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Do Errors in Forecasting Inflation Lead to Errors in Forecasting Interest Rates?

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Abstract

In the first of three related, and consecutive, papers we showed that forecasts for short-term policy interest rates in NZ and UK deteriorated over the first six months to a point when they became useless, after the first two quarters. Moreover they were ex post biased, underestimating future interest rates during upturns and the reverse during downturns.

Both NZ and UK have been inflation targeters during our data period. In this second paper we ask, first whether inflation forecasts exhibit the same syndrome as the related interest rate forecasts, and whether errors in the inflation forecast may help to explain errors in the interest rate forecast. We find that the pattern of inflation forecast errors is qualitatively much the same as those for interest rates, but that the inflation forecasts are quantitatively better, both in terms of prediction error and of bias. The evidence on the relationship between inflation forecast errors and interest rate forecast errors is mixed. Over the whole time period, both in NZ and UK, there is no such relationship. But if one should strip out certain short periods, when domestic interest rates appear to have been affected by external factors, then there does seem to be such a relationship, with under (over) estimates of future inflation associated with under (over) estimates of future policy interest rates.

Introduction

In the first of our trilogy of three papers on forecasting short-term policy-determined interest rates in New Zealand (NZ), and in the United Kingdom (UK), entitled 'Interest Rate Forecasts: A Pathology', we demonstrated that such forecasts were not only without informational content beyond two quarters hence, but that such forecasts were, ex post, biased in that such forecasts systematically underestimated interest rates during cyclical upswings in such rates, and overestimated them during downswings. In the third paper we shall see whether we can explain this ex post bias, and test whether the forecasts, despite being ex post biased, are nevertheless ex ante efficient.

In this second paper we take a slightly different tack. Both the NZ and UK Central Banks (CBs) are leading exponents of inflation targeting (IT). If inflation at the key future horizon is forecast to be above (below) target, the CB is supposed, under the Taylor principle, to raise (lower) interest rates. Thus for IT countries it would seem a reasonable hypothesis that errors in forecasting inflation should be a prime causative factor in leading to errors in forecasting interest rates.

Most prior work on the poor record of interest rate forecasts has been done for the USA, which is not an IT country. So the above hypothesis has not, to our knowledge, been previously tested, either for the USA or for any other country. Instead, the leading economist in this line of study, Glenn Rudebusch (2002 and 2006) has argued that the co-existence of the apparent slow adjustment of policy rates alongside predictive failure could be due to "various persistent factors – credit crunches, financial crises, etc., that a central bank might respond to, [and which] could be modelled as a simple first-order autoregressive process", (2006), p. 102. In his Figure 5, p. 98, (ibid) he shows how the differences between the derived desired value of a non-inertial and an inertial rule match up quite well with a number of events, besides output and inflation, to which the Fed may have reacted.

Here we take a somewhat different line of attack. Since, during these years the Central Banks in both our countries, UK and NZ, were following an Inflation Target, one possibility is that these inflation forecasts were similarly systematically (ex post) biased as we have already shown the interest forecasts to have been. So in Section 2 we apply the same tests for bias and systematic error to the inflation forecasts for NZ and for the UK that we applied in our first paper to the interest rate forecasts.

The results are not quite as stark, but do show a similar syndrome. Beyond the first quarter's (good) forecast, the tendency is for the forecast to under (over) estimate inflation during up (down) cycles of inflation. The timing of the cycles is less clearly marked than for interest rates. We do, however, have an advantage in the guise of a much longer time series, with data on UK CPI forecasts going back to 1970. This enables us to examine and compare forecasting ability in earlier decades, when inflation was much more volatile, with the present more stable period.

Our next step, in Section 3, is to see how far the (systematic) errors in predicting inflation can help to predict the (auto-correlated and inertial) errors in predicting interest rates. With inflation having been relatively stable, around its target value, during recent years, an expectation that inflation forecast errors would predict interest rate forecast errors might seem far-fetched and unlikely. And so it initially transpired. Running regressions over the full available data period, for both NZ and UK, gave no significant relationship.

However, a closer inspection of the data period showed that, both for NZ and for the UK, there were brief periods when the hypothesis, that errors in the inflation forecast would drive, similarly signed, errors in the interest rate forecast, was reversed. Thus in New Zealand in 2000/1 and in the UK in 2003/4, inflation was under-forecast (i.e. actual greater than predicted), but interest rates came out lower than earlier forecast. We tentatively attribute both occasions mainly to external pressures. When these (relatively few) observations are excluded a significant relationship between inflation forecast errors and interest rate prediction errors then does emerge.

We looked at the data to eliminate those periods when our hypothesis did not hold. This is data mining. Moreover, our residual period, both for NZ and UK, is short. So, the claim that systematic errors in forecasting inflation are responsible, some of the time, for the gradual, inertial adjustment of policy rates, and for some part of the systematic errors in forecasting interest rates does need support from further research before it may be accepted as a 'stylized fact'. Where we do feel more confident is in supporting Rudebusch's thesis that both the errors in forecasting policy interest rates and their slow inertial adjustment do not have a single cause; there is no mono-causal explanation. Instead, there are likely to be several such causes. We claim, on the basis of this research, that somewhat persistent, auto-correlated errors in predicting future inflation should be included in this set of potential causal factors.

That leads us into our Conclusion, Section 4, where we explore the implications of this work for future research, for the interpretation of past history, and for other public policy issues.

II. Errors in Inflation Forecasts

The primary objective of most Central Banks, certainly of those with Inflation Targets, is to achieve price stability, usually defined as a low (around 2%) and stable rate of inflation. Owing to the long and variable lags in the transmission mechanism between monetary policy measures and their effect, first on output and then on inflation, policy is actually set on the basis of forecast, not current, levels of inflation.

So if forecasts of interest rates are poor, biased and inefficient, it makes sense to enquire whether this may be because the accompanying forecasts for inflation are similarly poor, biased and inefficient. Accordingly in this Section we put our forecast series for inflation through exactly the same battery of tests to which we put the interest rate forecasts.

For both UK and NZ there are several alternative inflation series. The inflation target for the UK's Monetary Policy Committee (MPC) was defined in terms of RPIX, but this series only began at the end of 1992. We use this when we compare the MPC's constant interest rate assumption errors with its RPIX inflation forecast errors. But market views of inflation may have been based on other series. We have access to a long series of CPI data, and forecasts of future CPI, thanks to the National Institute of Economic and Social Research, which provided us with these forecast data. Both because we have a much longer consistent data series for CPI forecasts, partly because it is comparable with the NZ measure, and partly because it is a justifiable measure of general inflation, we use the CPI data in our main exercises with the forecasts for interest rates derived from the government debt series, as discussed at more length in our first paper. Again we exhibit the CPI series for inflation, inflation forecasts and errors in that forecast in the same format for the shorter period, (1992 Q4 until 2004 Q4), in which we can overlap it with the forecasts and errors in the forecasts of interest rates from the government debt series, in Appendix 1. Similar data for the full available CPI data period, going back until 1970 Q1, and for the RPIX forecast data (1993 – 2004) are available from the authors on request.

The inflation forecasts, both for NZ and UK, are not quarter on quarter, but over the previous year, $Q_t - Q_{t-4}/Q_{t-4}$. There is no alternative, since that is the way that the forecasts were constructed. Moreover, given the extent of noise in individual quarters, e.g. from indirect tax changes, weather and seasonal foods, etc., some such averaging process may be beneficial. However it does mean that forecasts for the level of inflation in the current and next few quarters are only partially forecast, thus forecasts for inflation in the current quarter (h = 0) contain 3 ⅔, out of 4, known observations, for the next quarter (h = 1) 2 ⅔, for h = 2, 1 ⅔, and for h = 3, ⅔. That is bound to make such forecasts relatively more accurate. That problem can be met either by focussing on forecasts for the change in inflation, or by ignoring all forecasts of inflation levels until h = 2 or 3, or just by applying a discount to apparent measures of early forecast accuracy.

Similarly the use of annualised forecasts means that adjacent forecasts (and forecast errors) will be auto-correlated, since the forecast for h = i and h = i + 1 will share three common quarters. In so far as our forecasts go out to two years hence, h = 8, both problems can be largely met by focussing primarily on the forecasts for h = 4 and h = 8 (or h = 7, when there are no forecasts available for h = 8).

This problem did not, however, arise for the interest rate forecasts, where the forecast is for the future short-term policy rate ruling in that quarter.

In our tests for forecasting accuracy we run four regressions both for the NZ and UK data series, as we did for interest rates in our first paper. These regression equations were:-

(1) $\text{Inf}(t + h) = C_1 + C_2$ Forecast $(t, t + h)$

(2) $\text{Inf}(t + h) – \text{Inf}(t) = C_1 + C_2$ (Forecast $t, t + h$ – Inf t)

(3) $\text{Inf}(t + h) – \text{Inf}(t + h – 1) = C_1 + C_2$ (Forecast, $t, t + h$ – Forecast, $t, t + h – 1$)

(4) $\text{Inf}(t + h) – \text{Inf}(t + h – 1) = C$ (Forecast, $t, t + h$ – Forecast, $t, t + h – 1$).

Where: Forecast (t,t+h) = forecast of Inf(t+h) made at time, t

Inf(t) = actual inflation rate outurn at time, t

The first equation is essentially a Mincer-Zarnowitz regression (Mincer and Zarnowitz, 1969), evaluating how well the forecast can predict the actual h-period ahead inflation rate outturn (h = 0 to n). If the forecast perfectly matches the actual inflation rate outturn for every single period, we would expect to have $C_2 = 1$, and $C_1 = 0$. This can be seen as an evaluation of the bias of the forecast. Taking expectation on both sides, $E\{IR(t+h)\} = E\,\{C_1 + C_2\,[\text{Forecast}(t,t+h)]\}$. A forecast is unbiased, i.e.

E{IR(t+h)} = E{[Forecast(t,t+h)]} for all t, if and only if $C_2 = 1$, and $C_1 = 0$. The second regression, by subtracting the inflation rate level from both sides, allows us to focus our attention on the performance of the forecast inflation rate difference {Inf(t + h) – Inf(t)}. It asks, as h increases, how accurately can the forecaster forecast h-quarter ahead inflation rate changes from the present level. The third regression is a slight twist on the second, focussing on one-period ahead forecasts; the regression examines the forecast performance of one-period ahead inflation rate changes {Inf(t + h) – Inf(t + h – 1)}, as h increases. The fourth equation just repeats equation 3, but drops the constant term.

All four regressions assess the accuracy/biasness of inflation rate forecasts from slightly different angles. In the first three equations, an unbiased forecast will necessarily implies a constant term of zero, and a slope coefficient of one. In all four equations the coefficient C_2 should be unity. We can test whether these conditions are fulfilled with a joint hypothesis test:

$$H_0: C_1=0 \text{ and } C_2=1$$

With four equations, two data sets, and h = 0 to 8 for both NZ and UK series, we have some 64 regression results and statistical test scores to report. Rather than asking the reader to plough through them all, we collect these together in Appendix 2. Interpretation of regression results is somewhat subjective. We give our interpretation of them here; the sceptical reader is invited to examine Appendix 2 and make his/her own assessment.

Let us start with NZ. The NZ data period for this sample covered 45 observations from 1995 Q4 until 2006 Q3. We also ran the same regressions over the shorter sample, 2000 Q1 – 2006 Q3, of 27 observations, that overlapped with the period for which we had data on the RBNZ interest rate forecast. The results of these latter regressions were generally quite similar to, but slightly worse than, those above. These latter regressions are available from the author(s) on request, but in the interests of conserving space are not included in Appendix 2.

These results show that the RBNZ was <u>much</u> better at forecasting inflation than at forecasting its own interest rate. Looking at the results of equations 3 and 4 in Appendix 2, it can be seen that the RBNZ did an excellent job of forecasting the quarterly <u>change</u> in inflation rates, a difficult task, up to <u>four quarters hence</u>. It is only in the second year that the forecast, of the change in inflation, is not superior to a random walk, (whereas with interest rates this predictive failure came as soon as the second quarter ahead). Given such excellent initial results using the first differences of forecasts, the forecasts in level format (Equations 1 and 2), naturally also behaved well, especially Equation 2. In Equation 2, the coefficient C2 remains very close to unity throughout, and the R squared values remain high, whereas in Equation 1, the C2 coefficient declines steadily, as does the R square.[1] Overall, and unlike the NZ interest rate forecast, the predictive ability of those forecasting inflation in the RBNZ should be described as good, perhaps excellent. A graphical illustration of the results of Equation 1 is given in Appendix 4, for Q1, Q4 and Q8.

We turn next to the UK inflation forecasts, for the CPI, taken from the NIESR. We start with the whole period sample, of 148 observations from 1970 Q1 until 2006 Q4.

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[1] The sharp-eyed will note that the results for Equation 2, in difference format, are often better than those for Equation 1 in level format. This may be because a common variable is inserted on both sides of the equation.

The results for the UK inflation forecast (whole period) are again much better than the (separately and differently obtained) interest rate forecasts, but considerably worse than the NZ inflation forecasts. Focussing on the first difference regressions (Equations 3 and 4), the forecasts get the direction of change correct, but underestimate the scale of change progressively over the four quarters of the first year. Then in the second year, the results are no better than a random walk forecast. Given the relatively successful first difference forecasts up to four quarters ahead, the level forecasts are again good over the whole time frame, though in this case the much better results are for Equation 1 rather than Equation 2. A graphical illustration of the results of Equation 1 is given in Appendix 3, for Q1 and Q4.

The period 1970-2006 is long; it includes the disturbed and high inflation 1970s, the downwards trending but cyclical 1980s, and the stable, low inflation period since 1992. One can think of off-setting reasons why it might have been either more difficult or easier to forecast inflation in the latter stable period than in the earlier more disturbed period. In any case we wanted to compare the errors made in forecasting inflation with those made in forecasting interest rates. Since we had the latter forecasts over a sample of 48 periods, from 1992 Q4 until 2004 Q3, we re-ran the above regressions over this shorter sample as well.

The predictive ability of the NIESR inflation forecasts, according to these tests, has become significantly worse during the last 12 years of approximate price stability than it was in the earlier years of large fluctuations in inflation. One can appreciate that the latter could well have been much easier to forecast. Anyhow, on the basis of the difference forecasts, equations 3 and 4, the forecasters are, over this recent shorter period, unable even to forecast the direction of change in inflation beyond a 2 quarter horizon. As a result, the forecast in terms of levels, Equations 1 and 2 are relatively poor, especially Equation 2 where the forecasters cannot explain more than about 25% of the change in the level of inflation (from its present level) at any horizon from 1 to 7. In this respect the ability of the NIESR to forecast future inflation over the recent stable period has only been slightly better than the ability of the market to forecast UK short-term policy rates. Their record has also been worse than that of the RBNZ forecasters in NZ, perhaps because fluctuations in inflation there have been larger, and thus more easily predictable. Thus in NZ (1995 Q4 – 2006 Q4) the standard deviation of (CPI) inflation around its mean was 1.06% and the series had 8 turning points; while over a similar period (1992 Q4 – 2006 Q4) the standard deviation in the UK was less, at 0.77%, with more turning points, 11 in all.

Nevertheless, once again, as with the interest rate forecasts, there is a tendency for the inflation forecast to be rather more static than the ex post actuals. In Figures 1, 2 and 3, we show a comparison of the four quarter ahead inflation forecast with the ex post actual for both NZ and UK, the latter for both the whole period and the shorter period that overlaps with our interest rate forecast sample period.

Figure 1
NZ inflation forecast (1995-2006)

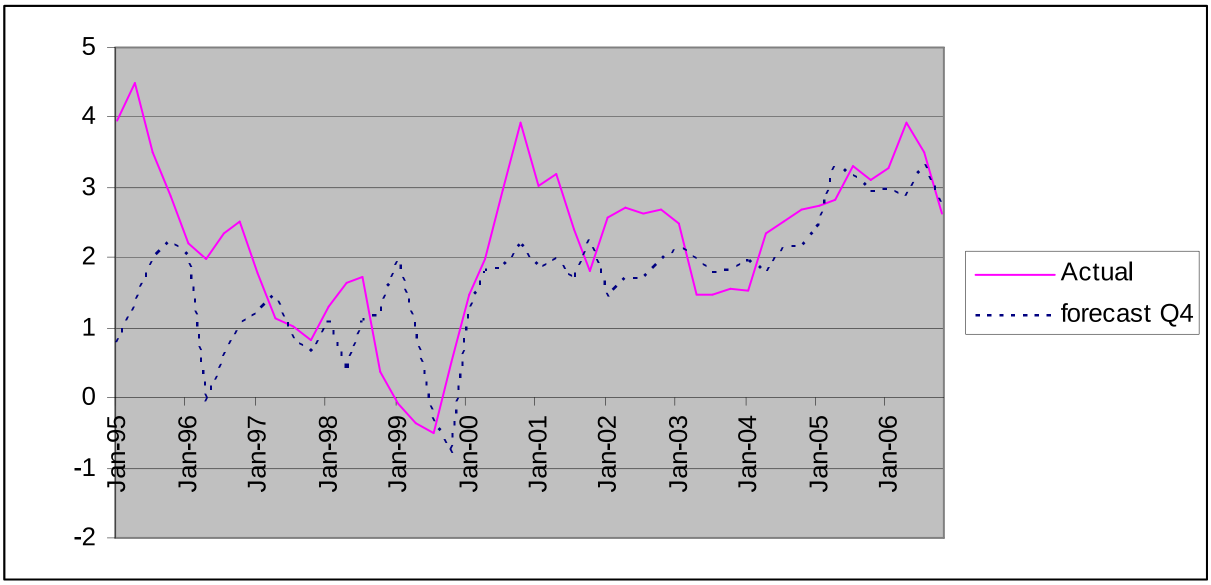


Figure 2
UK Π forecast (whole period)
UK Inflation Forecast (whole period)

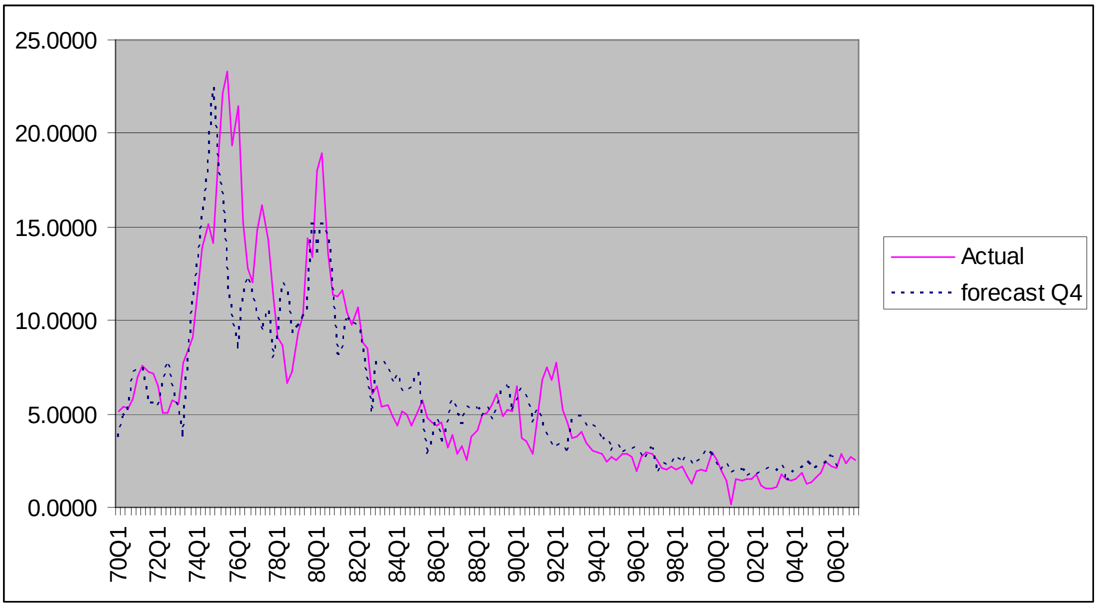
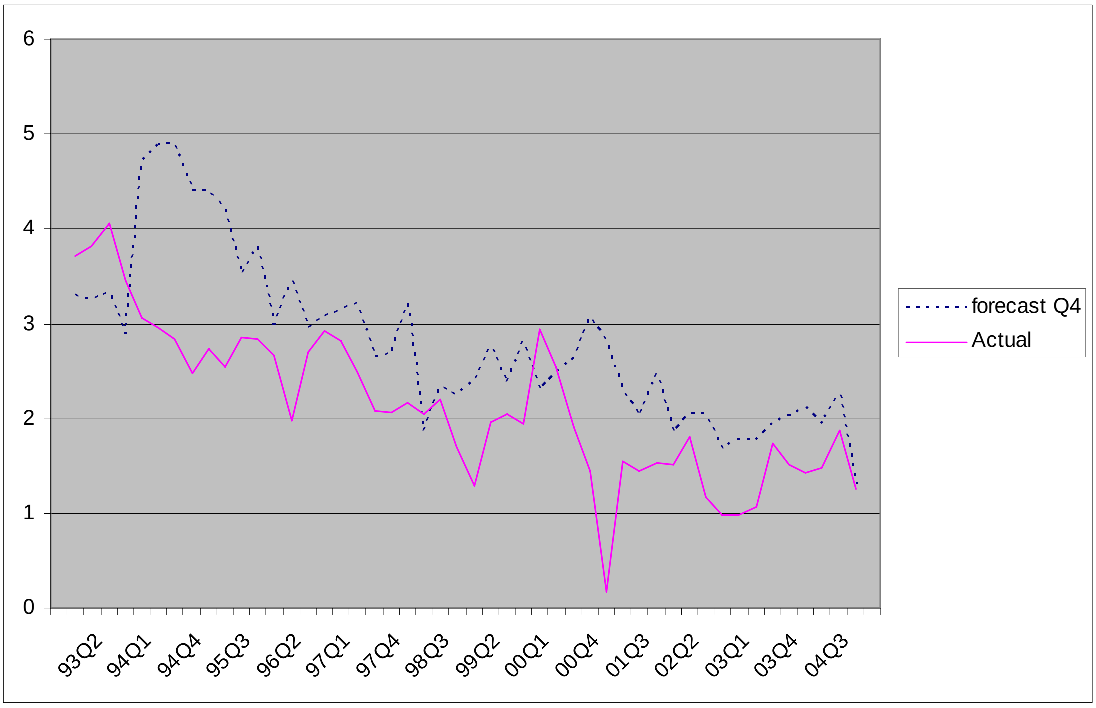


Figure 3
UK inflation forecast comparison (overlapping period)



The fact that the inflation forecasts appeared to have been better, in the light of our regression exercises, than those of interest rate forecasts, particularly in the NZ case (less so in the UK case, especially when using the shorter overlapping period), does not, however, necessarily mean that they are also unbiased and fully efficient. In this sub-section we apply the same tests that we ran for interest rates, to explore whether there are signs of systemic bias during periods in which the inflation rate is on an upwards path, as compared with when it is on a downwards path.

