Year-ahead quarterly inflation forecast errors

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Editor's note

The following paper prepared for senior management describes early findings regarding our forecast errors. Some initial analysis is done regarding possible causes of the bias in our CPI forecasts, looking particularly at the likely balance between international and domestic factors.

Note that this analysis covers only the post-1997 period, as the analysis requires a decomposition of inflation that relies on the Forecasting and Policy System (FPS) model, introduced at this time.

1 Introduction

Recent research within the Reserve Bank suggests that our one-year-ahead forecasts of quarterly inflation have been biased. It appears that we have tended to under-predict CPI inflation over recent years.[1]

Figure 1 depicts our forecast errors as the difference between our one-year-ahead forecasts of quarterly inflation and the measured inflation rates since 1997.[2] Below we suggest some possible reasons why CPI inflation has tended to be stronger than forecast. Our aim is not to provide a definitive examination of the causes, but simply to flag the problem and suggest possible avenues for further investigation.

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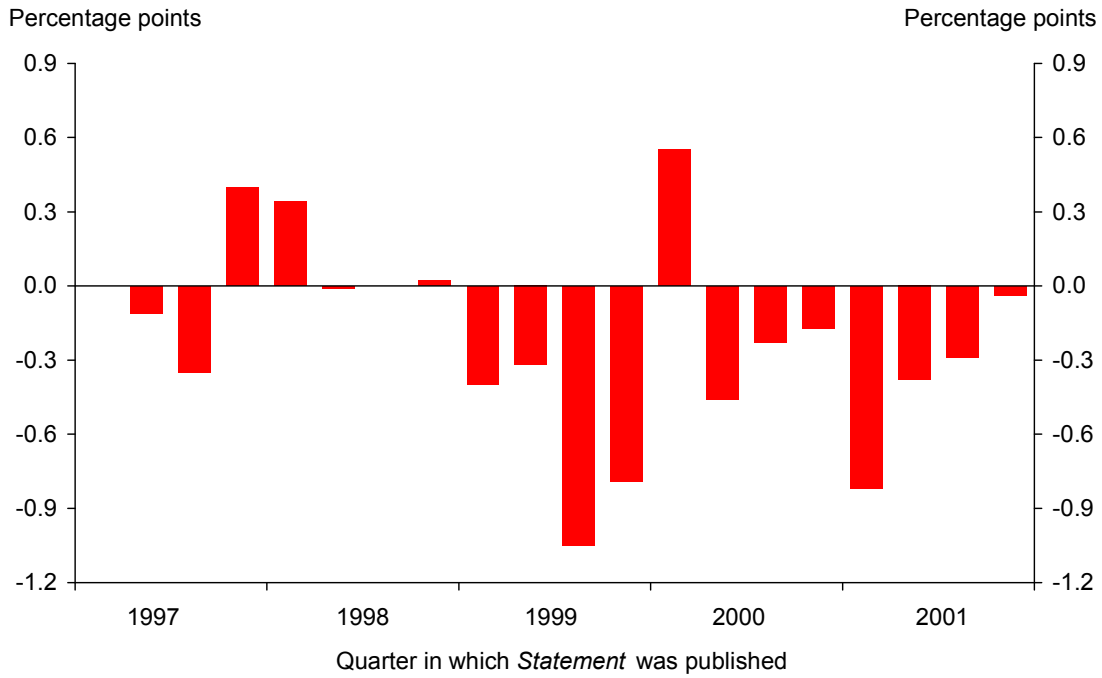
1 That work suggests that our forecasts have been unbiased for the current quarter and 1 quarter ahead, but biased at longer horizons (including one-year ahead). The measure of CPI inflation we examine here is the CPI excluding interest costs.

2 *Monetary Policy Statements* are referred to by the quarter in which they fall, rather than by the month. The forecasts from the *Statements* that were published during the 2001 calendar year are compared to those from the March 2002 *Statement*, since at the time the analysis was performed actual observations on the CPI were available only up to the December quarter of 2001. The final four observations therefore use forecast data as proxies for actual outturns and are therefore indicative only.

