	-0.38	-0.11	-0.75	-0.51	-0.69	-0.92	-0.99	-0.68	-1.12	-0.68	0.32	0.24
2002 Q1	1.37	0	-0.55	-0.61	-1.31	-0.73	-1.11	-1.44	-1.37	-1.02	-0.90	0.47	0.34
Q2	1.75	0.4	0.27	-0.22	-0.51	-0.97	-0.62	-0.76	-1.04	-0.95	-0.49	0.53	0.60
Q3	2.26	0.44	0.64	0.48	0.21	-0.16	-0.45	-0.36	-0.24	-0.5	0.01	0.44	0.71
Q4	2.31	0.02	-0.03	-0.01	-0.12	0.04	-0.02	-0.17	-0.5	-0.17	-0.11	0.17	0.31
2003 Q1	2.1	-0.43	-0.96	-0.81	-0.85	-0.66	-0.39	-0.14	-0.32	-0.79	-0.59	0.28	0.37
Q2	1.84	-0.54	-0.74	-1.34	-0.91	-1.11	-0.95	-0.82	-0.31	-0.58	-0.81	0.31	0.27
Q3	1.89	0.3	-0.11	-0.44	-1.28	-1.05	-1.26	-0.8	-0.81	-0.22	-0.63	0.55	0.44

Average	**2.45**	**0.22**	**0.24**	**0.19**	**0.17**	**0.15**	**0.03**	**-0.07**	**-0.17**	**-0.25**			
St. Deviation	**0.68**	**0.37**	**0.57**	**0.70**	**0.86**	**0.89**	**0.85**	**0.78**	**0.70**	**0.60**			
1rst O. Autocorr	**0.71**	**0.34**	**0.39**	**0.63**	**0.74**	**0.73**	**0.75**	**0.76**	**0.70**	**0.79**			

Table 9

	RPIX % change over 12	Differential between RPIX and forecast											
		0	1	2	3	4	5	6	7	8	Average	St. Dev.	1rst O. Autocorr
1993	3.5	0											
Q2	2.8	-0.6	-0.6										
Q3	3.3	0.4	-0.1	0.3									
Q4	2.7	-0.6	-0.3	-0.5	-0.4								
1994 Q1	2.4	-0.4	-1.2	-0.8	-0.8	-1							
Q2	2.4	-0.3	-0.6	-1.1	-0.9	-1.1	-1						
Q3	2	-0.3	-0.9	-1.1	-1.5	-1.3	-1.6	-1.4					
Q4	2.5	0.4	-0.1	-0.5	-0.7	-0.9	-0.8	-1.2	-0.8		-0.58	0.51	0.49
1995 Q1	2.8	-0.1	0.9	0.1	-0.3	-0.6	-0.6	-0.7			-0.19	0.56	0.42
Q2	2.8	0.1	0	0.8	-0.2	-0.6	-0.5	-0.6	-0.8		-0.23	0.52	0.39
Q3	3.1	0.2	0.1	0	0.8	-0.1	-0.3	-0.1			0.09	0.35	-0.06
Q4	3	-0.2	0	-0.1	-0.2	0.6	-0.2	-0.3	-0.2		-0.08	0.29	-0.2
1996 Q1	2.9	0.1	-0.4	-0.3	-0.5	0.2	0.1	-0.5	-0.4		-0.21	0.29	-0.07
Q2	2.8	0.1	0.1	-0.7	-0.7	-1	0.1	0.4	-0.3		-0.25	0.50	0.24
Q3	2.9	0.2	0.4	0.5	-0.3	-0.5	-0.8	0.3	0.5		0.04	0.50	0.34
Q4	3.1	0	0.7	0.8	0.9	0.1	-0.1	-0.3	0.6		0.34	0.46	0.25
1997 Q1	2.7	0	-0.2	0.4	0.4	0.4	0	-0.2	-0.3		0.06	0.30	0.39
Q2	2.7	0.1	0.3	-0.1	0.4	0.5	0.4	0	-0.1		0.19	0.24	0.1
Q3	2.7	0.05	0.3	0.5	0	0.3	0.3	0.4	0	-0.1	0.19	0.21	-0.03
Q4	2.7	0.1	0.38	0.5	0.5	0.3	0.2	0.3	0.3	0	0.29	0.17	0.19
1998 Q1	2.6	0	0.09	0.41	0.4	0.3	0.2	0	0.2	0.2	0.20	0.15	0.32
Q2	2.8	-0.03	0.17	0.38	0.74	0.6	0.3	0.3	0.1	0.3	0.32	0.24	0.42
Q3	2.5	-0.01	0.15	0.08	0.23	0.51	0.2	-0.2	-0.1	-0.3	0.06	0.25	0.41
Q4	2.6	0.06	0.04	0.25	0.19	0.41	0.52	0.1	-0.2	-0.1	0.14	0.23	0.46