Choosing periods of upwards, and downwards, movements in inflation is, however, more complicated than in the case of interest rates, especially during the recent period of stable inflation. There were, during these years of the Great Moderation, certain short periods which we could not allocate to ‘up’, or ‘down’, phases with any confidence. Figures 4, 5 and 6 show the actual, ex post, inflation data for NZ, over the period 1995 Q4 to 2006 Q3, for the UK over the period 1970 Q1 to 2006 Q4, and also for the UK over the shorter, overlapping period, 1992 Q4 until 2004 Q3. In these figures the chosen turning points and flat periods are marked.

Figure 4

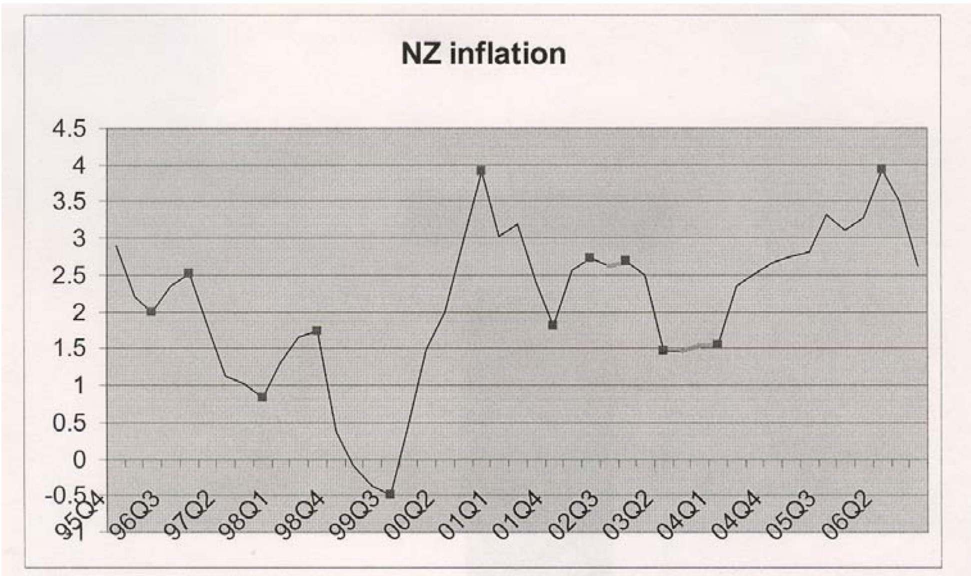


Figure 5

UK inflation: Whole period

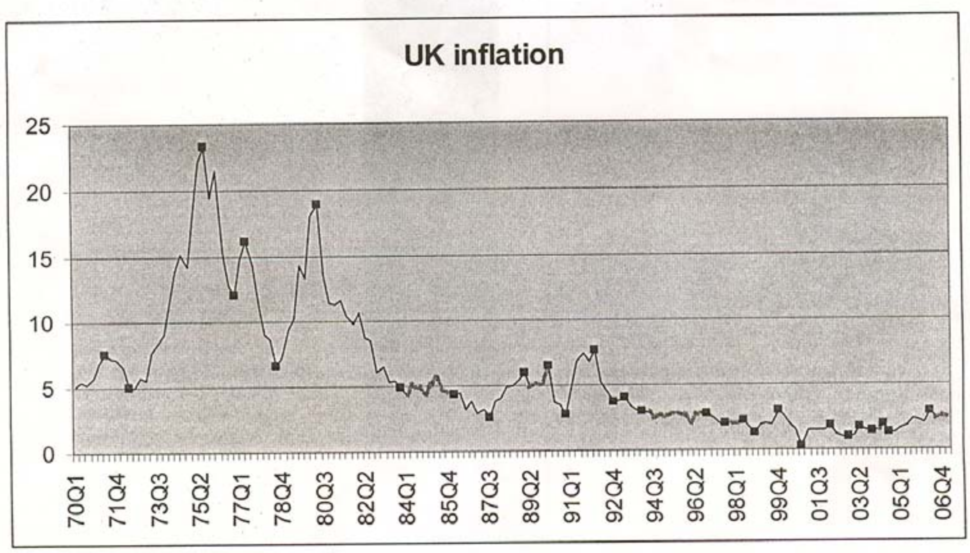
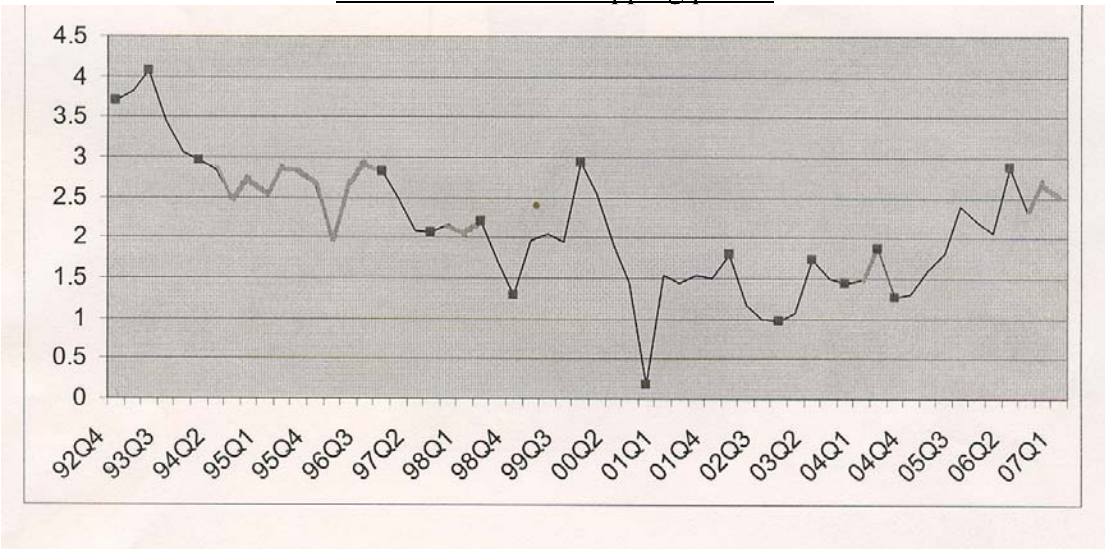
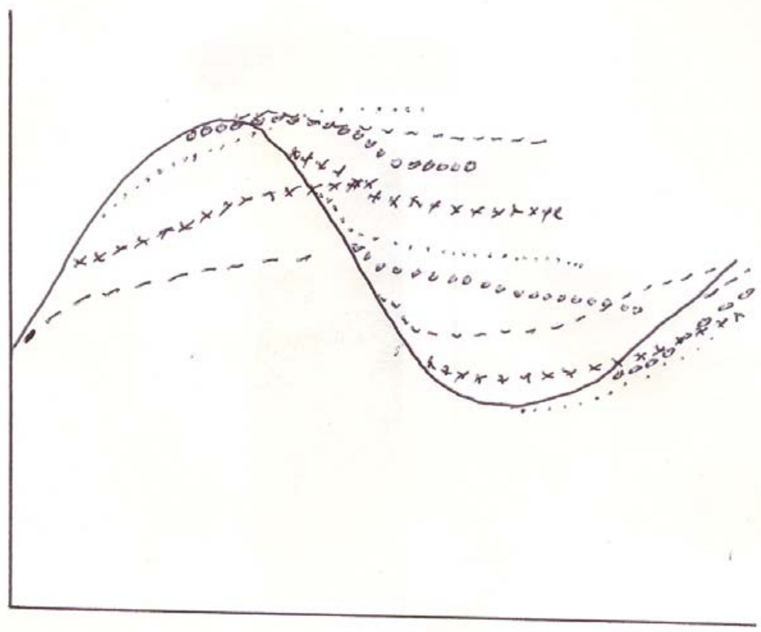


Figure 6
UK inflation: Overlapping period



We can explore this tendency towards cyclical bias more carefully by examining the sign and scale of errors in forecasts undertaken during periods when inflation is rising (up periods) or falling (down periods). These forecasts are generally made out to an 8 quarter horizon. Frequently the cycle will change before the full 8 quarters are finished. For the reasons described in our first paper, we distinguish between forecasts initially made during an up (down) period which at the out-turn date are still in the same cyclical up (down) phase, and those where the sign of the cycle has changed (once again, we ignore observations with two sign changes). We expect the bias to be greater when the forecasts remain within the same initial cycle phase. A diagram may again make this easier to understand. Assume that forecasts all are subject to mean reversion; then the errors will be more mixed in sign/scale after a cyclical sign change.

Figure 7



This leaves the question of how to handle flat periods. If there is no clear cyclical reversal, then the mean reversion of forecasts should make the systematic bias continue. So, we treated a flat period following an up (down) period as being essentially a continuation of the up (down) period. We have, however, shown the up/flat and down/flat periods separately in the tables below.

We turn first to New Zealand. The relevant table, of exactly the same format as described in our first paper, for the whole period, of 45 actual observations and 134 forecast quarters, is shown below. The table for the shorter overlapping period of observations is again left out for reasons of space, since it is so similar to that for the longer period, but it is available from the author(s) on request. Given that the inflation forecasts in NZ are good, as already reported, one might expect any residual bias to be less than for interest rate forecasts, and this is what Table 1 indicates. The signs of up errors, and up/flat errors, (both before and after the first sign change) tend to be more often positive than negative, and vice versa for down, and down/flat errors, but the results are no longer as overwhelming in numbers, nor as statistically significant, as in the case of the NZ interest rate forecast. Thus there are some slight signs of bias, but these are mild and somewhat tentative.

Table 1

NZ Inflation

Initial sign: Up

Up error till first sign change

#	+ ve	- ve	Mean	SD	P-value
21	10	11	-0.0571	0.3514	0.4761
16	6	10	0.0720	0.5099	0.5927
11	6	5	0.1450	0.7035	0.5293
8	6	2	0.3028	0.6503	0.2577
6	5	1	0.4933	0.7851	0.2190
4	4	0	0.3282	0.4307	0.2785
3	3	0	0.4303	0.4937	0.3429
2	2	0	0.7453	0.4085	0.3192
1	1	0	1.4166		
72	43	29	0.2016	0.5885	0.0052

Initial sign: Down

Down error till first sign change

#	+ ve	- ve	Mean	SD	P-value
19	5	14	-0.1328	0.1754	0.0048
13	4	9	-0.1926	0.5186	0.2226
7	4	3	0.1655	0.5150	0.4611
4	2	1	0.2514	0.4019	0.3580
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
43	15	27	-0.1258	0.3881	0.0417

Up/Flat error

#	+ ve	- ve	Mean	SD	P-value
2	1	1	0.0030	0.1286	0.9850
2	1	1	-0.1374	0.2029	0.6210
2	0	2	-0.1433	0.1663	0.5473
1	1	0	0.0034		
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
7	3	4	-0.0788	0.1418	0.2222

Down/Flat error

#	+ ve	- ve	Mean	SD	P-value
3	1	2	-0.0907	0.3951	0.7763
3	1	2	-0.1212	0.3421	0.6661
3	0	3	-0.2422	0.1897	0.2127
2	0	2	-0.1374	0.0293	0.1337
1	0	1	-0.4012		
0	0	0			
0	0	0			
0	0	0			
0	0	0			
12	2	10	-0.1699	0.2552	0.0494

After first sign change

Down error after first sign change

#	+ ve	- ve	Mean	SD	P-value
0	0	0			
5	1	4	-0.2250	0.3321	0.2469
10	3	7	-0.2670	0.5893	0.2071
12	5	7	-0.1454	0.7633	0.5404
13	7	6	-0.0370	0.9166	0.8911
10	6	4	0.0536	0.9711	0.8722
6	3	3	0.1873	0.9217	0.6686
4	3	1	0.2739	0.5140	0.4241
3	2	1	0.2584	0.4439	0.4970
63	30	33	0.2050	0.6139	0.0108

After first sign change

Up error after first sign change

#	+ ve	- ve	Mean	SD	P-value
0	0	0			
5	0	5	-0.2806	0.3466	0.1808
10	5	5	0.0170	0.4398	0.9103
13	8	5	0.3385	0.4937	0.0351
14	14	0	0.7426	0.4665	0.0001
12	12	0	1.0251	0.7504	0.0009
9	9	0	1.0272	0.8451	0.0089
7	7	0	0.9930	1.0722	0.0638
6	6	0	0.8933	0.9983	0.1018
76	61	15	0.6161	0.7966	0.0000

Down/Flat error

#	+ ve	- ve	Mean	SD	P-value
0	0	0			
0	0	0			
0	0	0			
1	0	1	-0.3424		
2	0	2	-0.2894	0.0255	0.0559
3	0	3	-0.3643	0.2037	0.1272
3	0	3	-0.3380	0.1295	0.0662
2	0	2	-0.4267	0.2172	0.2998
1	0	1	-0.3405		
12	0	12	-0.3518	0.1295	0.0000

Up/Flat error

#	+ ve	- ve	Mean	SD	P-value
0	0	0			
0	0	0			
0	0	0			
1	1	0	0.4411		
2	2	0	0.8431	0.1288	0.0965
2	2	0	1.1700	0.0837	0.0454
2	2	0	1.4811	0.4133	0.1733
1	1	0	1.6420		
0	0	0			
8	8	0	1.1340	0.4384	0.0002

Again we also provide a simpler demonstration of the same syndrome, using the following regression equation:-

Infl Forecast Error = C1 + C2 + C3 + C4 + u

where:-

C1 = a constant taking the value 1 in up periods;

C2 = a constant taking the value 1 in both up and succeeding flat periods;

C3 = a constant taking the value 1 in down periods;

C4 = a constant taking the value 1 in both down and succeeding flat periods;

u = a residual.

The results are shown in Table 2

Table 2

(A) Indicator variable is based on state at out-turn (whole data set)

H =	Adj R-sqr	C(1)	P-value	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	-0.03	-0.01	0.91	-0.14	0.68	-0.20	0.08	-0.12	0.66
Q2	-0.04	0.08	0.50	-0.14	0.72	-0.09	0.52	-0.24	0.46
Q3	0.05	0.32	0.02	0.22	0.60	-0.06	0.67	-0.21	0.55
Q4	0.22	0.67	0.00	0.84	0.09	-0.07	0.69	-0.33	0.41
Q5	0.25	0.83	0.00	1.17	0.03	0.02	0.91	-0.36	0.40
Q6	0.24	0.85	0.00	1.48	0.01	0.07	0.72	-0.34	0.45
Q7	0.20	0.87	0.00	1.37	0.03	0.02	0.92	-0.24	0.63
Q8	0.12	0.86	0.00	1.14	0.09	0.05	0.84	-0.05	0.93

(B) Indicator variable is based on state at out-turn,
but only includes periods during which sign is unchanged

H =	Adj R-sqr	C(1)	P-value	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	-0.03	-0.01	0.91	-0.14	0.68	-0.20	0.08	-0.12	0.66
Q2	-0.05	0.08	0.58	-0.14	0.73	-0.13	0.44	-0.24	0.47
Q3	-0.06	0.22	0.15	0.22	0.53	0.09	0.65	-0.21	0.48
Q4	0.16	0.55	0.03	0.75	0.24	-0.13	0.71	-0.34	0.45
Q5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Q6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Q7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Q8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(C) Indicator variable is based on state at forecast date (whole data set)

H =	Adj R-sqr	C(1)	P-value	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	-0.03	-0.01	0.91	-0.14	0.68	-0.20	0.08	-0.12	0.66
Q2	-0.05	0.05	0.70	0.01	0.97	-0.11	0.41	0.05	0.88
Q3	-0.04	0.09	0.53	-0.25	0.58	0.24	0.13	0.17	0.64
Q4	0.00	0.22	0.21	-0.41	0.46	0.50	0.01	0.48	0.29
Q5	0.07	0.21	0.28	-0.28	0.64	0.78	0.00	0.49	0.30
Q6	0.08	0.27	0.18	-0.38	0.53	0.87	0.00	0.40	0.43
Q7	-0.06	0.43	0.08	-0.02	0.97	0.64	0.01	0.43	0.46
Q8	-0.07	0.66	0.02	0.48	0.51	0.38	0.15	0.49	0.42

(D) Indicator variable is based on state at forecast date,
but only includes periods during which sign is unchanged

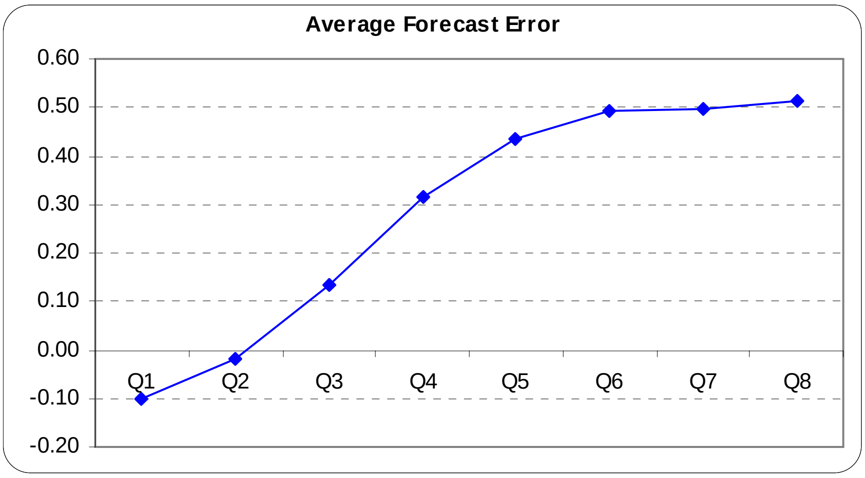
H =	Adj R-sqr	C(1)	P-value	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	-0.03	-0.01	0.91	-0.14	0.68	-0.20	0.08	-0.12	0.66
Q2	-0.06	0.06	0.67	-0.03	0.96	-0.15	0.36	-0.16	0.69
Q3	0.01	0.22	0.11	N/A	N/A	0.01	0.97	N/A	N/A
Q4	0.29	0.57	0.01	N/A	N/A	-0.22	0.41	N/A	N/A
Q5	0.08	0.66	0.14	N/A	N/A	-0.54	0.58	N/A	N/A
Q6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Q7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Q8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

The forecasters from the RBNZ, however, tended to underestimate inflation on average, increasingly so at longer forecasting horizons, as h increases, see Table 3 and Figure 8.