Figure 1
Errors in one year ahead forecasts of quarterly inflation



2 Taking account of special factors

One possible explanation of forecast errors is special factors that affect just a few goods rather than affecting general inflation in its broader macroeconomic sense. We examine quarterly price changes for particular items that we could not have anticipated when we produced our forecasts. Figure 2 shows the pattern of forecast errors that arises when we compare our forecasts to an inflation rate that is adjusted for sizeable surprises in individual items (mainly government-policy-induced price changes and petrol prices).[3] For comparison, it includes the non-adjusted errors from figure 1.

[3] Details of the items that have been stripped out of the CPI are given in an appendix.

Figure 2
Adjusted and raw forecast errors

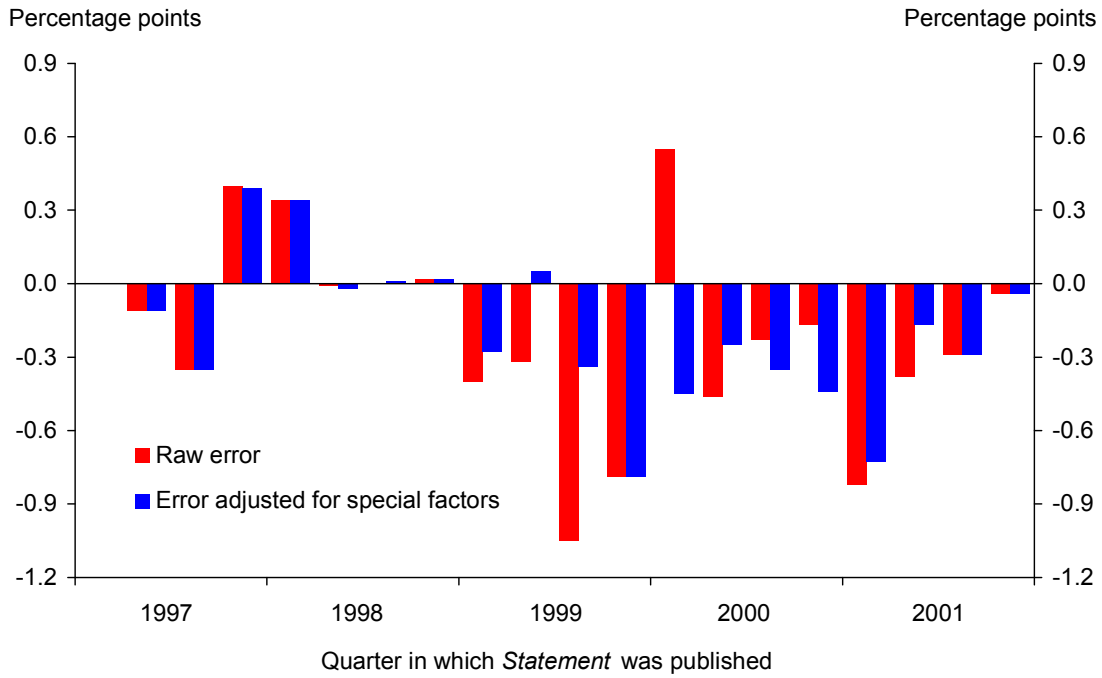


Figure 2 suggests that we have mostly under-predicted inflation even when special factors are taken into account. If surprises in the prices of individual items cannot explain the apparent bias in our forecasts, then perhaps our assumptions on macro-economic factors such as real activity and the exchange rate have contributed to our forecast errors (Section 3).