1999 Q1	2.7	0.21	0.14	0.01	0.29	0.26	0.52	0.46	0	-0.2	0.19	0.23	0.31
Q2	2.2	-0.28	-0.33	-0.51	-0.62	-0.17	-0.19	-0.05	-0.16	-0.7	-0.33	0.23	0.13
Q3	2.1	-0.21	-0.3	-0.45	-0.64	-0.76	-0.2	-0.37	-0.27	-0.4	-0.40	0.19	0.17
Q4	2.2	0	-0.08	-0.16	-0.41	-0.39	-0.57	-0.06	-0.35	-0.22	-0.25	0.19	0.09
2000 Q1	2	0.07	-0.12	-0.09	-0.2	-0.52	-0.56	-0.69	-0.27	-0.64	-0.34	0.27	0.37
Q2	2.2	0.32	0.22	0.14	0.21	-0.03	-0.29	-0.31	-0.36	-0.15	-0.03	0.26	0.69
Q3	2.2	-0.18	0.27	0.25	0.18	0.32	-0.05	-0.27	-0.28	-0.27	0.00	0.26	0.51
Q4	2	-0.36	-0.28	-0.1	-0.05	0.16	0.08	-0.23	-0.47	-0.45	-0.19	0.23	0.57
2001 Q1	1.9	-0.04	-0.43	-0.36	-0.3	-0.42	0.18	-0.18	-0.45	-0.66	-0.30	0.25	0.01
Q2	2.4	0.5	0.48	0.18	0.01	-0.07	-0.08	0.6	0.12	-0.03	0.19	0.27	0.14
Q3	2.3	-0.01	0.4	0.43	0.11	-0.18	-0.23	-0.23	0.11	-0.29	0.01	0.27	0.38
Q4	1.9	-0.1	-0.27	-0.01	0.03	-0.29	-0.72	-0.63	-0.66	-0.63	-0.36	0.30	0.62
2002 Q1	2.3	0.16	0.27	0.13	0.39	0.21	0.12	-0.38	-0.23	-0.28	0.04	0.27	0.54
Q2	1.5	-0.52	-0.37	-0.35	-0.41	-0.44	-0.68	-0.87	-1.2	-1.06	-0.66	0.32	0.73
Q3	2.1	0.26	0.02	0.14	0.04	0.14	0.07	-0.17	-0.36	-0.62	-0.05	0.28	0.46
Q4	2.7	0.06	0.45	0.46	0.59	0.64	0.57	0.54	0.28	0.14	0.41	0.21	0.32
2003 Q1	3	0.23	0.27	0.75	0.82	0.87	0.92	0.68	0.61	0.45	0.62	0.25	0.5
Q2	2.8	-0.29	-0.1	0.08	0.55	0.75	0.67	0.65	0.39	0.27	0.33	0.37	0.62
Q3	2.8	-0.05	-0.1	-0.18	0.08	0.49	0.71	0.62	0.57	0.35	0.28	0.34	0.75
Average	2.55	-0.02	-0.02	0.00	-0.03	-0.06	-0.09	-0.12	-0.13	-0.22			
St. Dev.	0.42	0.26	0.41	0.47	0.53	0.57	0.53	0.51	0.42	0.38			
1rst. O. Autocorr.	0.61	-0.16	0.3	0.55	0.58	0.68	0.62	0.52	0.35	0.43			