Table 3

H=	Average Forecast Error
Q1	-0.1027
Q2	-0.0177
Q3	0.1342
Q4	0.3163
Q5	0.4342
Q6	0.4917
Q7	0.4963
Q8	0.5153

Figure 8



When the forecasts are re-adjusted to remove the effects of this average error, and the regressions re-run, the results are shown in Table 4, below:-

Table 4

(A) Indicator variable is based on state at out-turn
(whole data set, with average forecast error removed)

H =	Adj R-sqr	C(1)	P-value	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	-0.03	0.09	0.38	-0.03	0.92	-0.10	0.38	-0.02	0.95
Q2	-0.04	0.10	0.41	-0.13	0.75	-0.07	0.60	-0.22	0.49
Q3	0.05	0.19	0.15	0.09	0.84	-0.20	0.19	-0.34	0.33
Q4	0.22	0.35	0.03	0.53	0.28	-0.38	0.03	-0.64	0.11
Q5	0.25	0.40	0.02	0.74	0.17	-0.41	0.03	-0.80	0.07
Q6	0.24	0.36	0.05	0.99	0.08	-0.42	0.04	-0.83	0.07
Q7	0.20	0.37	0.07	0.87	0.16	-0.47	0.05	-0.73	0.15
Q8	0.12	0.34	0.12	0.62	0.35	-0.46	0.08	-0.56	0.31

(B) Indicator variable is based on state at out-turn, but only includes periods
during which sign is unchanged, with average forecast error removed

H =	Adj R-sqr	C(1)	P-value	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	-0.03	0.09	0.38	-0.03	0.92	-0.10	0.38	-0.02	0.95
Q2	-0.05	0.10	0.50	-0.13	0.76	-0.11	0.51	-0.22	0.50
Q3	-0.06	0.09	0.57	0.09	0.80	-0.04	0.84	-0.34	0.25
Q4	0.16	0.23	0.31	0.44	0.49	-0.45	0.23	-0.65	0.16
Q5	N/A								
Q6	N/A								
Q7	N/A								
Q8	N/A								

(C) Indicator variable is based on state at forecast date
(whole data set, with average forecast error removed)

H =	Adj R-sqr	C(1)	P-value	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	-0.03	0.09	0.38	-0.03	0.92	-0.10	0.38	-0.02	0.95
Q2	-0.05	0.07	0.60	0.03	0.94	-0.10	0.49	0.07	0.84
Q3	-0.04	-0.05	0.72	-0.38	0.39	0.11	0.50	0.04	0.92
Q4	0.00	-0.10	0.57	-0.72	0.19	0.18	0.35	0.17	0.71
Q5	0.07	-0.23	0.24	-0.71	0.23	0.35	0.10	0.06	0.90
Q6	0.08	-0.22	0.28	-0.88	0.15	0.37	0.09	-0.10	0.85
Q7	-0.06	-0.06	0.80	-0.52	0.46	0.14	0.56	-0.07	0.90
Q8	-0.07	0.14	0.59	-0.03	0.96	-0.13	0.61	-0.03	0.96

(D) Indicator variable is based on state at forecast date, but only includes periods during which sign is unchanged, with average forecast error removed

H =	Adj R-sqr	C(1)	P-value	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	-0.03	0.09	0.38	-0.03	0.92	-0.10	0.38	-0.02	0.95
Q2	-0.06	0.08	0.59	-0.01	0.99	-0.13	0.42	-0.15	0.72
Q3	0.00	0.09	0.52			-0.13	0.46		
Q4	0.29	0.25	0.20			-0.53	0.06		
Q5	0.08	0.23	0.57			-0.98	0.34		
Q6	N/A								
Q7	N/A								
Q8	N/A								

Largely because the RBNZ was able to forecast inflation so well, apart from the average error, there is relatively little systematic cyclical bias in the errors. The signs of the coefficients tend to take the expected values, see panels B and D of Table 4 above, but they are not significant.

When we turn to examine the UK results (whole period) for bias and inefficiency, we get much stronger results, much more akin to the bias in the interest rate forecasts. Only in one sub-set (up/flat error, up till first sign change) is the hypothesis, (that up period errors will be overwhelmingly positive (actual less forecast) and down period errors equivalently negative), not strongly supported. Once again note that the scale of the up and down period errors is approximately offsetting, so if one should take the time period as a whole, (not divided into ‘up’ and ‘down’ periods), the forecasts appear unbiased and efficient.

Table 5

UK inflation

Initial sign: Up

Up error till first sign change

#	+ ve	- ve	Mean	SD	P-value
59	32	27	0.1144	0.8924	0.3332
48	30	18	0.5173	1.4212	0.0162
37	29	8	1.0219	1.7063	0.0010
29	25	4	2.0559	2.3367	0.0001
21	18	3	3.7508	3.2799	0.0001
11	11	0	6.5127	4.0098	0.0004
2	2	0	9.5821	0.0511	0.0034
0	0	0			
0	0	0			
207	147	60	1.4424	2.6664	0.0000

Initial sign: Down

Down error till first sign change

#	+ ve	- ve	Mean	SD	P-value
58	14	44	-0.5542	0.8739	0.0000
48	12	36	-0.6822	1.1558	0.0002
38	12	26	-0.8502	1.3930	0.0007
29	7	22	-0.8695	1.4700	0.0041
24	6	18	-0.9966	1.7308	0.0111
18	3	15	-1.3615	1.3418	0.0006
13	1	12	-1.6650	1.0620	0.0002
7	0	7	-2.0600	0.9625	0.0019
2	0	2	-2.2565	0.3927	0.1097
237	55	182	-0.8641	1.0596	0.0000

Up/Flat error

#	+ ve	- ve	Mean	SD	P-value
7	3	4	-0.0710	0.6185	0.7881
7	4	3	-0.1388	0.5691	0.5719
7	3	4	-0.1522	0.6064	0.5613
7	3	4	-0.0491	0.3226	0.7220
7	4	3	0.2322	0.4429	0.2464
5	1	4	-0.1284	0.3051	0.4474
5	2	3	-0.2956	0.5016	0.3038
3	1	2	-0.0951	0.3906	0.7635
1	0	1	-0.4112		
49	21	28	-0.0830	0.4794	0.2361

Down/Flat error

#	+ ve	- ve	Mean	SD	P-value
24	9	15	-0.0655	0.5431	0.5685
25	11	14	-0.1912	0.5964	0.1293
25	6	19	-0.5113	0.7854	0.0039
24	3	21	-0.9327	0.9122	0.0001
22	1	21	-1.3591	1.0136	0.0000
18	2	16	-1.3053	0.8371	0.0000
11	1	10	-1.2842	0.9599	0.0017
7	0	7	-1.5317	0.6901	0.0016
2	0	2	-1.4695	0.4535	0.1906
158	33	125	-0.7766	0.9388	0.0000

After first sign change

Down error after first sign change

#	+ ve	- ve	Mean	SD	P-value
0	0	0			
10	4	6	-0.9020	1.2577	0.0599
20	3	17	-0.9738	1.5901	0.0152
26	6	20	-0.9413	1.5343	0.0051
28	8	20	-0.9043	1.8723	0.0184
25	6	19	-1.1857	1.9481	0.0065
17	2	15	-1.2825	2.5065	0.0575
9	3	6	-0.8650	2.4956	0.3556
2	1	1	0.0020	3.4421	0.9996
137	33	104	-1.0038	1.8667	0.0000

After first sign change

Up error after first sign change

#	+ ve	- ve	Mean	SD	P-value
0	0	0			
10	3	7	-0.1798	1.2986	0.6877
20	7	13	-0.1517	1.2593	0.6056
27	9	18	0.0012	1.1570	0.9957
31	13	18	0.3336	1.7776	0.3122
26	12	14	0.5785	2.5349	0.2646
15	9	6	1.0678	2.3974	0.1178
7	4	3	0.2156	1.5842	0.7502
2	0	2	-0.6605	0.8401	0.5759
138	57	81	-0.1849	0.8877	0.0160

Down/Flat error

#	+ ve	- ve	Mean	SD	P-value
0	0	0			
0	0	0			
0	0	0			
1	0	1	-0.8990		
3	0	3	-0.9767	0.9421	0.2803
3	0	3	-1.5235	1.2001	0.2145
2	0	2	-2.3061	0.2610	0.0717
1	0	1	-2.3118		
0	0	0			
10	0	10	-1.5323	0.9343	0.0008

Up/Flat error

#	+ ve	- ve	Mean	SD	P-value
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!

We did exactly the same exercise for the UK for the shorter, overlapping period; the equivalent Table is shown below. As is evident, the same extent, scale and significance of the bias reappears on the down side. On the ‘up’ side, however, the results are much weaker, and indeed are incorrectly signed after the first sign change.

Table 6

UK inflation (overlapping period)

Initial sign: Up

Up error till first sign change

#	+ ve	- ve	Mean	SD	P-value
14	7	7	0.1098	0.3632	0.2955
10	6	4	0.1619	0.3713	0.2233
6	3	3	0.1242	0.4677	0.5786
4	3	1	0.1678	0.4226	0.5410
2	0	2	-0.1445	0.1587	0.5297
0	0	0			
0	0	0			
0	0	0			
0	0	0			
36	19	17	0.1190	0.3695	0.0650

Up/Flat error

#	+ ve	- ve	Mean	SD	P-value
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!

After first sign change

Down error after first sign change

#	+ ve	- ve	Mean	SD	P-value
0	0	0			
4	2	2	-0.3902	0.6561	0.3787
8	0	8	-0.6662	0.6067	0.0228
9	0	9	-0.8689	0.6939	0.0076
8	1	7	-1.1548	0.8520	0.0089
6	0	6	-1.4186	0.9306	0.0191
4	0	4	-1.6510	0.7302	0.0296
2	0	2	-1.8701	0.4173	0.1398
0	0	0			
41	3	38	-1.0440	0.8033	0.0000

Down/Flat error

#	+ ve	- ve	Mean	SD	P-value
0	0	0			
0	0	0			
0	0	0			
1	0	1	-0.8990		
3	0	3	-0.9767	0.9421	0.2803
3	0	3	-1.5235	1.2001	0.2145
2	0	2	-2.3061	0.2610	0.0717
1	0	1	-2.3118		
0	0	0			
10	0	10	-1.5323	0.9343	0.0008

Initial sign: Down

Down error till first sign change

#	+ ve	- ve	Mean	SD	P-value
19	3	16	-0.3600	0.3807	0.0008
14	2	12	-0.5321	0.5422	0.0036
10	2	8	-0.7093	0.5517	0.0039
7	1	6	-0.8278	0.7184	0.0303
6	0	6	-0.6066	0.3366	0.0100
4	0	4	-0.9359	0.2395	0.0066
3	0	3	-1.0449	0.4327	0.0761
1	0	1	-1.0162		
0	0	0			
64	8	56	-0.6048	0.5077	0.0000

Down/Flat error

#	+ ve	- ve	Mean	SD	P-value
15	6	9	-0.0485	0.3943	0.6524
16	9	7	-0.0599	0.4229	0.5913
16	5	11	-0.3476	0.6266	0.0484
15	3	12	-0.5419	0.6675	0.0089
13	1	12	-0.8039	0.6985	0.0018
9	2	7	-0.7799	0.6824	0.0120
5	1	4	-0.8302	0.6015	0.0508
3	0	3	-1.4041	0.3997	0.0382
0	0	0			
92	27	65	-0.4479	0.6592	0.0000

After first sign change

Up error after first sign change

#	+ ve	- ve	Mean	SD	P-value
0	0	0			
5	0	5	-0.5090	0.2942	0.0258
9	0	9	-0.6683	0.3249	0.0004
11	0	11	-0.5300	0.2241	0.0000
13	1	12	-0.4146	0.4203	0.0051
10	2	8	-0.4269	0.4359	0.0165
6	2	4	-0.3204	0.6645	0.3302
3	2	1	-0.2405	0.6824	0.6677
0	0	0			
57	7	50	-0.4683	0.4100	0.0000

Up/Flat error

#	+ ve	- ve	Mean	SD	P-value
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0			
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!

Again the simpler regression results, both for the whole and for the shorter periods, give the following results (Table 7):-

Table 7

(A) Indicator variable is based on state at out-turn (whole data set)

H =	Adj R-sqr	C(1)	P-value	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	0.13	0.40	0.01	-0.14	0.76	-0.72	0.00	-0.19	0.42
Q2	0.17	0.61	0.00	-0.15	0.78	-0.89	0.00	-0.51	0.07
Q3	0.23	1.07	0.00	-0.05	0.94	-0.88	0.00	-0.93	0.01
Q4	0.24	1.60	0.00	0.23	0.78	-0.85	0.00	-1.31	0.00
Q5	0.23	2.10	0.00	-0.13	0.91	-1.00	0.01	-1.34	0.02
Q6	0.13	1.39	0.01	-0.30	0.80	-0.95	0.02	-1.44	0.05
Q7	0.01	0.12	0.85	-0.10	0.94	-0.64	0.17	-1.63	0.04
Q8									

(B) Indicator variable is based on state at out-turn,
but only includes periods during which sign is unchanged

H =	Adj R-sqr	C(1)	P-value	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	0.13	0.40	0.01	-0.14	0.76	-0.72	0.00	-0.19	0.42
Q2	0.22	0.83	0.00	-0.15	0.78	-0.93	0.00	-0.51	0.08
Q3	0.33	1.67	0.00	-0.05	0.94	-1.00	0.00	-0.93	0.01
Q4	0.45	3.04	0.00	0.23	0.77	-1.12	0.01	-1.35	0.00
Q5	0.57	5.04	0.00	-0.13	0.90	-1.48	0.00	-1.36	0.01
Q6	0.72	7.04	0.00	-0.30	0.67	-1.85	0.00	-1.35	0.00
Q7									
Q8									

(C) Indicator variable is based on state at forecast date (whole data set)

H =	Adj R-sqr	C(1)	P-value	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	0.13	0.40	0.01	-0.14	0.76	-0.72	0.00	-0.19	0.42
Q2	0.16	0.58	0.00	-0.45	0.44	-0.90	0.00	-0.38	0.18
Q3	0.16	0.88	0.00	-0.87	0.26	-0.79	0.00	-0.64	0.07
Q4	0.15	1.28	0.00	-1.72	0.14	-0.68	0.03	-0.83	0.07
Q5	0.10	1.39	0.00	-2.90	0.08	-0.42	0.30	-1.03	0.10
Q6	0.02	0.12	0.83	-2.95	0.13	-0.14	0.76	-1.20	0.09
Q7	0.06	-0.62	0.23	-2.96	0.16	0.17	0.75	-1.51	0.03
Q8									

(D) Indicator variable is based on state at forecast date,
but only includes periods during which sign is unchanged

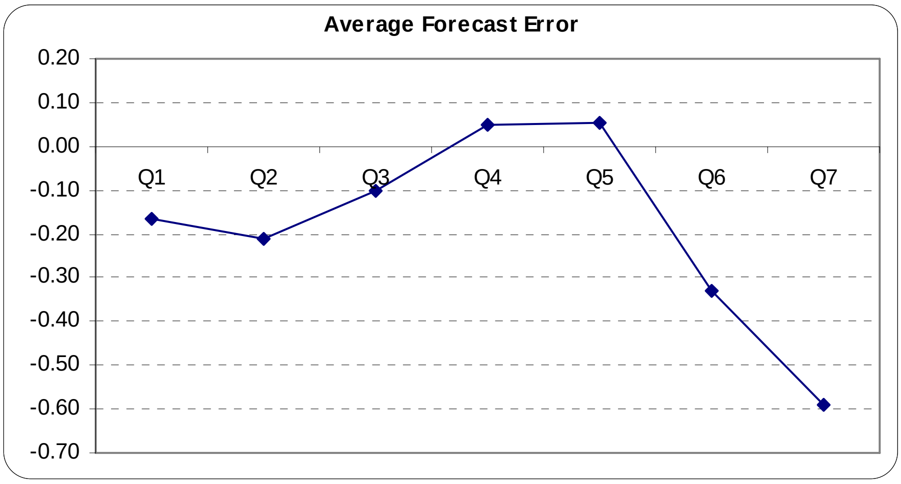
H =	Adj R-sqr	C(1)	P-value	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	0.13	0.40	0.01	-0.14	0.76	-0.72	0.00	-0.19	0.42
Q2	0.22	0.79	0.00	-0.13	0.84	-0.99	0.00	-0.38	0.18
Q3	0.32	1.49	0.00	-0.02	0.99	-1.18	0.00	-0.64	0.07
Q4	0.40	2.52	0.00	1.14	0.61	-1.47	0.00	-0.87	0.07
Q5	0.43	3.75	0.00			-1.72	0.00		
Q6	0.27	2.46	0.01			-1.91	0.01		
Q7	-1.48	-0.10	0.92			-1.62	0.03		
Q8									

Unlike NZ there is no systematic trend in the average errors. These are small, and flat, until the longest forecast horizon (h = 6/7), see Table 8 and Figure 9.

Table 8

H=	Average Forecast Error
Q1	-0.1654
Q2	-0.2099
Q3	-0.1015
Q4	0.0507
Q5	0.0527
Q6	-0.3307
Q7	-0.5911

Figure 9



Adjusting the forecasts for such average errors and re-running the regressions gives the following results:-

Table 9

(A) Indicator variable changes is based on state at out-turn
(whole data set, with average forecast error removed)

H =	Adj R-sqr	C(1)	P-value	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	0.13	0.56	0.00	0.03	0.95	-0.55	0.00	-0.03	0.91
Q2	0.17	0.82	0.00	0.06	0.91	-0.68	0.00	-0.30	0.29
Q3	0.23	1.17	0.00	0.05	0.93	-0.78	0.00	-0.83	0.01
Q4	0.24	1.55	0.00	0.18	0.83	-0.90	0.00	-1.36	0.00
Q5	0.23	2.05	0.00	-0.18	0.88	-1.06	0.01	-1.39	0.02
Q6	0.13	1.72	0.00	0.04	0.98	-0.62	0.14	-1.11	0.12
Q7	0.01	0.72	0.27	0.50	0.69	-0.05	0.91	-1.04	0.17
Q8									

(B) Indicator variable is based on state at out-turn, but only includes periods during which sign is unchanged, with average forecast error removed

H =	Adj R-sqr	C(1)	P-value	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	0.13	0.56	0.00	0.03	0.95	-0.55	0.00	-0.03	0.91
Q2	0.22	1.04	0.00	0.06	0.92	-0.72	0.00	-0.30	0.30
Q3	0.33	1.77	0.00	0.05	0.94	-0.90	0.00	-0.83	0.02
Q4	0.45	2.99	0.00	0.18	0.82	-1.17	0.00	-1.40	0.00
Q5	0.57	4.98	0.00	-0.18	0.86	-1.54	0.00	-1.41	0.01
Q6	0.72	7.37	0.00	0.04	0.96	-1.52	0.00	-1.02	0.03
Q7									
Q8									

(C) Indicator variable is based on state at forecast date (whole data set, with average forecast error removed)

H =	Adj R-sqr	C(1)	P-value	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	0.13	0.56	0.00	0.03	0.95	-0.55	0.00	-0.03	0.91
Q2	0.16	0.79	0.00	-0.24	0.68	-0.69	0.00	-0.18	0.54
Q3	0.16	0.98	0.00	-0.77	0.32	-0.69	0.00	-0.54	0.12
Q4	0.15	1.23	0.00	-1.77	0.13	-0.73	0.02	-0.88	0.06
Q5	0.10	1.33	0.00	-2.95	0.08	-0.47	0.24	-1.08	0.09
Q6	0.02	0.45	0.40	-2.62	0.18	0.19	0.68	-0.87	0.22
Q7	0.06	-0.03	0.95	-2.37	0.26	0.76	0.15	-0.92	0.17
Q8									

(D) Indicator variable is based on state at forecast date, but only includes periods during which sign is unchanged, with average forecast error removed

H =	Adj R-sqr	0.56256	0.0004	C(2)	P-value	C(3)	P-value	C(4)	P-value
Q1	0.13	1.00	0.00	0.03	0.95	-0.55	0.00	-0.03	0.91
Q2	0.22	1.59	0.00	0.08	0.91	-0.78	0.00	-0.18	0.54
Q3	0.32	2.15	0.00	0.08	0.93	-1.08	0.00	-0.54	0.13
Q4	0.40	3.69	0.00	0.77	0.73	-1.84	0.00	-1.24	0.01
Q5	0.43	2.79	0.00			-1.78	0.00		
Q6	0.31	0.50	0.50			-1.57	0.02		
Q7	-0.50					-1.03	0.06		
Q8									

To recapitulate, in this Section we have examined whether the inflation forecasts in NZ and the UK exhibited the same syndrome as the interest rate forecasts, that is ex post cyclical inefficiency and bias, in that actuals systematically exceed forecasts during 'up' periods, and decline below forecasts during 'down' periods. For the NIESR inflation forecasts for the UK, the answer was generally 'yes'. In NZ over this period the RBNZ forecasts of inflation were remarkably good, and similarly their cyclical (up/down) bias was much less, with only a slight tendency in that direction.