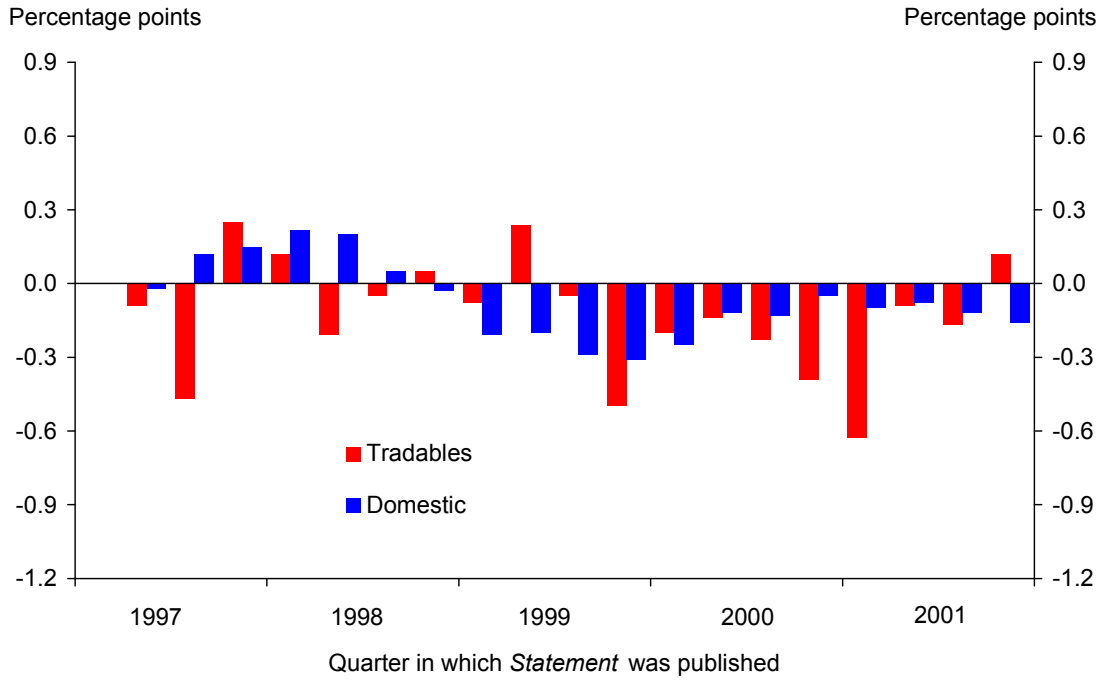
3 Errors in predicting domestic and imported inflation

Inflation and our forecasts of inflation can be split into a domestic component and a 'tradable' component.[4] Because the first of these components is largely determined by domestic pressure on resources, while the second is driven relatively more by the prices of tradable goods and the exchange rate, errors in forecasting the two components should be related to errors in forecasting different aspects of the macro-economy.

Figure 3 depicts the contribution of our tradables and domestic inflation forecast errors to the errors we have made in forecasting CPI inflation, with the effect of special factors removed.

[4] The measures of tradable and domestic inflation in this section are constructs from our Forecasting and Policy System model (FPS), and roughly correspond to the tradables and domestic components of inflation.

Figure 3
Contributions of domestic/tradables forecast errors to CPI ex-interest forecast errors (adjusted for special factors)