III. Could Errors in Forecasting Inflation have been Partly Responsible for Errors in Forecasting Future Policy Interest Rates and for Inertial Adjustments in Actual Policy Rates?

The primary responsibility of Central Banks nowadays is to maintain price stability, generally in the guise of low, but positive, inflation targets. Since interest rates only affect inflation after long, and variable, lags, the decision to adjust the policy rate has to be, and normally is, taken on the basis of an inflation forecast.

In the previous Section we examined whether the inflation forecasts, for which we had data, exhibited systematic errors. We concluded that they had such a tendency, mildly in the case of the RBNZ inflation forecast, markedly so in the case of the NIESR UK forecast. So, in this Section we explore whether the errors in the inflation forecast are associated with, and perhaps cause, the errors in the inflation forecast. This is quite a demanding test, to attempt to find the error in one forecast associated with the error in another forecast.

This is especially so in the case of NZ, where the RBNZ inflation forecasts were so comparatively good. We start by noting that in NZ there was a close over-lap between periods of rising/falling interest rates and periods of rising/falling inflation between 2001 Q1 and 2006 Q4. Over these seven years (28 quarters) in only six quarters were the signs different, and in three of these inflation was basically flat, rather than moving in the opposite direction. But, while consistent with the hypothesis above, it is also consistent with the hypothesis that the RBNZ planned to raise/lower interest rates gradually in order to bring inflation back onto track.

So the test we employ is whether the error in the forecast for inflation for Q_{t+i} made at time t significantly affects the error in the forecast for interest rates for Q_{t+i} at time t, i.e.,

$$Ei_{t+i,t} = a + bE\pi_{t+i,t}$$

Because of concerns about potential simultaneity, we also run the same equation with the forecast for inflation, $\pi_{t+i,t}$ instrumented by the forecast for the t + i quarter made in the previous quarter, t – 1.

The initial results for New Zealand showed <u>no support</u> for our hypothesis. These are shown in Table 10 below:

Table 10

Data period 2000Q1-2006Q4

	Contemporaneous				Instrumented			
h =	C1 (P value)	C2 (P value)	R sq.	DW	C1 (P value)	C2 (P value)	R sq.	DW
0	0.0034 0.8253	-0.1466 0.0667	0.1235	1.6293	0.0087 0.5917	-0.0067 0.8548	0.0014	1.7071
1	-0.074 0.2162	-0.0055 0.9674	0.0001	1.4769	-0.1017 0.0821	0.0527 0.6162	0.0106	1.4922
2	-0.1464 0.1686	0.0403 0.8346	0.0019	1.0005	-0.1427 0.2284	-0.0633 0.7568	0.0043	0.9674
3	-0.1808 0.2676	0.0475 0.8663	0.0013	0.4609	-0.1723 0.3417	-0.0081 0.9763	0.0000	0.4029
4	-0.2318 0.3265	0.1591 0.6538	0.0093	0.4909	-0.2287 0.3776	0.1514 0.6684	0.0089	0.4231
5	-0.1724 0.5645	0.0312 0.9393	0.0003	0.4706	-0.1554 0.6171	0.1001 0.8156	0.0028	0.4770
6	-0.1429 0.7053	-0.0287 0.9552	0.0002	0.3014	-0.1498 0.7091	0.1832 0.7529	0.0073	0.2365
7	-0.1718 0.7479	0.0304 0.9677	0.0002	0.1091	0.1983 0.7499	-0.2979 0.7396	0.0146	0.1682

Further careful examination of the errors for NZ inflation and interest rates, with the NZ interest rate errors reported in Appendix 1 of our first paper, and the inflation errors in Appendix 1 here, however, reveals that part of the answer for this failure may have lain in the somewhat anomalous and unusual behaviour in the sub-period 2000 Q1 until 2001 Q3. During this sub-period (excluding the forecasts for Q0 and Q1 as so close to the outturn as to be unbiased), all the 49 inflation forecast errors, except for 5, are positive (actual greater than forecast), and on quite a large scale (e.g. 1%+), whereas of the 40 interest rate errors, no less than 36 are negative (actual below forecast), and some are again substantial in size. So, during this period inflation (as measured by CPI) consistently exceeded forecasts, yet interest rates were set in practice below their previously forecast rate.

If we exclude this anomalous period, and re-run the same equations, from 2001 Q4 to 2006 Q3, we get a relatively strong relationship between errors in the inflation forecast and errors in the interest rate forecast, as shown in the table below:-

Table 11

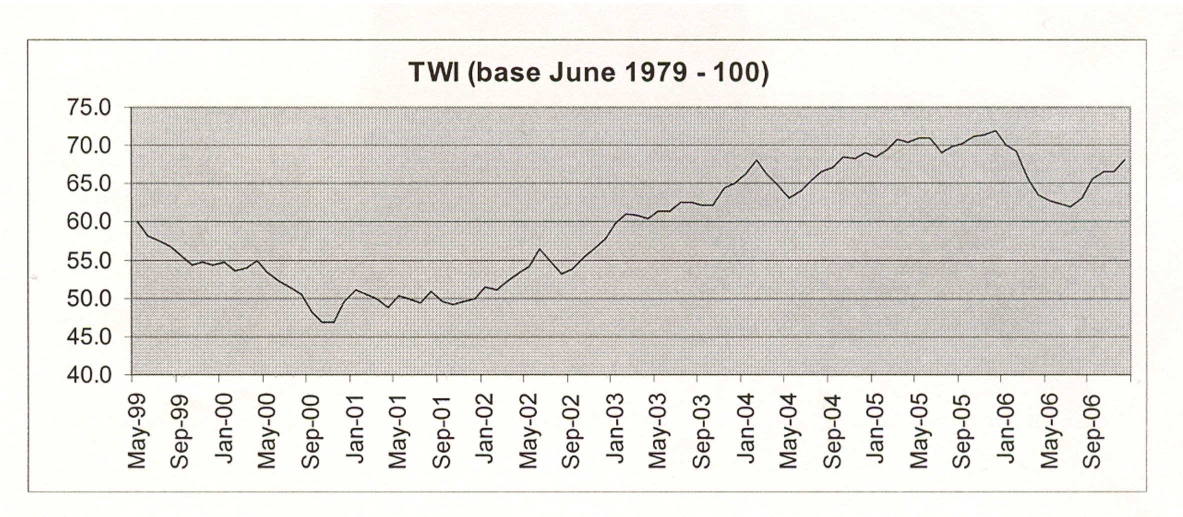
NZ regression:
Data period 2001Q4-2006Q4

	Contemporaneous				Instrumented			
h =	C1 (P value)	C2 (P value)	R sq.	DW	C1 (P value)	C2 (P value)	R sq.	DW
0	-0.0009 0.9521	-0.1029 0.1678	0.0977	1.3848	0.0120 0.4066	-0.0134 0.7134	0.0077	0.9686
1	-0.0192 0.7158	-0.0022 0.9866	0.0000	1.6973	-0.0113 0.8257	0.1299 0.2465	0.0781	1.3601
2	0.0288 0.7715	0.0793 0.7091	0.0084	0.9162	-0.0406 0.6517	0.5390 0.0517	0.2165	1.0249
3	0.0264 0.8385	0.8285 0.0395	0.2389	0.9868	-0.0290 0.8434	0.4830 0.1452	0.1360	0.5968
4	0.0072 0.9642	1.0290 0.0090	0.3746	0.8441	-0.0450 0.7985	0.9564 0.0188	0.3351	0.5130
5	0.0519 0.7838	1.2294 0.0067	0.4192	1.0550	0.0222 0.9207	1.2560 0.0292	0.3159	1.2565
6	0.1804 0.3612	2.0348 0.0027	0.6508	2.0261	0.1338 0.6346	1.3616 0.0559	0.3485	1.3993
7	0.4064 0.1292	2.0341 0.0122	0.7464	0.6972	0.0506 0.9003	2.0264 0.0861	0.4763	1.1087

So what is going on? Adding to the problem is the fact that a recent critique of RBNZ policy, (by Rodney Dickens, 2007), claims that the period of excessively lax policy began in September 2002 after Alan Bollard was appointed Governor. But, unless there is an implicit suggestion that the RBNZ inflation forecasts were biased downwards from September 2002 onwards, our data suggest that policy followed a standard path whereby under (over) estimates of CPI inflation led to under (over) estimates of future interest rates. In contrast, in our data series, the problematical time period is 2000/2001 at the end of Don Brash’s period in office.

What is noticeable, however, is that Dickens expresses his critique in terms of non-tradeables inflation whereas our data are for overall CPI inflation. As shown in Figure 10 for the NZ exchange rate, Trade Weighted Index (1979 = 100) from May 1999 until December 2006, the NZ $ depreciated quite strongly from May 1999 until the end of 2000, remained roughly constant then until end 2001, and then appreciated strongly until end 2005. In so far as Dickens (and Brash?) believes that non-tradeables inflation is a better measure of (core) inflation than GDP inflation, the underestimate of inflation in 2000/1 could be dismissed as being due to exogenous external influences, which were less relevant for the policy decision than the continued control over non-tradeables inflation (see Dickens Figure 1, p. 72). Equivalently the sharp rise in non-tradeables inflation, after Bollard's appointment, was masked by the exchange rate appreciation.

Figure 10



So, the assessment of NZ monetary policy must depend in some considerable part on what was held to be the appropriate measure of inflation. But if the appropriate measure was held, by some, to be non-tradeables inflation, then surely the Policy

Target Agreement should have been framed in the same terms. The monetary authorities must abide by their publicly-set target, until it is changed. It is not helpful to have a private target measure that differs from that publicly set.

Turning next to the UK, our initial results for the UK were equally unsupportive. Here we initially related the errors implicit in the market forecast against the errors in the National Institute forecast for inflation. The results, not shown here but available from the authors, provided no evidence of any significant relationship. A possibility that immediately occurred to us was that, during this period, the official target was RPIX, not CPI, and that the basis of the MPC's forecast was an unchanged interest rate. So we switched to an examination of the MPC's errors in forecasting RPIX as a potential explanation of the errors in predicting interest rates, from the unchanged assumption. The basic data are also included in Appendix 1.

But the first results remained just about as unpromising, see Table 12 below.

Table 12

Data period: 1993Q1 – 2004Q1

	Contemporaneous				Instrumented			
h =	C1 (P value)	C2 (P value)	R sq.	DW	C1 (P value)	C2 (P value)	R sq.	DW
1	-0.0685 0.0360	0.2018 0.0292	0.1083	0.9486	-0.0701 0.0434	0.0967 0.2271	0.0354	1.0683
2	-0.1227 0.1329	0.3092 0.1070	0.0621	0.6699	-0.1192 0.1654	0.1057 0.5380	0.0096	0.6687
3	-0.1721 0.1615	0.3278 0.1855	0.0434	0.4783	-0.1702 0.1857	0.1388 0.5617	0.0087	0.4683
4	-0.2146 0.1705	0.3238 0.2683	0.0313	0.3911	-0.2156 0.1891	0.0410 0.9001	0.0004	0.3944
5	-0.2601 0.1547	0.1717 0.6367	0.0059	0.3399	-0.2762 0.1470	-0.1305 0.7365	0.0031	0.3488
6	-0.3168 0.1127	-0.0433 0.9150	0.0003	0.3107	-0.3899 0.0696	-0.1650 0.7376	0.0033	0.3257
7	-0.4379 0.0432	-0.1604 0.7450	0.0032	0.2939	-0.4108 0.1666	0.6524 0.3813	0.0308	0.3024

An examination of the errors in forecasting RPIX inflation, and the implied errors from the constant interest rate assumption, revealed, however, that there were two periods when the expected positive relationship between the two sets of errors was reversed. The first comes at the start of the period. In 1994/95 the policy rate was rising above the levels reached in 1992/93 (so the implicit forecast was too low, actual greater than forecast) at a time when the RPIX forecast was coming in below predicted levels (actual less than forecast). Interest rates had been brought down sharply in 1992/93 because of the recession then, especially in the housing market. The lower than forecast inflation rate was largely due to the much less than expected pass-through onto domestic prices from the large devaluation in 1992. So the lower RPI, than expected, in 1994/95 was not taken as a sign of lower domestic inflationary pressures. As in NZ external factors were disguising perceived relationships between domestic inflation and interest rates.

The second period when the hypothesis of a positive relationship between errors in inflation forecast and errors in interest rate forecasts clearly breaks down is at the end of the period in 2003/4. At this time interest rates were declining, (so the forecast error was actual less than forecast) whereas inflation was picking up (actual greater than forecast). Again we tentatively attribute this to external factors, i.e. the worldwide decline in nominal and real interest rates in the years following the collapse of the equity bubble.

If we exclude these two periods, thereby cutting the sample period by about one quarter for h = 5 – 8, the (positive) relationship between errors in inflation forecasts and in interest rate forecasts does re-emerge, see Table 13, though its strength, and the significance of the coefficient is limited rather than strong.[2]

Table 13

h =	Contemporaneous				Instrumented			
	C1 (P value)	C2 (P value)	R sq.	DW	C1 (P value)	C2 (P value)	R sq.	DW
1	-0.0805 0.0514	0.2464 0.1030	0.0785	0.9326	-0.0756 0.0703	0.1439 0.2197	0.0453	1.0701
2	-0.1961 0.0473	0.4976 0.0726	0.0972	0.7315	-0.1749 0.0779	0.2973 0.2027	0.0502	0.7433
3	-0.3100 0.0311	0.6508 0.0536	0.1150	0.5601	-0.2939 0.0428	0.5277 0.1102	0.0802	0.5452
4	-0.3943 0.0485	1.1954 0.0208	0.1959	0.5418	-0.3429 0.1112	0.7971 0.2419	0.0544	0.4380
5	-0.3761 0.1039	1.3558 0.0690	0.1262	0.5092	-0.3832 0.1332	0.4736 0.5438	0.0149	0.3972
6	-0.3532 0.1740	0.9605 0.2335	0.0563	0.4502	-0.3826 0.1829	0.3781 0.6223	0.0099	0.3423
7	-0.3260 0.2465	0.5958 0.4317	0.0249	0.3531	0.2783 0.5592	2.2049 0.0612	0.1724	0.6037

We turn, finally, to a purely visual, graphical example taken from the paper by Adolfson, et al., in the IJCB (December 2007). Figures 1(a) and (b) show charts (reproduced below) for the relationship between Riksbank (Swedish) forecasts and outturns for inflation and interest rates. Between 2002 Q2 and 2005 there is an apparent positive correlation between the errors in the two series, but this was patently not there between 1999 and 2002 Q2. During this latter period, policy interest rates were apparently forecast to rise sharply to around 5%, or above, despite inflation being predicted, as largely turned out to be the case, to remain around 2/2 ½ %. Why there was some expectation that in Sweden <u>real</u> rates would rise to 3%, while they were in sharp decline everywhere else in the world, is not an issue covered further here.

[2] We examined whether any such relationship re-emerged also when using the government debt/CPI error series over this same shortened period.

Figure 11

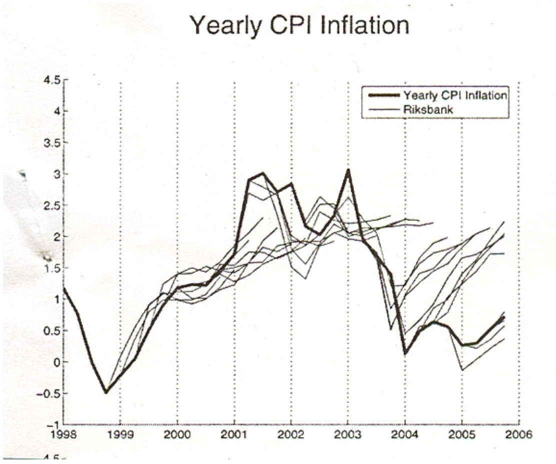
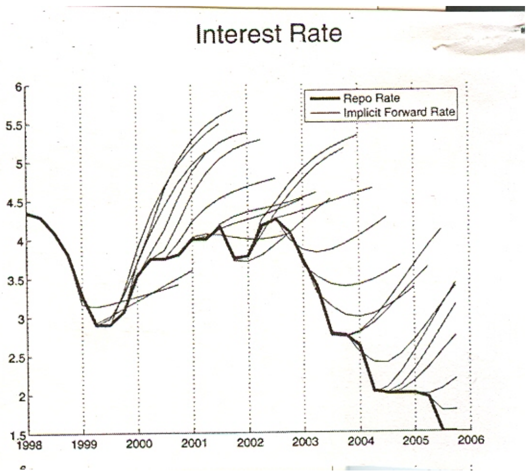


Figure 12



What is germane is that this is a further example of a country where during <u>some</u> periods errors in forecasting inflation and in forecasting interest rates seem to have a reasonably strong positive association, but in other, perhaps briefer, periods they do not. In the case of both NZ and the UK, two open economies, the periods when this relationship does <u>not</u> hold appear to be associated with external influences affecting the course either of inflation, or of interest rates, or both, in ways that may have distorted the direct domestic inflation/interest rate nexus.

IV. Conclusions

(1) The inflation forecasts, both official and private sector, that we studied here were rather better than the interest rate forecasts, especially in NZ. They were rather good over the next year, and had some, but not much, value over the second year.

(2) Nevertheless both the inflation and interest rate forecasts were, ex post, inefficient and biased. This may have been caused by forecasters generally assuming a quicker reversion to some equilibrium level than actually occurs in up, and down, cycles, a hypothesis that we shall examine in our third, and final, paper of this trilogy. Since this bias is offsetting between up, and down, phases it does not appear in whole sample econometric tests.

(3) Our hypothesis was that, in inflation targeting countries, errors in forecasting interest rates would be positively associated with errors in forecasting inflation. Over our complete sample periods, this was not supported. It was, however, supported over the larger part of our periods in both NZ and UK. There were, instead, periods in both countries (and in Sweden) when the relationship reversed. On inspection in both NZ and UK these latter periods were occasions when external influences may have distorted the nexus between interest rates and domestic inflationary impulses.

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Appendix 1: Table 1: UK inflation forecast, measured in terms of CPI

Date	CPI	R(t,t)	R(t-1,t)	R(t-2,t)	R(t-3,t)	R(t-4,t)	R(t-5,t)	R(t-6,t)	R(t-7,t)
1992Q1	7.7039	7.3485	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1992Q2	5.1939	5.1207	4.6188	N/A	N/A	N/A	N/A	N/A	N/A
1992Q3	4.552	4.3134	4.3197	3.6023	N/A	N/A	N/A	N/A	N/A
1992Q4	3.7062	4.4191	3.5436	3.617	3.2764	N/A	N/A	N/A	N/A
1993Q1	3.8136	3.8787	4.507	3.1535	3.2959	3.2463	N/A	N/A	N/A
1993Q2	4.0645	4.2747	4.123	4.3902	2.9903	3.3403	3.3637	N/A	N/A
1993Q3	3.4513	4.1696	4.656	4.5045	4.7685	2.8946	3.3816	3.4771	N/A
1993Q4	3.0586	3.5933	4.1982	4.8143	4.7358	4.7099	2.9432	3.3539	3.5172
1994Q1	2.9514	3.3015	3.9029	4.2206	5.034	4.888	N/A	N/A	N/A
1994Q2	2.8424	2.8424	3.3621	4.0517	4.1751	4.9059	4.8993	N/A	N/A
1994Q3	2.4829	3.0796	3.0796	3.7671	4.3627	4.4029	4.8473	4.9735	N/A
1994Q4	2.7341	2.5554	3.3163	3.4014	4.0782	4.3993	4.5575	4.8556	5.0459
1995Q1	2.5402	2.7895	2.5359	3.5413	3.457	4.2052	N/A	N/A	N/A
1995Q2	2.8595	2.439	2.9387	2.605	3.6851	3.5176	4.3369	N/A	N/A
1995Q3	2.8404	3.0075	2.5063	3.172	2.7569	3.8174	3.5685	4.4554	N/A
1995Q4	2.6677	2.99	3.2392	2.6578	3.314	2.99	3.9506	3.6184	4.4898
1996Q1	1.9769	2.6359	1.8946	3.2152	2.8076	3.4539	N/A	N/A	N/A
1996Q2	2.6961	1.8018	2.6144	3.1122	3.1889	2.9557	3.5889	N/A	N/A
1996Q3	2.9221	2.6786	1.8745	3.0106	3.0869	3.0819	2.8525	3.7217	N/A
1996Q4	2.8235	2.9863	2.6634	2.0276	3.1528	3.1452	2.9767	2.7508	3.8492
1997Q1	2.486	2.56	2.8823	2.48	2.3425	3.2103	N/A	N/A	N/A
1997Q2	2.075	2.2293	2.224	3.1873	2.6253	2.6549	3.3439	N/A	N/A
1997Q3	2.0586	1.9002	1.8942	1.9716	2.9968	2.6877	2.8	3.3965	N/A
1997Q4	2.1622	2.4467	2.131	1.9623	1.9608	3.2132	2.9874	3.0207	3.5266
1998Q1	2.0424	2.1978	2.4314	2.2799	2.1909	1.8721	N/A	N/A	N/A
1998Q2	2.1926	2.036	2.3438	2.8974	2.3456	2.3364	2.0979	N/A	N/A
1998Q3	1.6949	2.0202	1.7871	2.2481	2.4825	2.2533	2.4787	2.2428	N/A
1998Q4	1.2915	1.4019	2.0849	1.7761	2.6255	2.3883	2.2411	2.5404	2.3077
1999Q1	1.9626	1.8709	2.0561	2.6194	2.0785	2.765	N/A	N/A	N/A
1999Q2	2.0465	2.2326	1.8605	2.3277	2.7586	2.3791	2.9008	N/A	N/A
1999Q3	1.9481	2.1257	2.1257	2.037	2.3148	2.818	2.5191	2.881	N/A
1999Q4	2.9464	1.7479	2.2059	2.2059	2.3063	2.3041	2.8744	2.5038	2.784
2000Q1	2.5501	2.3636	2.2957	2.844	2.6581	2.4793	N/A	N/A	N/A
2000Q2	1.9056	2.0758	1.8902	2.7473	3.0082	2.6388	2.5571	N/A	N/A
2000Q3	1.4453	1.9874	1.8834	2.3381	2.7298	3.0769	2.8054	2.4501	N/A
2000Q4	0.17937	1.5274	2.0665	1.875	2.2321	2.8029	3.4173	2.8777	2.3445
2001Q1	1.5413	1.4493	1.9766	2.5112	1.865	2.3091	N/A	N/A	N/A
2001Q2	1.4467	1.3562	1.7179	2.1505	2.4043	2.0336	2.4735	N/A	N/A
2001Q3	1.5343	1.3514	1.3514	1.9856	1.959	2.4801	2.1127	2.5483	N/A
2001Q4	1.5044	1.2579	1.0743	1.2534	1.8834	1.8584	2.4648	2.2787	2.5328
2002Q1	1.7969	1.7986	1.435	1.25	1.5179	2.0536	N/A	N/A	N/A
2002Q2	1.167	1.2478	1.1576	1.3381	1.5152	2.0517	2.2222	N/A	N/A
2002Q3	0.98655	1.6129	1.1535	1.1535	1.4222	1.6889	2.3111	2.3894	N/A
2002Q4	0.97778	1.6158	1.6129	1.5058	1.3274	1.7746	1.8601	2.4757	2.5528
2003Q1	1.0657	0.62389	1.5179	2.3194	1.677	1.7668	N/A	N/A	N/A
2003Q2	1.7396	1.7778	1.1597	2.0536	2.2183	1.9366	2.0246	N/A	N/A
2003Q3	1.5078	1.778	2.1277	1.5138	2.0426	2.0282	2.193	2.3684	N/A
2003Q4	1.4346	1.3297	1.7345	2.4757	1.8667	2.1201	1.8405	2.356	2.5328
2004Q1	1.4736	1.4432	1.397	1.4996	2.3726	1.9486	N/A	N/A	N/A
2004Q2	1.8791	1.9336	1.766	1.4962	1.2277	2.2707	2.0282	N/A	N/A
2004Q3	1.2614	1.8946	1.941	1.9119	1.5365	1.3123	2.0833	2.0175	N/A
2004Q4	1.3094	1.4374	2.1801	2.0354	1.9458	1.7	1.5136	1.9845	2.007

Forecast Error	R(t,t)	R(t-1,t)	R(t-2,t)	R(t-3,t)	R(t-4,t)	R(t-5,t)	R(t-6,t)	R(t-7,t)
1992Q1	0.355	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1992Q2	0.073	0.575	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1992Q3	0.239	0.232	0.950	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1992Q4	-0.713	0.163	0.089	0.430	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1993Q1	-0.065	-0.693	0.660	0.518	0.567	#VALUE!	#VALUE!	#VALUE!
1993Q2	-0.210	-0.059	-0.326	1.074	0.724	0.701	#VALUE!	#VALUE!
1993Q3	-0.718	-1.205	-1.053	-1.317	0.557	0.070	-0.026	#VALUE!
1993Q4	-0.535	-1.140	-1.756	-1.677	-1.651	0.115	-0.295	-0.459
1994Q1	-0.350	-0.952	-1.269	-2.083	-1.937	#VALUE!	#VALUE!	#VALUE!
1994Q2	0.000	-0.520	-1.209	-1.333	-2.064	-2.057	#VALUE!	#VALUE!
1994Q3	-0.597	-0.597	-1.284	-1.880	-1.920	-2.364	-2.491	#VALUE!
1994Q4	0.179	-0.582	-0.667	-1.344	-1.665	-1.823	-2.122	-2.312
1995Q1	-0.249	0.004	-1.001	-0.917	-1.665	#VALUE!	#VALUE!	#VALUE!
1995Q2	0.421	-0.079	0.255	-0.826	-0.658	-1.477	#VALUE!	#VALUE!
1995Q3	-0.167	0.334	-0.332	0.083	-0.977	-0.728	-1.615	#VALUE!
1995Q4	-0.322	-0.572	0.010	-0.646	-0.322	-1.283	-0.951	-1.822
1996Q1	-0.659	0.082	-1.238	-0.831	-1.477	#VALUE!	#VALUE!	#VALUE!
1996Q2	0.894	0.082	-0.416	-0.493	-0.260	-0.893	#VALUE!	#VALUE!
1996Q3	0.244	1.048	-0.089	-0.165	-0.160	0.070	-0.800	#VALUE!
1996Q4	-0.163	0.160	0.796	-0.329	-0.322	-0.153	0.073	-1.026
1997Q1	-0.074	-0.396	0.006	0.144	-0.724	#VALUE!	#VALUE!	#VALUE!
1997Q2	-0.154	-0.149	-1.112	-0.550	-0.580	-1.269	#VALUE!	#VALUE!
1997Q3	0.158	0.164	0.087	-0.938	-0.629	-0.741	-1.338	#VALUE!
1997Q4	-0.285	0.031	0.200	0.201	-1.051	-0.825	-0.859	-1.364
1998Q1	-0.155	-0.389	-0.238	-0.149	0.170	#VALUE!	#VALUE!	#VALUE!
1998Q2	0.157	-0.151	-0.705	-0.153	-0.144	0.095	#VALUE!	#VALUE!
1998Q3	-0.325	-0.092	-0.553	-0.788	-0.558	-0.784	-0.548	#VALUE!
1998Q4	-0.110	-0.793	-0.485	-1.334	-1.097	-0.950	-1.249	-1.016
1999Q1	0.092	-0.093	-0.657	-0.116	-0.802	#VALUE!	#VALUE!	#VALUE!
1999Q2	-0.186	0.186	-0.281	-0.712	-0.333	-0.854	#VALUE!	#VALUE!
1999Q3	-0.178	-0.178	-0.089	-0.367	-0.870	-0.571	-0.933	#VALUE!
1999Q4	1.199	0.741	0.741	0.640	0.642	0.072	0.443	0.162
2000Q1	0.187	0.254	-0.294	-0.108	0.071	#VALUE!	#VALUE!	#VALUE!
2000Q2	-0.170	0.015	-0.842	-1.103	-0.733	-0.652	#VALUE!	#VALUE!
2000Q3	-0.542	-0.438	-0.893	-1.285	-1.632	-1.360	-1.005	#VALUE!
2000Q4	-1.348	-1.887	-1.696	-2.053	-2.624	-3.238	-2.698	-2.165
2001Q1	0.092	-0.435	-0.970	-0.324	-0.768	#VALUE!	#VALUE!	#VALUE!
2001Q2	0.091	-0.271	-0.704	-0.958	-0.587	-1.027	#VALUE!	#VALUE!
2001Q3	0.183	0.183	-0.451	-0.425	-0.946	-0.578	-1.014	#VALUE!
2001Q4	0.247	0.430	0.251	-0.379	-0.354	-0.960	-0.774	-1.028
2002Q1	-0.002	0.362	0.547	0.279	-0.257	#VALUE!	#VALUE!	#VALUE!
2002Q2	-0.081	0.009	-0.171	-0.348	-0.885	-1.055	#VALUE!	#VALUE!
2002Q3	-0.626	-0.167	-0.167	-0.436	-0.702	-1.325	-1.403	#VALUE!
2002Q4	-0.638	-0.635	-0.528	-0.350	-0.797	-0.882	-1.498	-1.575
2003Q1	0.442	-0.452	-1.254	-0.611	-0.701	#VALUE!	#VALUE!	#VALUE!
2003Q2	-0.038	0.580	-0.314	-0.479	-0.197	-0.285	#VALUE!	#VALUE!
2003Q3	-0.270	-0.620	-0.006	-0.535	-0.520	-0.685	-0.861	#VALUE!
2003Q4	0.105	-0.300	-1.041	-0.432	-0.686	-0.406	-0.921	-1.098
2004Q1	0.030	0.077	-0.026	-0.899	-0.475	#VALUE!	#VALUE!	#VALUE!
2004Q2	-0.055	0.113	0.383	0.651	-0.392	-0.149	#VALUE!	#VALUE!
2004Q3	-0.633	-0.680	-0.651	-0.275	-0.051	-0.822	-0.756	#VALUE!
2004Q4	-0.128	-0.871	-0.726	-0.636	-0.391	-0.204	-0.675	-0.698

Table 2: UK interest rate forecast (taken as constant forecast from official bank rate)

	Official Bank Rate	R(t,t)	R(t-1,t)	R(t-2,t)	R(t-3,t)	R(t-4,t)	R(t-5,t)	R(t-6,t)	R(t-7,t)	R(t-8,t)
1993Q1	6.13	6.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1993Q2	5.88	6.00	6.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1993Q3	5.88	6.00	6.00	6.00	N/A	N/A	N/A	N/A	N/A	N/A
1993Q4	5.66	5.50	6.00	6.00	6.00	N/A	N/A	N/A	N/A	N/A
1994Q1	5.22	5.25	5.50	6.00	6.00	6.00	N/A	N/A	N/A	N/A
1994Q2	5.13	5.25	5.25	5.50	6.00	6.00	6.00	N/A	N/A	N/A
1994Q3	5.24	5.75	5.25	5.25	5.50	6.00	6.00	6.00	N/A	N/A
1994Q4	5.75	6.25	5.75	5.25	5.25	5.50	6.00	6.00	6.00	N/A
1995Q1	6.45	6.75	6.25	5.75	5.25	5.25	5.50	6.00	6.00	6.00
1995Q2	6.63	6.75	6.75	6.25	5.75	5.25	5.25	5.50	6.00	6.00
1995Q3	6.63	6.75	6.75	6.75	6.25	5.75	5.25	5.25	5.50	6.00
1995Q4	6.58	6.50	6.75	6.75	6.75	6.25	5.75	5.25	5.25	5.50
1996Q1	6.13	6.00	6.50	6.75	6.75	6.75	6.25	5.75	5.25	5.25
1996Q2	5.87	5.75	6.00	6.50	6.75	6.75	6.75	6.25	5.75	5.25
1996Q3	5.69	5.75	5.75	6.00	6.50	6.75	6.75	6.75	6.25	5.75
1996Q4	5.86	6.00	5.75	5.75	6.00	6.50	6.75	6.75	6.75	6.25
1997Q1	5.94	6.00	6.00	5.75	5.75	6.00	6.50	6.75	6.75	6.75
1997Q2	6.20	6.50	6.00	6.00	5.75	5.75	6.00	6.50	6.75	6.75
1997Q3	6.87	7.00	6.50	6.00	6.00	5.75	5.75	6.00	6.50	6.75
1997Q4	7.15	7.25	7.00	6.50	6.00	6.00	5.75	5.75	6.00	6.50
1998Q1	7.25	7.25	7.25	7.00	6.50	6.00	6.00	5.75	5.75	6.00
1998Q2	7.33	7.50	7.25	7.25	7.00	6.50	6.00	6.00	5.75	5.75
1998Q3	7.50	7.50	7.50	7.25	7.25	7.00	6.50	6.00	6.00	5.75
1998Q4	6.86	6.25	7.50	7.50	7.25	7.25	7.00	6.50	6.00	6.00
1999Q1	5.69	5.50	6.25	7.50	7.50	7.25	7.25	7.00	6.50	6.00
1999Q2	5.20	5.00	5.50	6.25	7.50	7.50	7.25	7.25	7.00	6.50
1999Q3	5.07	5.25	5.00	5.50	6.25	7.50	7.50	7.25	7.25	7.00
1999Q4	5.40	5.50	5.25	5.00	5.50	6.25	7.50	7.50	7.25	7.25
2000Q1	5.87	6.00	5.50	5.25	5.00	5.50	6.25	7.50	7.50	7.25
2000Q2	6.00	6.00	6.00	5.50	5.25	5.00	5.50	6.25	7.50	7.50
2000Q3	6.00	6.00	6.00	6.00	5.50	5.25	5.00	5.50	6.25	7.50
2000Q4	6.00	6.00	6.00	6.00	6.00	5.50	5.25	5.00	5.50	6.25
2001Q1	5.86	5.75	6.00	6.00	6.00	6.00	5.50	5.25	5.00	5.50
2001Q2	5.36	5.25	5.75	6.00	6.00	6.00	6.00	5.50	5.25	5.00
2001Q3	5.05	4.75	5.25	5.75	6.00	6.00	6.00	6.00	5.50	5.25
2001Q4	4.23	4.00	4.75	5.25	5.75	6.00	6.00	6.00	6.00	5.50
2002Q1	4.00	4.00	4.00	4.75	5.25	5.75	6.00	6.00	6.00	6.00
2002Q2	4.00	4.00	4.00	4.00	4.75	5.25	5.75	6.00	6.00	6.00
2002Q3	4.00	4.00	4.00	4.00	4.00	4.75	5.25	5.75	6.00	6.00
2002Q4	4.00	4.00	4.00	4.00	4.00	4.00	4.75	5.25	5.75	6.00
2003Q1	3.85	3.75	4.00	4.00	4.00	4.00	4.00	4.75	5.25	5.75
2003Q2	3.75	3.75	3.75	4.00	4.00	4.00	4.00	4.00	4.75	5.25
2003Q3	3.53	3.50	3.75	3.75	4.00	4.00	4.00	4.00	4.00	4.75
2003Q4	3.65	3.75	3.50	3.75	3.75	4.00	4.00	4.00	4.00	4.00
2004Q1	3.91	4.00	3.75	3.50	3.75	3.75	4.00	4.00	4.00	4.00

Forecast Error	R(t,t)	R(t-1,t)	R(t-2,t)	R(t-3,t)	R(t-4,t)	R(t-5,t)	R(t-6,t)	R(t-7,t)	R(t-8,t)
1993Q1	0.13	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1993Q2	-0.12	-0.12	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1993Q3	-0.12	-0.12	-0.12	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1993Q4	0.16	-0.34	-0.34	-0.34	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1994Q1	-0.03	-0.28	-0.78	-0.78	-0.78	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1994Q2	-0.12	-0.12	-0.37	-0.87	-0.87	-0.87	#VALUE!	#VALUE!	#VALUE!
1994Q3	-0.51	-0.01	-0.01	-0.26	-0.76	-0.76	-0.76	#VALUE!	#VALUE!
1994Q4	-0.50	0.00	0.50	0.50	0.25	-0.25	-0.25	-0.25	#VALUE!
1995Q1	-0.30	0.20	0.70	1.20	1.20	0.95	0.45	0.45	0.45
1995Q2	-0.12	-0.12	0.38	0.88	1.38	1.38	1.13	0.63	0.63
1995Q3	-0.12	-0.12	-0.12	0.38	0.88	1.38	1.38	1.13	0.63
1995Q4	0.08	-0.17	-0.17	-0.17	0.33	0.83	1.33	1.33	1.08
1996Q1	0.13	-0.37	-0.62	-0.62	-0.62	-0.12	0.38	0.88	0.88
1996Q2	0.12	-0.13	-0.63	-0.88	-0.88	-0.88	-0.38	0.12	0.62
1996Q3	-0.06	-0.06	-0.31	-0.81	-1.06	-1.06	-1.06	-0.56	-0.06
1996Q4	-0.14	0.11	0.11	-0.14	-0.64	-0.89	-0.89	-0.89	-0.39
1997Q1	-0.06	-0.06	0.19	0.19	-0.06	-0.56	-0.81	-0.81	-0.81
1997Q2	-0.30	0.20	0.20	0.45	0.45	0.20	-0.30	-0.55	-0.55
1997Q3	-0.13	0.37	0.87	0.87	1.12	1.12	0.87	0.37	0.12
1997Q4	-0.10	0.15	0.65	1.15	1.15	1.40	1.40	1.15	0.65
1998Q1	0.00	0.00	0.25	0.75	1.25	1.25	1.50	1.50	1.25
1998Q2	-0.17	0.08	0.08	0.33	0.83	1.33	1.33	1.58	1.58
1998Q3	0.00	0.00	0.25	0.25	0.50	1.00	1.50	1.50	1.75
1998Q4	0.61	-0.64	-0.64	-0.39	-0.39	-0.14	0.36	0.86	0.86
1999Q1	0.19	-0.56	-1.81	-1.81	-1.56	-1.56	-1.31	-0.81	-0.31
1999Q2	0.20	-0.30	-1.05	-2.30	-2.30	-2.05	-2.05	-1.80	-1.30
1999Q3	-0.18	0.07	-0.43	-1.18	-2.43	-2.43	-2.18	-2.18	-1.93
1999Q4	-0.10	0.15	0.40	-0.10	-0.85	-2.10	-2.10	-1.85	-1.85
2000Q1	-0.13	0.37	0.62	0.87	0.37	-0.38	-1.63	-1.63	-1.38
2000Q2	0.00	0.00	0.50	0.75	1.00	0.50	-0.25	-1.50	-1.50
2000Q3	0.00	0.00	0.00	0.50	0.75	1.00	0.50	-0.25	-1.50
2000Q4	0.00	0.00	0.00	0.00	0.50	0.75	1.00	0.50	-0.25
2001Q1	0.11	-0.14	-0.14	-0.14	-0.14	0.36	0.61	0.86	0.36
2001Q2	0.11	-0.39	-0.64	-0.64	-0.64	-0.64	-0.14	0.11	0.36
2001Q3	0.30	-0.20	-0.70	-0.95	-0.95	-0.95	-0.95	-0.45	-0.20
2001Q4	0.23	-0.52	-1.02	-1.52	-1.77	-1.77	-1.77	-1.77	-1.27
2002Q1	0.00	0.00	-0.75	-1.25	-1.75	-2.00	-2.00	-2.00	-2.00
2002Q2	0.00	0.00	0.00	-0.75	-1.25	-1.75	-2.00	-2.00	-2.00
2002Q3	0.00	0.00	0.00	0.00	-0.75	-1.25	-1.75	-2.00	-2.00
2002Q4	0.00	0.00	0.00	0.00	0.00	-0.75	-1.25	-1.75	-2.00
2003Q1	0.10	-0.15	-0.15	-0.15	-0.15	-0.15	-0.90	-1.40	-1.90
2003Q2	0.00	0.00	-0.25	-0.25	-0.25	-0.25	-0.25	-1.00	-1.50
2003Q3	0.03	-0.22	-0.22	-0.47	-0.47	-0.47	-0.47	-0.47	-1.22
2003Q4	-0.10	0.15	-0.10	-0.10	-0.35	-0.35	-0.35	-0.35	-0.35
2004Q1	-0.09	0.16	0.41	0.16	0.16	-0.09	-0.09	-0.09	-0.09

Table 3: UK inflation forecast, measured in terms of RPIX

	RPIX	I(t,t)	I(t-1,t)	I(t-2,t)	I(t-3,t)	I(t-4,t)	I(t-5,t)	I(t-6,t)	I(t-7,t)	I(t-8,t)
1993Q1	**3.4**	3.50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1993Q2	**2.8**	3.40	3.40	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1993Q3	**3.1**	2.90	3.40	3.00	N/A	N/A	N/A	N/A	N/A	N/A
1993Q4	**2.7**	3.30	3.00	3.20	3.10	N/A	N/A	N/A	N/A	N/A
1994Q1	**2.7**	2.80	3.60	3.20	3.20	3.40	N/A	N/A	N/A	N/A
1994Q2	**2.4**	2.70	3.00	3.50	3.30	3.50	3.40	N/A	N/A	N/A
1994Q3	**2.2**	2.30	2.90	3.10	3.50	3.30	3.60	3.40	N/A	N/A
1994Q4	**2.3**	2.10	2.60	3.00	3.20	3.40	3.30	3.70	3.30	N/A
1995Q1	**2.7**	2.90	1.90	2.70	3.10	3.40	3.40	3.50	N/A	N/A
1995Q2	**2.7**	2.70	2.80	2.00	3.00	3.40	3.30	3.40	3.60	N/A
1995Q3	**2.9**	2.90	3.00	3.10	2.30	3.20	3.40	3.20	N/A	N/A
1995Q4	**2.9**	3.20	3.00	3.10	3.20	2.40	3.20	3.30	3.20	N/A
1996Q1	**2.9**	2.80	3.30	3.20	3.40	2.70	2.80	3.40	3.30	N/A
1996Q2	**2.8**	2.70	2.60	3.50	3.50	3.80	2.70	2.40	3.10	N/A
1996Q3	**2.9**	2.70	2.60	2.30	3.20	3.40	3.70	2.60	2.40	N/A
1996Q4	**3.2**	3.10	2.40	2.40	2.10	3.00	3.20	3.40	2.50	N/A
1997Q1	**2.9**	2.80	2.90	2.40	2.30	2.10	2.70	2.90	3.00	N/A
1997Q2	**2.6**	2.60	2.40	2.90	2.40	2.30	2.20	2.70	2.80	N/A
1997Q3	**2.8**	2.65	2.50	2.30	2.70	2.60	2.50	2.30	2.70	2.80
1997Q4	**2.8**	2.60	2.32	2.40	2.30	2.40	2.70	2.60	2.50	2.70
1998Q1	**2.6**	2.60	2.51	2.19	2.40	2.40	2.60	2.80	2.70	2.60
1998Q2	**2.9**	2.83	2.63	2.42	2.06	2.40	2.70	2.70	2.90	2.80
1998Q3	**2.5**	2.51	2.35	2.42	2.27	1.99	2.50	2.80	2.90	3.00
1998Q4	**2.5**	2.54	2.56	2.35	2.41	2.19	2.08	2.60	2.90	3.10
1999Q1	**2.5**	2.49	2.57	2.69	2.41	2.44	2.18	2.24	2.80	3.00
1999Q2	**2.3**	2.48	2.53	2.71	2.82	2.37	2.39	2.25	2.36	2.90
1999Q3	**2.2**	2.31	2.40	2.55	2.74	2.86	2.30	2.47	2.37	2.50
1999Q4	**2.2**	2.20	2.28	2.36	2.61	2.59	2.77	2.26	2.55	2.42
2000Q1	**2.1**	1.93	2.12	2.09	2.20	2.52	2.56	2.69	2.27	2.64
2000Q2	**2.1**	1.88	1.98	2.06	1.99	2.23	2.49	2.51	2.56	2.35
2000Q3	**2.1**	2.38	1.93	1.95	2.02	1.88	2.25	2.47	2.48	2.47
2000Q4	**2.1**	2.36	2.28	2.10	2.05	1.84	1.92	2.23	2.47	2.45
2001Q1	**1.9**	1.94	2.33	2.26	2.20	2.32	1.72	2.08	2.35	2.56
2001Q2	**2.3**	1.90	1.92	2.22	2.39	2.47	2.48	1.81	2.28	2.43
2001Q3	**2.4**	2.31	1.90	1.87	2.19	2.48	2.53	2.53	2.19	2.59
2001Q4	**2**	2.00	2.17	1.91	1.87	2.19	2.62	2.53	2.56	2.53
2002Q1	**2.4**	2.14	2.03	2.17	1.91	2.09	2.18	2.68	2.53	2.58
2002Q2	**1.9**	2.02	1.87	1.85	1.91	1.94	2.18	2.37	2.70	2.56
2002Q3	**2**	1.84	2.08	1.96	2.06	1.96	2.03	2.27	2.46	2.72
2002Q4	**2.6**	2.64	2.25	2.24	2.11	2.06	2.13	2.16	2.42	2.56
2003Q1	**2.9**	2.77	2.73	2.25	2.18	2.13	2.08	2.32	2.39	2.55
2003Q2	**2.9**	3.09	2.90	2.72	2.25	2.05	2.13	2.15	2.41	2.53
2003Q3	**2.8**	2.85	2.90	2.98	2.72	2.31	2.09	2.18	2.23	2.45
2003Q4	**2.6**	2.72	2.58	2.63	2.78	2.41	2.29	2.26	2.28	2.36
2004Q1	**2.3**	2.32	2.55	2.30	2.40	2.70	2.38	2.31	2.39	2.34

Forecast Error	I(t,t)	I(t-1,t)	I(t-2,t)	I(t-3,t)	I(t-4,t)	I(t-5,t)	I(t-6,t)	I(t-7,t)	I(t-8,t)
1993Q1	-0.10	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1993Q2	-0.60	-0.60	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1993Q3	0.20	-0.30	0.10	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1993Q4	-0.60	-0.30	-0.50	-0.40	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1994Q1	-0.10	-0.90	-0.50	-0.50	-0.70	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1994Q2	-0.30	-0.60	-1.10	-0.90	-1.10	-1.00	#VALUE!	#VALUE!	#VALUE!
1994Q3	-0.10	-0.70	-0.90	-1.30	-1.10	-1.40	-1.20	#VALUE!	#VALUE!
1994Q4	0.20	-0.30	-0.70	-0.90	-1.10	-1.00	-1.40	-1.00	#VALUE!
1995Q1	-0.20	0.80	0.00	-0.40	-0.70	-0.70	-0.80	#VALUE!	#VALUE!
1995Q2	0.00	-0.10	0.70	-0.30	-0.70	-0.60	-0.70	-0.90	#VALUE!
1995Q3	0.00	-0.10	-0.20	0.60	-0.30	-0.50	-0.30	#VALUE!	#VALUE!
1995Q4	-0.30	-0.10	-0.20	-0.30	0.50	-0.30	-0.40	-0.30	#VALUE!
1996Q1	0.10	-0.40	-0.30	-0.50	0.20	0.10	-0.50	-0.40	#VALUE!
1996Q2	0.10	0.20	-0.70	-0.70	-1.00	0.10	0.40	-0.30	#VALUE!
1996Q3	0.20	0.30	0.60	-0.30	-0.50	-0.80	0.30	0.50	#VALUE!
1996Q4	0.10	0.80	0.80	1.10	0.20	0.00	-0.20	0.70	#VALUE!
1997Q1	0.10	0.00	0.50	0.60	0.80	0.20	0.00	-0.10	#VALUE!
1997Q2	0.00	0.20	-0.30	0.20	0.30	0.40	-0.10	-0.20	#VALUE!
1997Q3	0.15	0.30	0.50	0.10	0.20	0.30	0.50	0.10	0.00
1997Q4	0.20	0.48	0.40	0.50	0.40	0.10	0.20	0.30	0.10
1998Q1	0.00	0.09	0.41	0.20	0.20	0.00	-0.20	-0.10	0.00
1998Q2	0.07	0.27	0.48	0.84	0.50	0.20	0.20	0.00	0.10
1998Q3	-0.01	0.15	0.08	0.23	0.51	0.00	-0.30	-0.40	-0.50
1998Q4	-0.04	-0.06	0.15	0.09	0.31	0.42	-0.10	-0.40	-0.60
1999Q1	0.01	-0.07	-0.19	0.09	0.06	0.32	0.26	-0.30	-0.50
1999Q2	-0.18	-0.23	-0.41	-0.52	-0.07	-0.09	0.05	-0.06	-0.60
1999Q3	-0.11	-0.20	-0.35	-0.54	-0.66	-0.10	-0.27	-0.17	-0.30
1999Q4	0.00	-0.08	-0.16	-0.41	-0.39	-0.57	-0.06	-0.35	-0.22
2000Q1	0.17	-0.02	0.01	-0.10	-0.42	-0.46	-0.59	-0.17	-0.54
2000Q2	0.22	0.12	0.04	0.11	-0.13	-0.39	-0.41	-0.46	-0.25
2000Q3	-0.28	0.17	0.15	0.08	0.22	-0.15	-0.37	-0.38	-0.37
2000Q4	-0.26	-0.18	0.00	0.05	0.26	0.18	-0.13	-0.37	-0.35
2001Q1	-0.04	-0.43	-0.36	-0.30	-0.42	0.18	-0.18	-0.45	-0.66
2001Q2	0.40	0.38	0.08	-0.09	-0.17	-0.18	0.49	0.02	-0.13
2001Q3	0.09	0.50	0.53	0.21	-0.08	-0.13	-0.13	0.21	-0.19
2001Q4	0.00	-0.17	0.09	0.13	-0.19	-0.62	-0.53	-0.56	-0.53
2002Q1	0.26	0.37	0.23	0.49	0.31	0.22	-0.28	-0.13	-0.18
2002Q2	-0.12	0.03	0.05	-0.01	-0.04	-0.28	-0.47	-0.80	-0.66
2002Q3	0.16	-0.08	0.04	-0.06	0.04	-0.03	-0.27	-0.46	-0.72
2002Q4	-0.04	0.35	0.36	0.49	0.54	0.47	0.44	0.18	0.04
2003Q1	0.13	0.17	0.65	0.72	0.77	0.82	0.58	0.51	0.35
2003Q2	-0.19	0.00	0.18	0.65	0.85	0.77	0.75	0.49	0.37
2003Q3	-0.05	-0.10	-0.18	0.08	0.49	0.71	0.62	0.57	0.35
2003Q4	-0.12	0.02	-0.03	-0.18	0.19	0.31	0.34	0.32	0.24
2004Q1	-0.02	-0.25	0.00	-0.10	-0.40	-0.08	-0.01	-0.09	-0.04

Table 4: NZ inflation forecast

	NZ CPI	r(t,t)	r(t-1,t)	r(t-2,t)	r(t-3,t)	r(t-4,t)	r(t-5,t)	r(t-6,t)	r(t-7,t)	r(t-8,t)
00Q1	1.477676	1.7141	2.4854	2.0948	1.7582	1.1822	-0.8155	0.0915	0.8099	0.1788
00Q2	1.986044	2.1262	2.0698	2.9753	2.2734	1.8014	1.3606	-0.0900	0.6371	0.9883
00Q3	2.958595	2.5660	2.2882	2.0794	2.6521	1.8400	1.5252	1.2645	0.5472	1.0906
00Q4	3.919932	3.7594	2.8568	2.4139	2.2133	2.1684	1.5146	1.4694	1.2600	1.0018
01Q1	3.032903	3.1241	3.7636	2.6445	2.0240	1.8314	1.9732	1.3922	1.4570	1.4363
01Q2	3.203955	3.2419	3.0331	3.6606	2.3186	1.9715	1.7234	1.7227	1.3969	1.4197
01Q3	2.401206	2.4314	2.4693	2.2198	2.8568	1.6776	1.8220	1.6831	1.6280	1.4270
01Q4	1.807237	1.8107	1.8709	1.7194	1.2038	2.2560	1.4703	1.8146	1.6606	1.5528
02Q1	2.561823	2.9384	2.5619	2.4740	2.2363	1.4365	1.9250	1.3555	1.7493	1.6575
02Q2	2.726831	2.8198	2.8164	2.3110	1.9379	1.7054	1.0832	1.7063	1.4234	1.7467
02Q3	2.619137	2.7070	2.9000	2.8800	2.1780	1.6849	1.5083	0.8458	1.5191	1.5269
02Q4	2.696539	2.6026	2.6905	2.7222	2.6931	1.9445	1.4674	1.5077	1.0545	1.5166
03Q1	2.498789	2.4986	2.3092	2.4447	2.5935	2.1414	1.7127	1.4154	1.5472	1.2881
03Q2	1.471712	1.8360	2.0185	1.7495	1.8695	1.9786	1.8464	1.4216	1.4484	1.5414
03Q3	1.464979	1.8293	1.8276	1.8655	1.8074	1.7724	1.8732	1.7092	1.3258	1.4683
03Q4	1.546299	1.1840	1.8176	1.5783	1.7044	1.8177	1.6885	2.0321	1.8194	1.3391
04Q1	1.540704	1.8107	1.2704	1.8348	1.6574	1.9419	2.0831	1.8248	2.1210	1.8812
04Q2	2.347878	2.4407	2.4407	1.8704	2.3551	1.7897	2.0267	2.1637	1.8138	2.1123
04Q3	2.515281	2.4225	2.6953	2.5476	1.8814	2.1573	1.8777	2.3423	2.1963	1.7874
04Q4	2.67416	2.4973	2.4972	2.8403	2.3834	2.1453	2.2085	2.0637	2.4610	2.1991
05Q1	2.752336	2.9241	2.8397	2.8849	3.3014	2.4700	2.3729	2.5342	2.2222	2.4288
05Q2	2.817762	2.8178	2.8969	2.8147	2.9418	3.2924	2.5493	2.4609	2.7189	2.3306
05Q3	3.319554	3.4061	2.8870	2.9072	2.8832	3.1742	3.2743	2.6599	2.6682	2.7794
05Q4	3.119725	3.3764	3.5475	2.7392	2.7981	2.9335	3.0968	3.0416	2.7335	2.6908
06Q1	3.276246	3.2762	3.3619	3.8220	3.0060	2.9748	2.9781	3.0581	2.8198	2.6145
06Q2	3.923916	3.8395	3.1638	3.3144	3.8700	2.8741	2.9773	2.9294	2.8898	2.5073
06Q3	3.499348	3.7977	3.6308	2.6297	2.8415	3.3424	2.8950	3.0752	2.9330	2.7951
06Q4	2.616393	2.7157	3.7723	3.8618	2.7085	2.7091	3.0109	2.8858	3.0069	2.8000

Forecast Error	r(t,t)	r(t-1,t)	r(t-2,t)	r(t-3,t)	r(t-4,t)	r(t-5,t)	r(t-6,t)	r(t-7,t)	r(t-8,t)
00Q1	-0.236	-1.008	-0.617	-0.281	0.295	2.293	1.386	0.668	1.299
00Q2	-0.140	-0.084	-0.989	-0.287	0.185	0.625	2.076	1.349	0.998
00Q3	0.393	0.670	0.879	0.306	1.119	1.433	1.694	2.411	1.868
00Q4	0.161	1.063	1.506	1.707	1.752	2.405	2.451	2.660	2.918
01Q1	-0.091	-0.731	0.388	1.009	1.202	1.060	1.641	1.576	1.597
01Q2	-0.038	0.171	-0.457	0.885	1.232	1.481	1.481	1.807	1.784
01Q3	-0.030	-0.068	0.181	-0.456	0.724	0.579	0.718	0.773	0.974
01Q4	-0.003	-0.064	0.088	0.603	-0.449	0.337	-0.007	0.147	0.254
02Q1	-0.377	0.000	0.088	0.326	1.125	0.637	1.206	0.813	0.904
02Q2	-0.093	-0.090	0.416	0.789	1.021	1.644	1.021	1.303	0.980
02Q3	-0.088	-0.281	-0.261	0.441	0.934	1.111	1.773	1.100	1.092
02Q4	0.094	0.006	-0.026	0.003	0.752	1.229	1.189	1.642	1.180
03Q1	0.000	0.190	0.054	-0.095	0.357	0.786	1.083	0.952	1.211
03Q2	-0.364	-0.547	-0.278	-0.398	-0.507	-0.375	0.050	0.023	-0.070
03Q3	-0.364	-0.363	-0.401	-0.342	-0.307	-0.408	-0.244	0.139	-0.003
03Q4	0.362	-0.271	-0.032	-0.158	-0.271	-0.142	-0.486	-0.273	0.207
04Q1	-0.270	0.270	-0.294	-0.117	-0.401	-0.542	-0.284	-0.580	-0.340
04Q2	-0.093	-0.093	0.477	-0.007	0.558	0.321	0.184	0.534	0.236
04Q3	0.093	-0.180	-0.032	0.634	0.358	0.638	0.173	0.319	0.728
04Q4	0.177	0.177	-0.166	0.291	0.529	0.466	0.610	0.213	0.475
05Q1	-0.172	-0.087	-0.133	-0.549	0.282	0.379	0.218	0.530	0.324
05Q2	0.000	-0.079	0.003	-0.124	-0.475	0.268	0.357	0.099	0.487
05Q3	-0.087	0.433	0.412	0.436	0.145	0.045	0.660	0.651	0.540
05Q4	-0.257	-0.428	0.381	0.322	0.186	0.023	0.078	0.386	0.429
06Q1	0.000	-0.086	-0.546	0.270	0.301	0.298	0.218	0.456	0.662
06Q2	0.084	0.760	0.610	0.054	1.050	0.947	0.995	1.034	1.417
06Q3	-0.298	-0.131	0.870	0.658	0.157	0.604	0.424	0.566	0.704
06Q4	-0.099	-1.156	-1.245	-0.092	-0.093	-0.394	-0.269	-0.391	-0.184

Appendix 2

We apply exactly the same four equations used earlier to assess the predictive abilities of interest rate forecasts. To recap, these are:-

(1) $\Pi(t + h) = C_1 + C_2$ Forecast (t, t + h)

(2) $\Pi(t + h) - \Pi(t) = C_1 + C_2$ (Forecast (t, t + h) – Π_t)

(3) $\Pi(t + h) - \Pi(t + h - 1) = C_1 + C_2$ (Forecast, t, t + h – Forecast, t, t + h – 1)

(4) $\Pi(t + h) - \Pi(t + h - 1) = C$ (Forecast, t, t + h – Forecast, t, t + h – 1)

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Equation (1)

h =	C1 (P value)	C2 (P value)	R sq.	DW
0	-0.1391 0.1783	1.0231 0.0000	0.9310	2.0267
1	-0.0862 0.6248	0.9924 0.0000	0.8120	1.6955
2	0.0944 0.6433	0.9463 0.0000	0.7384	1.4151
3	0.2126 0.3375	0.9595 0.0000	0.6893	1.1257
4	0.5161 0.0627	0.8857 0.0000	0.5154	0.8608
5	0.7117 0.0157	0.8286 0.0000	0.4362	0.7280
6	0.7607 0.0160	0.8285 0.0000	0.3933	0.5368
7	0.8159 0.0273	0.7988 0.0003	0.3056	0.5343
8	0.8368 0.0487	0.7989 0.0017	0.2484	0.5281

Mincer-Zarnowitz test

Null hypothesis: $C_1 = 0$ and $C_2 = 1$

H	0	1	2	3	4	5	6	7	8
F-statistics	0.1045	0.3521	0.8132	0.3496	0.0326	0.0059	0.0039	0.0075	0.0096
Chi - square	0.0924	0.3429	0.8123	0.3399	0.0237	0.0028	0.0016	0.0036	0.0049

Equation (2)

h =	C1 (P value)	C2 (P value)	R sq.	DW
1	-0.0696 0.2780	0.6567 0.0000	0.4941	1.7563
2	-0.0103 0.9005	0.8232 0.0000	0.6571	1.4428
3	0.1286 0.1796	0.9126 0.0000	0.7147	1.1201
4	0.3184 0.0149	1.0095 0.0000	0.6659	0.9486
5	0.4567 0.0026	1.0698 0.0000	0.6589	0.8457
6	0.5065 0.0018	1.0439 0.0000	0.6370	0.5965
7	0.5010 0.0039	1.0159 0.0000	0.5966	0.5903
8	0.5218 0.0041	1.0249 0.0000	0.5865	0.6008

Mincer-Zarnowitz test

Null hypothesis: $C_1 = 0$ and $C_2 = 1$

H	1	2	3	4	5	6	7	8
F-statistics	0.0025	0.1725	0.2402	0.0458	0.0094	0.0061	0.0122	0.0136
Chi - square	0.0010	0.1596	0.2280	0.0354	0.0051	0.0028	0.0068	0.0077

Equation (3)

h =	C1 (P value)	C2 (P value)	R sq.	DW
1	-0.0137 0.8208	0.9277 0.0000	0.5309	1.9732
2	0.0537 0.4221	0.8646 0.0000	0.4478	1.8140
3	0.1050 0.1557	0.8361 0.0000	0.3947	1.6199
4	0.1729 0.0595	0.9784 0.0004	0.2817	1.5413
5	0.0651 0.5227	0.5960 0.1406	0.0562	1.4585
6	0.0254 0.7901	0.2647 0.5409	0.0102	1.4985
7	0.0237 0.8131	0.2867 0.5812	0.0085	1.5198
8	0.0292 0.7756	0.2907 0.6016	0.0079	1.4960

Equation (4)

h =	C1 (P value)	R sq.	DW
1	0.9272 0.0000	0.5303	1.9705
2	0.8506 0.0000	0.4390	1.7795
3	0.7786 0.0000	0.3630	1.5161
4	0.7461 0.0021	0.2122	1.4245
5	0.4902 0.1785	0.0459	1.4263
6	0.2570 0.5468	0.0083	1.4938
7	0.3216 0.5135	0.0070	1.5240
8	0.3322 0.5315	0.0055	1.4965

UK, Full period, 1970 Q1 – 2006 Q4 (148 observations)

Equation (1)

h =	C1 (P value)	C2 (P value)	R sq.	DW
0	0.1444 0.1800	0.9468 0.0000	0.9714	1.9374
1	0.1022 0.5373	0.9566 0.0000	0.9348	1.5251
2	-0.0344 0.8706	0.9718 0.0000	0.9001	0.9948
3	-0.2441 0.3598	1.0233 0.0000	0.8548	0.7655
4	-0.3719 0.3170	1.0709 0.0000	0.7508	0.6540
5	-0.3672 0.4987	1.0688 0.0000	0.6306	0.4664
6	-0.4295 0.4969	1.0163 0.0000	0.6259	0.4724
7	-0.5799 0.4217	0.9981 0.0000	0.6796	0.4895

Mincer-Zarnowitz test

Null hypothesis: $C_1 = 0$ and $C_2 = 1$

H	0	1	2	3	4	5	6	7
F-statistics	0.0000	0.0349	0.1571	0.6508	0.3799	0.6529	0.5630	0.2081
Chi - square	0.0000	0.0322	0.1534	0.6500	0.3774	0.6519	0.5606	0.1957

Equation (2)

h =	C1 (P value)	C2 (P value)	R sq.	DW
1	-0.1098 0.2629	0.6228 0.0000	0.3178	1.6409
2	-0.1801 0.1604	0.8278 0.0000	0.4805	0.9595
3	-0.0962 0.5364	0.8812 0.0000	0.5285	0.7048
4	0.0234 0.9084	0.7873 0.0000	0.4067	0.5236
5	-0.0320 0.9076	0.7631 0.0000	0.3413	0.3876
6	-0.4646 0.1316	0.7543 0.0000	0.4335	0.4276
7	-0.8177 0.0089	0.7292 0.0000	0.6658	0.7168

Mincer-Zarnowitz test

Null hypothesis: $C_1 = 0$ and $C_2 = 1$

H	1	2	3	4	5	6	7
F-statistics	0.0000	0.0158	0.1900	0.0296	0.0581	0.0295	0.0014
Chi - square	0.0000	0.0140	0.1864	0.0271	0.0542	0.0249	0.0004

Equation (3)

h =	C1 (P value)	C2 (P value)	R sq.	DW
1	0.0126 0.8957	0.8252 0.0000	0.3296	2.1921
2	-0.0390 0.6950	0.8202 0.0000	0.2947	2.0793
3	0.0495 0.6592	0.5421 0.0000	0.1310	1.9386
4	0.0462 0.6958	0.3937 0.0000	0.0645	1.8729
5	-0.1459 0.2873	0.2147 0.3507	0.0075	1.6207
6	-0.3097 0.0252	0.7101 0.0307	0.0600	2.1630
7	-0.4859 0.0165	0.3647 0.3127	0.0249	1.9474

Equation (4)

h =	C1 (P value)	R sq.	DW
1	0.8248 0.0000	0.3295	2.1918
2	0.8191 0.0000	0.2939	2.0770
3	0.5353 0.0000	0.1298	1.9353
4	0.3845 0.0021	0.0635	1.8694
5	0.2489 0.2751	-0.0023	1.6110
6	0.8267 0.0135	-0.0045	2.0228
7	0.7160 0.0458	-0.1239	1.6468

UK, Short period, 1992 Q4 – 2004 Q3 (48 observations)

Equation (1)

h =	C1 (P value)	C2 (P value)	R sq.	DW
1	0.4218 0.0348	0.7224 0.0000	0.6478	1.2704
2	0.4671 0.0383	0.4671 0.0000	0.5680	1.1885
3	0.5502 0.0112	0.5548 0.0000	0.5580	1.3074
4	0.5573 0.0210	0.5169 0.0000	0.4900	1.1480
5	0.5482 0.1080	0.4851 0.0001	0.3792	0.8582
6	0.2578 0.5884	0.5415 0.0021	0.3849	1.0940
7	-0.2306 0.7366	0.6643 0.0103	0.5367	

Mincer-Zarnowitz test

Null hypothesis: $C_1 = 0$ and $C_2 = 1$

H	1	2	3	4	5	6	7
F-statistics	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003
Chi - square	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Equation (2)

h =	C1 (P value)	C2 (P value)	R sq.	DW
1	-0.1131 0.0862	0.3723 0.0034	0.1716	2.0092
2	-0.2818 0.0035	0.4803 0.0009	0.2192	1.2290
3	-0.4209 0.0005	0.5700 0.0007	0.2343	1.0293
4	-0.5604 0.0002	0.6299 0.0013	0.2161	0.9151
5	-0.4121 0.0229	0.2147 0.3211	0.0318	0.9234
6	-0.5459 0.0302	0.1980 0.4929	0.0238	0.9077
7	-1.0318 0.0270	0.7196 0.0966	0.2765	

Mincer-Zarnowitz test

Null hypothesis: $C_1 = 0$ and $C_2 = 1$

H	1	2	3	4	5	6	7
F-statistics	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008
Chi - square	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

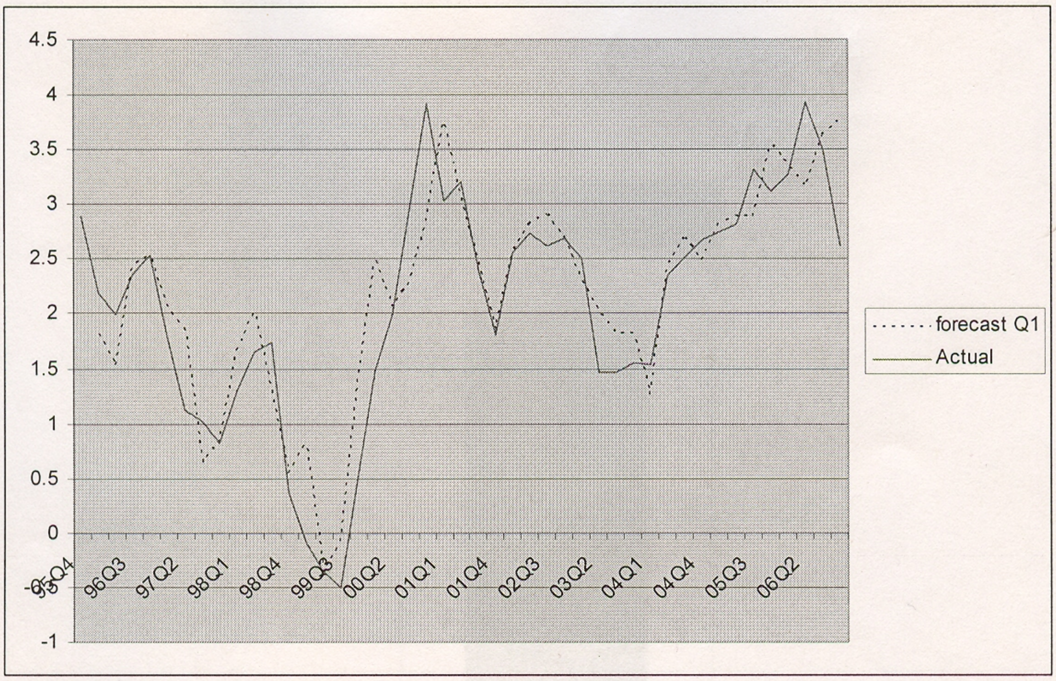
Equation (3)

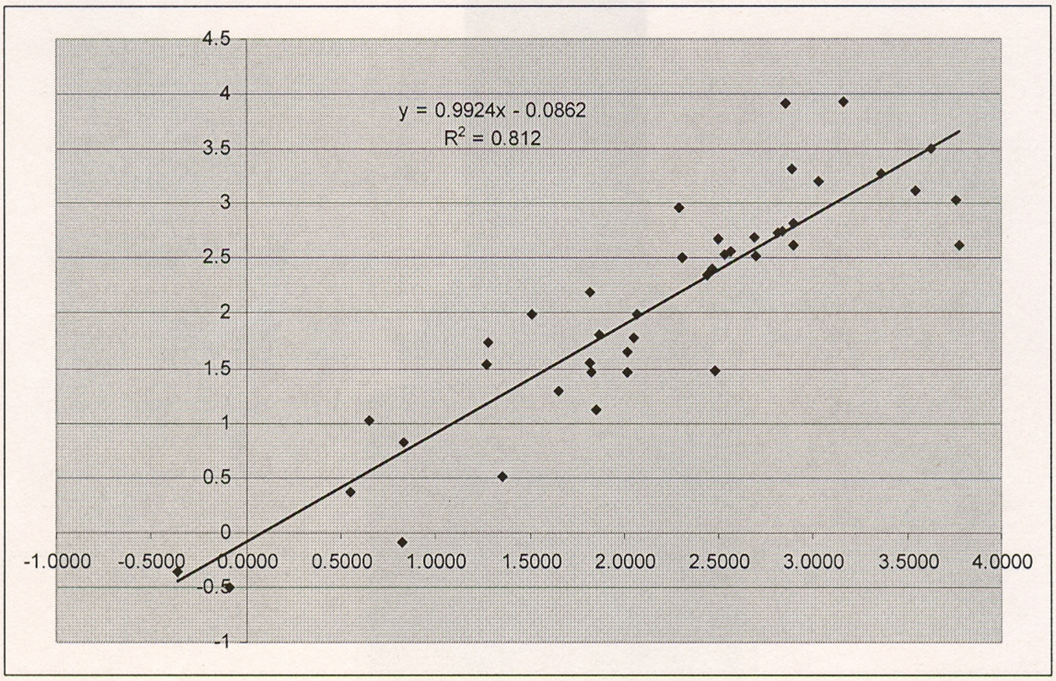
h =	C1 (P value)	C2 (P value)	R sq.	DW
1	-0.0823 0.1796	0.6925 0.0010	0.2120	2.3528
2	-0.1662 0.0526	0.5282 0.0353	0.0947	2.3269
3	-0.0377 0.6305	-0.2351 0.5331	0.0089	2.3709
4	-0.0433 0.6138	-0.0425 0.9285	0.0002	2.4105
5	-0.0653 0.5173	-0.0587 0.9230	0.0003	1.4393
6	-0.1186 0.2969	-0.1259 0.8818	0.0011	1.4319
7	-0.0807 0.6820	0.4471 0.8132	0.0065	

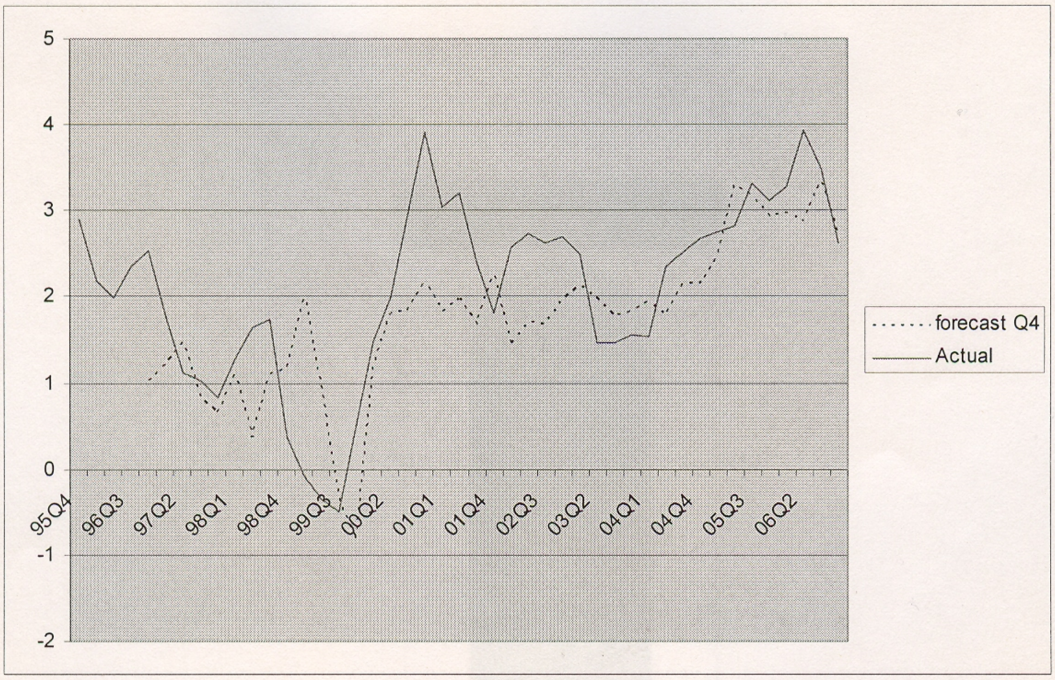
Equation (4)

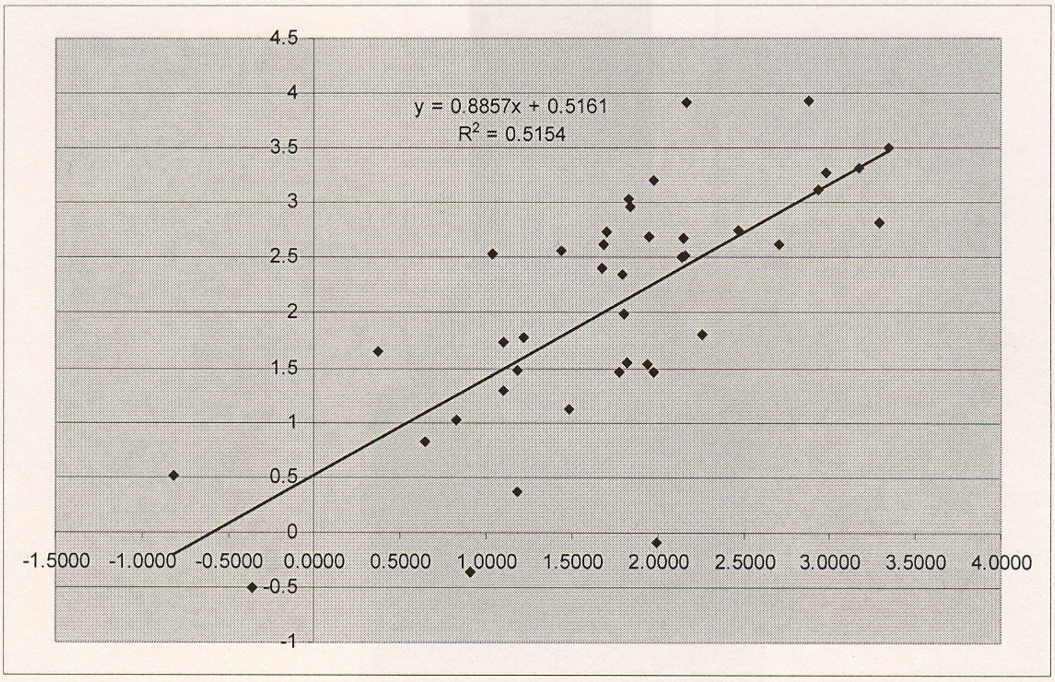
h =	C1 (P value)	R sq.	DW
1	0.6517 0.0017	0.1802	2.2717
2	0.2261 0.2556	0.0150	2.2619
3	-0.3172 0.3429	0.0036	2.3681
4	-0.1778 0.6469	-0.0058	2.3914
5	-0.3076 0.5109	-0.0135	1.5044
6	-0.6360 0.3665	-0.0562	1.3005
7	0.0871 0.9566	-0.0132	

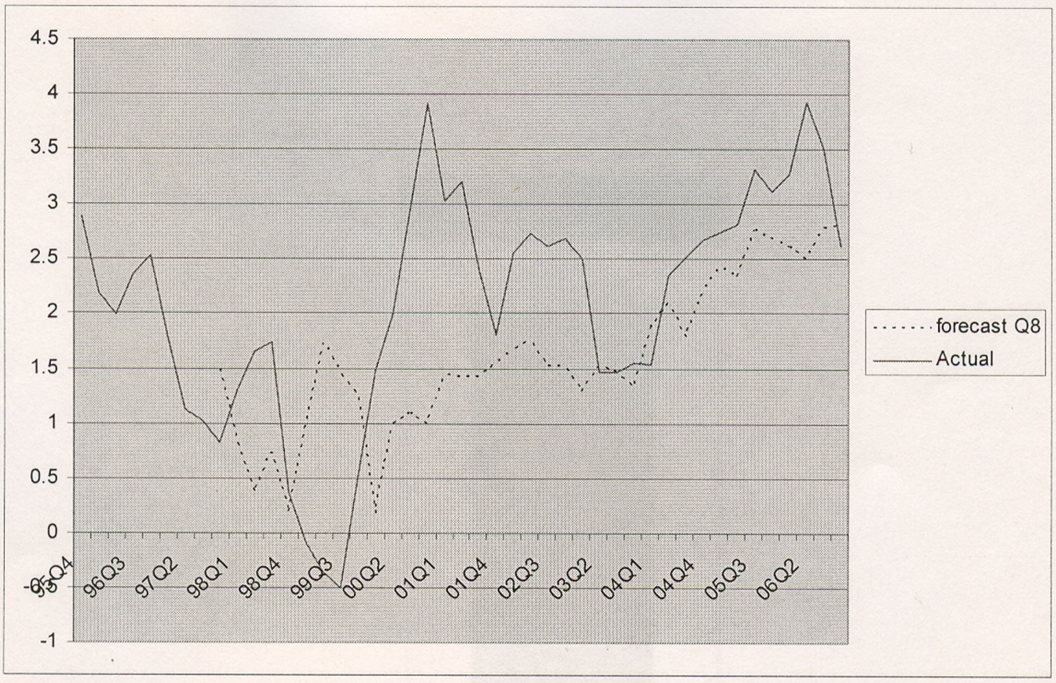
Appendix 3



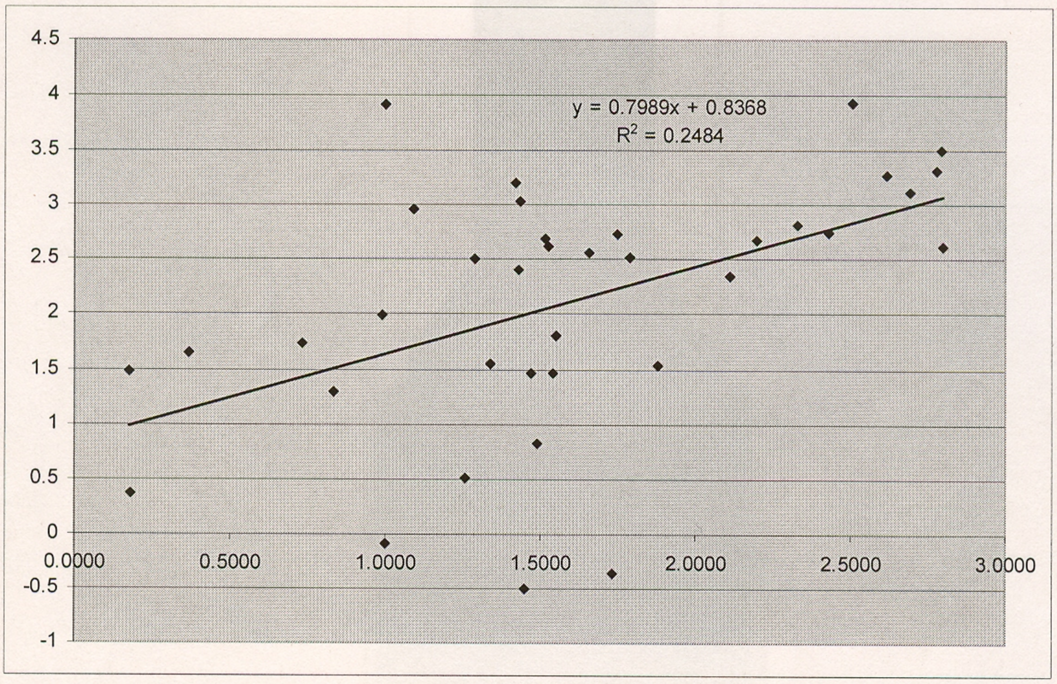



5
4
3
2
1
0
-1
-2
95Q4
96Q3
97Q2
98Q1
98Q4
99Q3
00Q2
01Q1
01Q4
02Q3
03Q2
04Q1
04Q4
05Q3
06Q2
forecast Q4
Actual

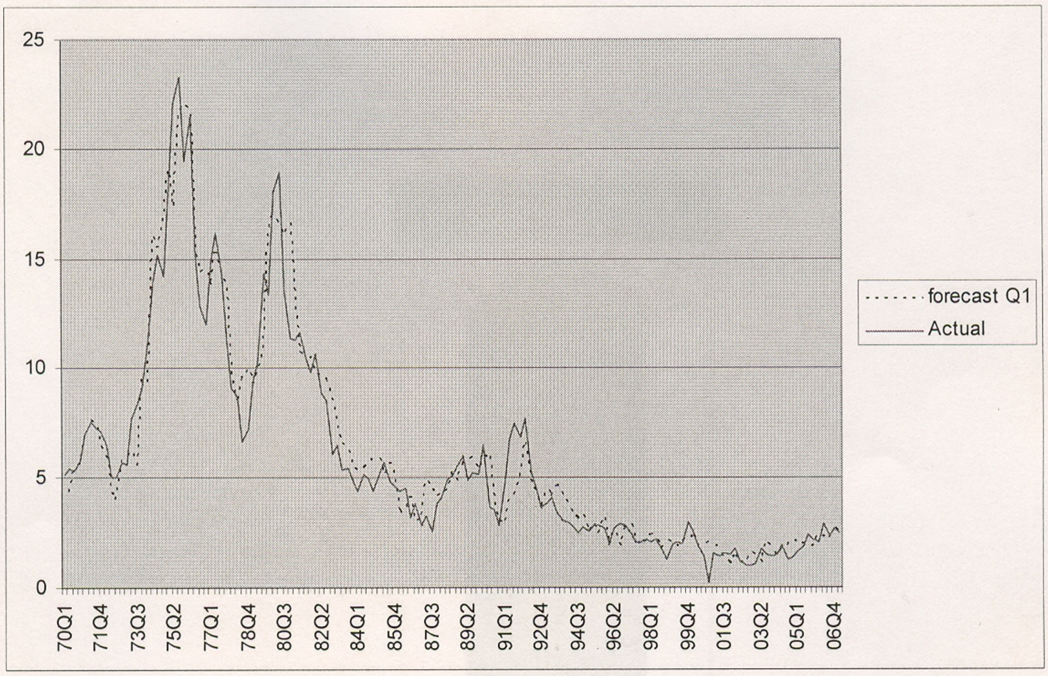

y = 0.8857x + 0.5161
R2 = 0.5154
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5000
-1.0000
-0.5000
0.0000
0.5000
1.0000
1.5000
2.0000
2.5000
3.0000
3.5000
4.0000

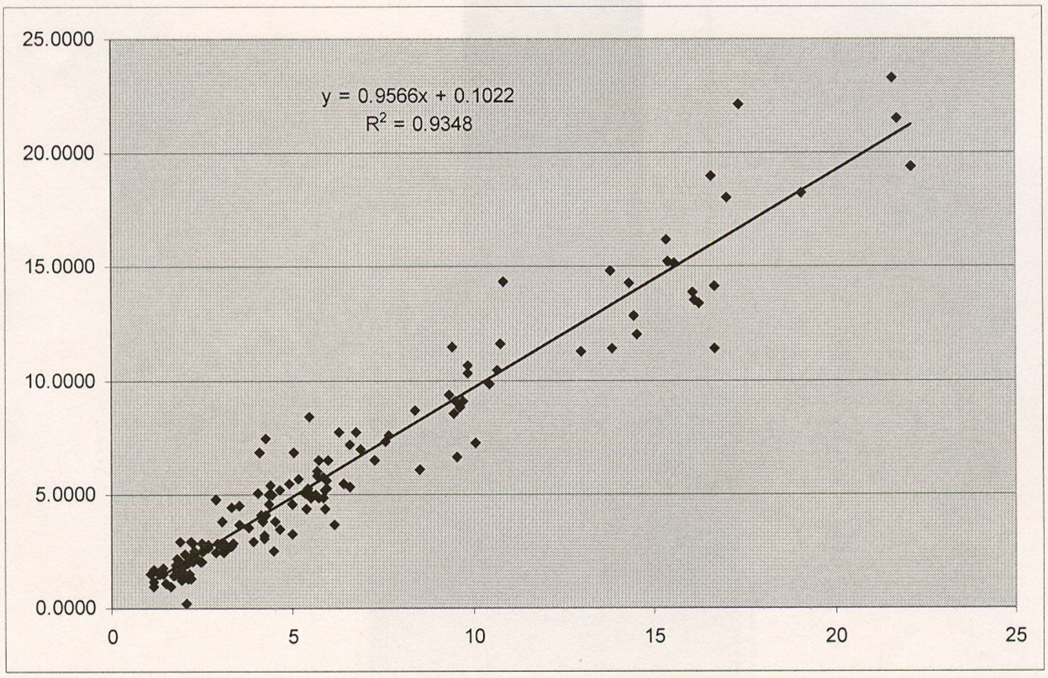


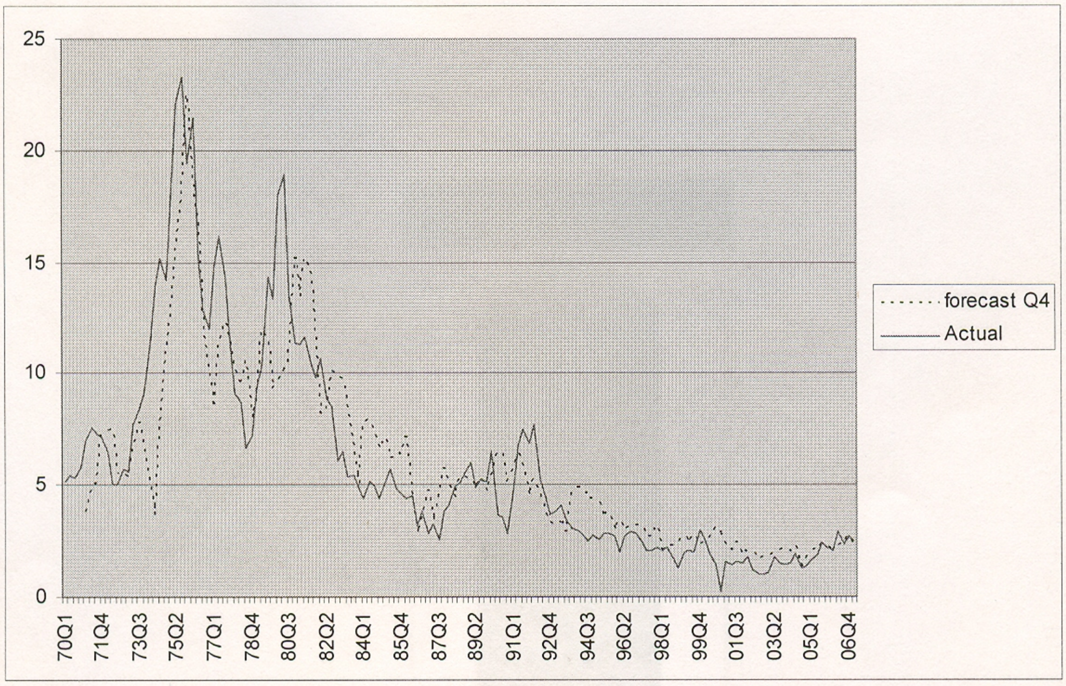
forecast Q8
Actual
95Q4
96Q3
97Q2
98Q1
98Q4
99Q3
00Q2
01Q1
01Q4
02Q3
03Q2
04Q1
04Q4
05Q3
06Q2

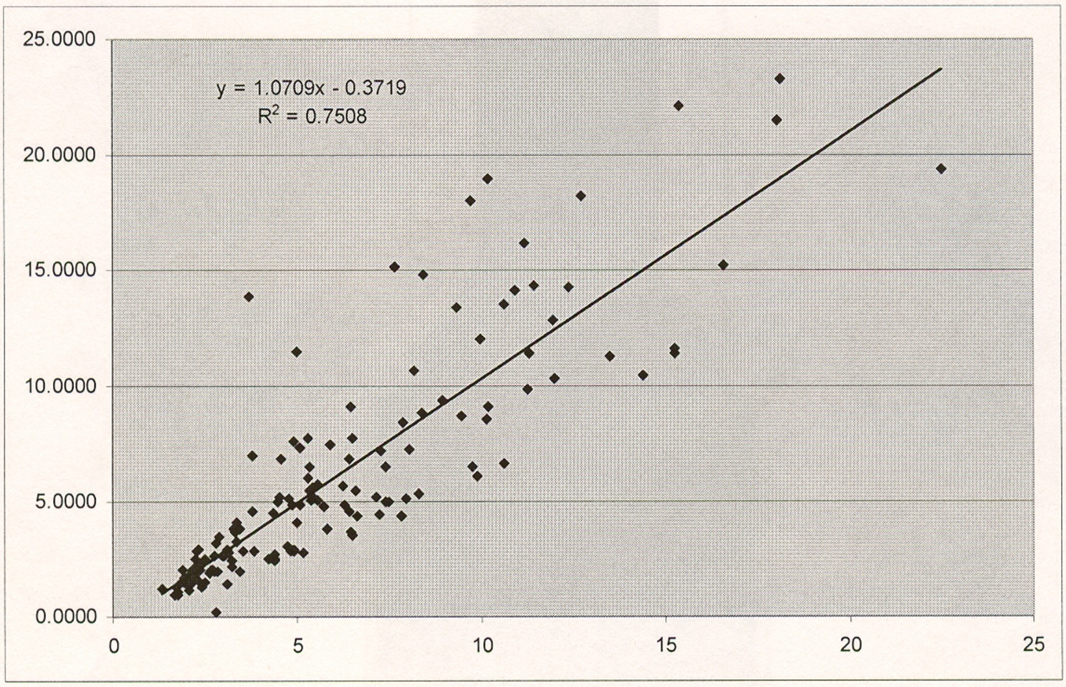


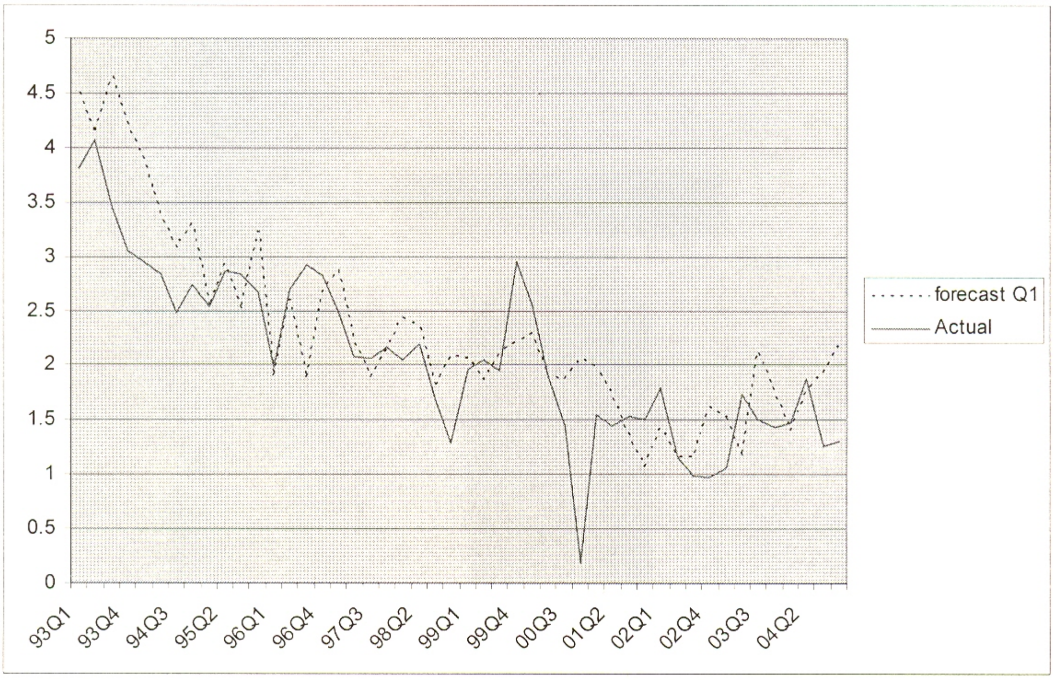
y = 0.7989x + 0.8368
R^2 = 0.2484

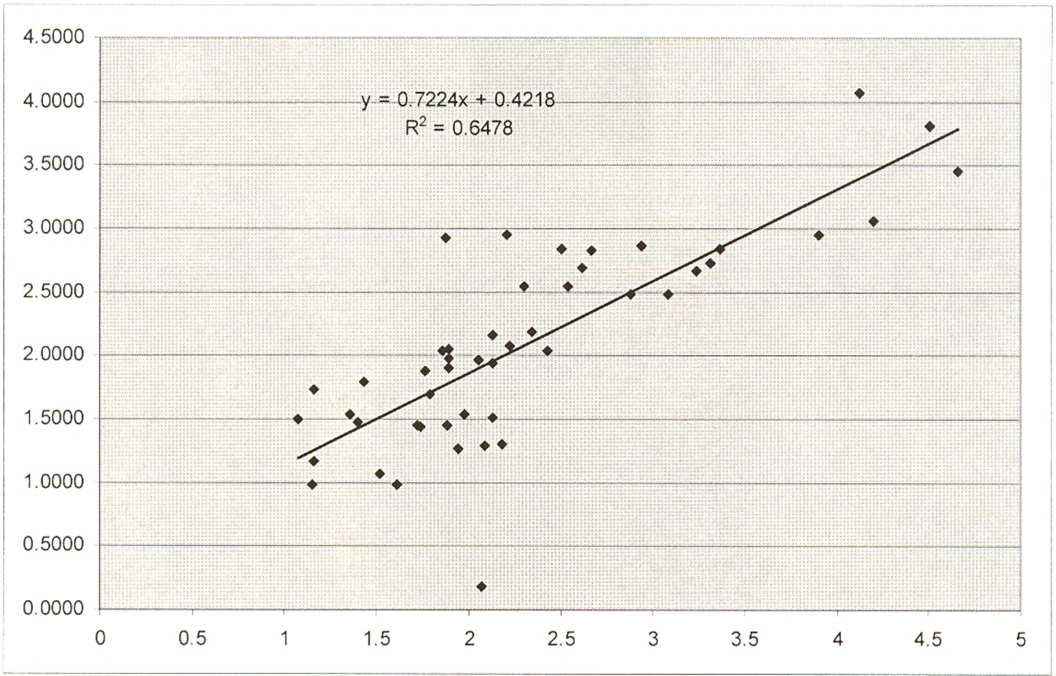

forecast Q1
Actual
25
20
15
10
5
0
70Q1
71Q4
73Q3
75Q2
77Q1
78Q4
80Q3
82Q2
84Q1
85Q4
87Q3
89Q2
91Q1
92Q4
94Q3
96Q2
98Q1
99Q4
01Q3
03Q2
05Q1
06Q4

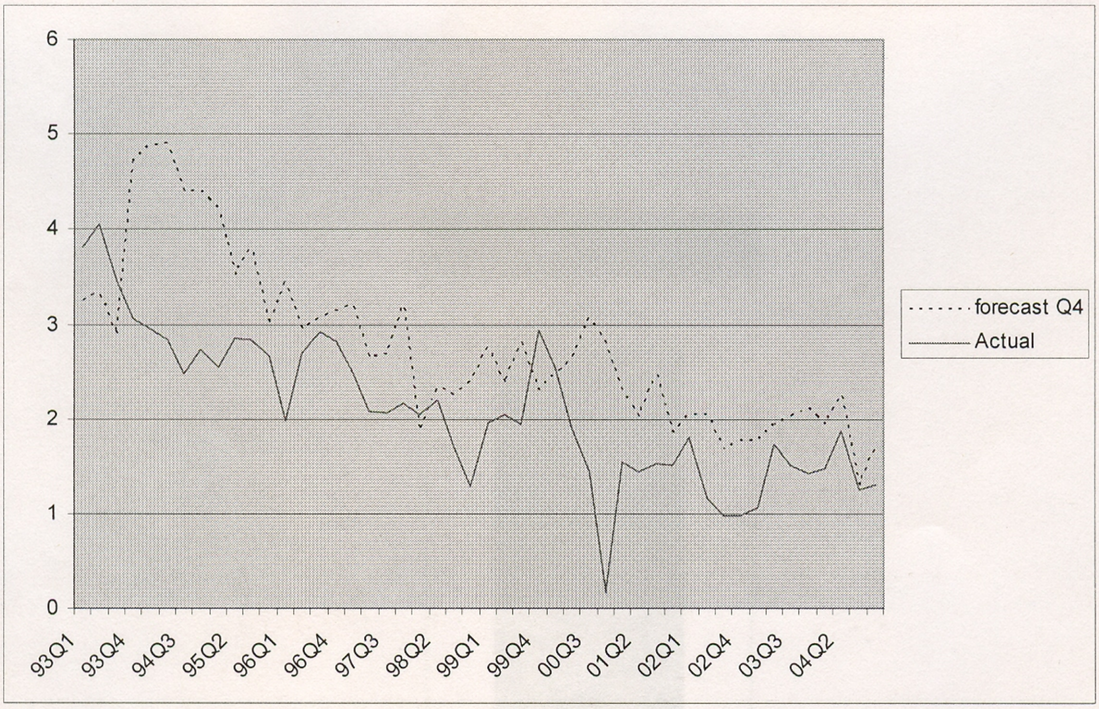

y = 0.9566x + 0.1022
R^2 = 0.9348
25.0000
20.0000
15.0000
10.0000
5.0000
0.0000
0
5
10
15
20
25

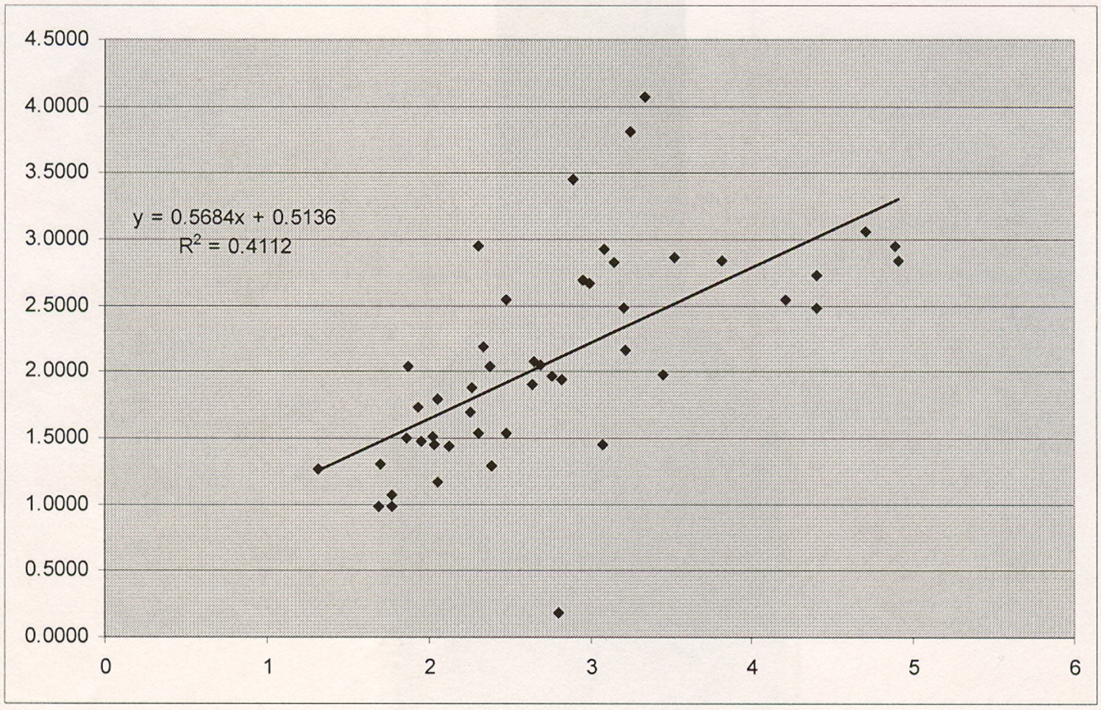

forecast Q4
Actual
25
20
15
10
5
0
70Q1
71Q4
73Q3
75Q2
77Q1
78Q4
80Q3
82Q2
84Q1
85Q4
87Q3
89Q2
91Q1
92Q4
94Q3
96Q2
98Q1
99Q4
01Q3
03Q2
05Q1
06Q4


y = 1.0709x - 0.3719
R2 = 0.7508
25.0000
20.0000
15.0000
10.0000
5.0000
0.0000
0
5
10
15
20
25


forecast Q1
Actual
93Q1
93Q4
94Q3
95Q2
96Q1
96Q4
97Q3
98Q2
99Q1
99Q4
00Q3
01Q2
02Q1
02Q4
03Q3
04Q2


y = 0.7224x + 0.4218
R2 = 0.6478


6
5
4
3
2
1
0
93Q1
93Q4
94Q3
95Q2
96Q1
96Q4
97Q3
98Q2
99Q1
99Q4
00Q3
01Q2
02Q1
02Q4
03Q3
04Q2
forecast Q4
Actual


4.5000
4.0000
3.5000
3.0000
2.5000
2.0000
1.5000
1.0000
0.5000
0.0000
y = 0.5684x + 0.5136
R^2 = 0.4112
0
1
2
3
4
5
6