3.1 Tradables inflation

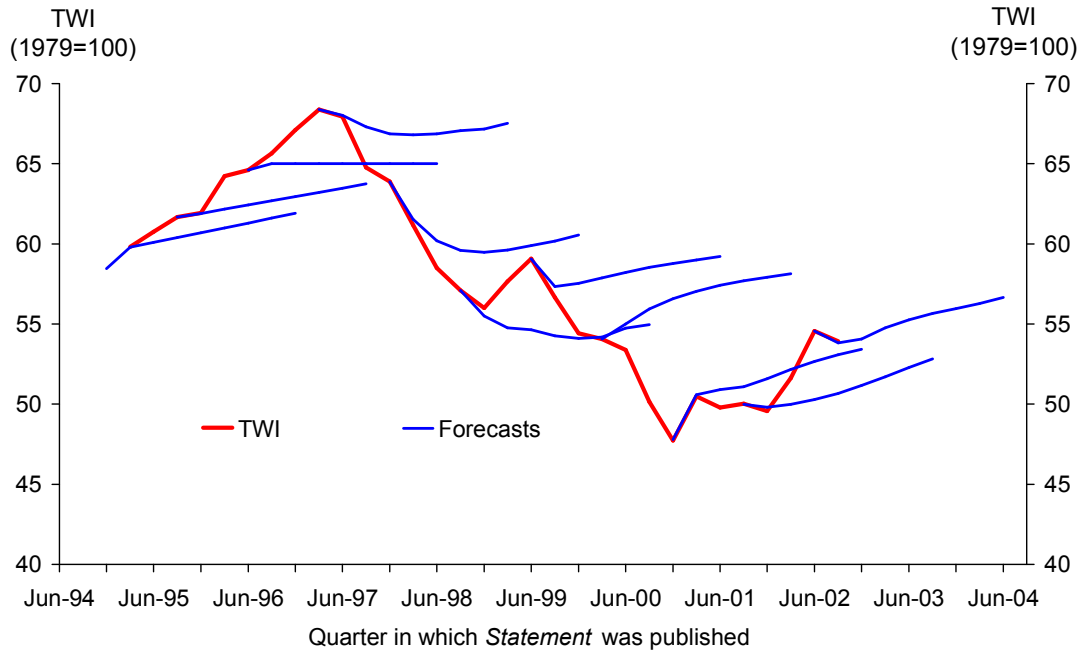
- The errors we made in forecasting one-year-ahead 'tradables' inflation in mid-1997 and from the June 1998 Statement to the September 2000 Statement were mainly negative. The significant depreciation of the currency relative to our flat or rising forward-path assumptions during this period may explain our under-prediction of tradables inflation in these periods. Figure 4 shows how the actual TWI track relates to the forecast tracks we published in successive Monetary Policy Statements.

- Later in the period, we changed the level of the equilibrium exchange rate in the FPS model, so the later forecast tracks do not tend to rise to the same degree as earlier ones. Nevertheless, we continued to over-predict the level of the exchange rate until near the end of the period. This would lead to higher-than-expected import prices, and so we tended to under-predict tradables inflation.[5]

- On some occasions we forecast this measure of tradables inflation to be stronger than it turned out to be. In some of these cases (the December 1997, March 1998, and December 1998 Statements) we forecast the TWI to be stronger than actually occurred, which would tend to cause tradables inflation to be weaker than expected. This suggests that other factors, perhaps surprises in international goods prices, were responsible for our over-prediction of tradables inflation in these instances.

[5] Prices of domestically-produced tradable goods (eg milk) will also rise when the exchange rate falls, as the domestic market has to compete with the rest of the world for the goods.

Figure 4
TWI forecasts[6]



3.2 Domestic inflation

We now believe that misjudgements regarding resource pressure in the economy contributed to our under-prediction of inflation in the mid-1990s. However, this paper covers the period only since 1997, since the FPS model is required to decompose the inflation forecast errors into its components.

With this in mind, turning to domestic inflation, figure 5 shows that the domestic forecast errors may have been related to errors in forecasting the output gap. These output gap errors could reflect either errors in forecasts of actual growth, or forecasts of the rate of growth of 'potential output' (ie the non-inflationary 'speed limit' of the economy.)

There are three main episodes within this period in which we appear to have made too weak an assumption on the degree of pressure on resources in the economy, and in which we consequently under-predicted domestic inflation. The first episode relates to the Statements from the last quarter of 1998 to the first quarter of 2000, in which we underestimated the speed of New Zealand's recovery from the effects of the Asian crisis, and so underestimated the degree of pressure on resources.

In the case of the sharp drop in business confidence that occurred from late 1999 into 2000, the initial unexpected shock did cause the output gap to dip below what we had forecast, but activity subsequently recovered more quickly than we expected. Indeed, the Statements we published in the last quarter of 2000 and in early 2001 forecast pressure on resources to ease by more than turned out to be the case. Consequently, we under-predicted domestic inflation.

Finally, it seems that our forecasts during 2001 may have overstated the negative effects of the nascent global downturn on New Zealand (particularly through export prices). This is especially evident with the December Statement of 2001, following the terrorist attacks of 11

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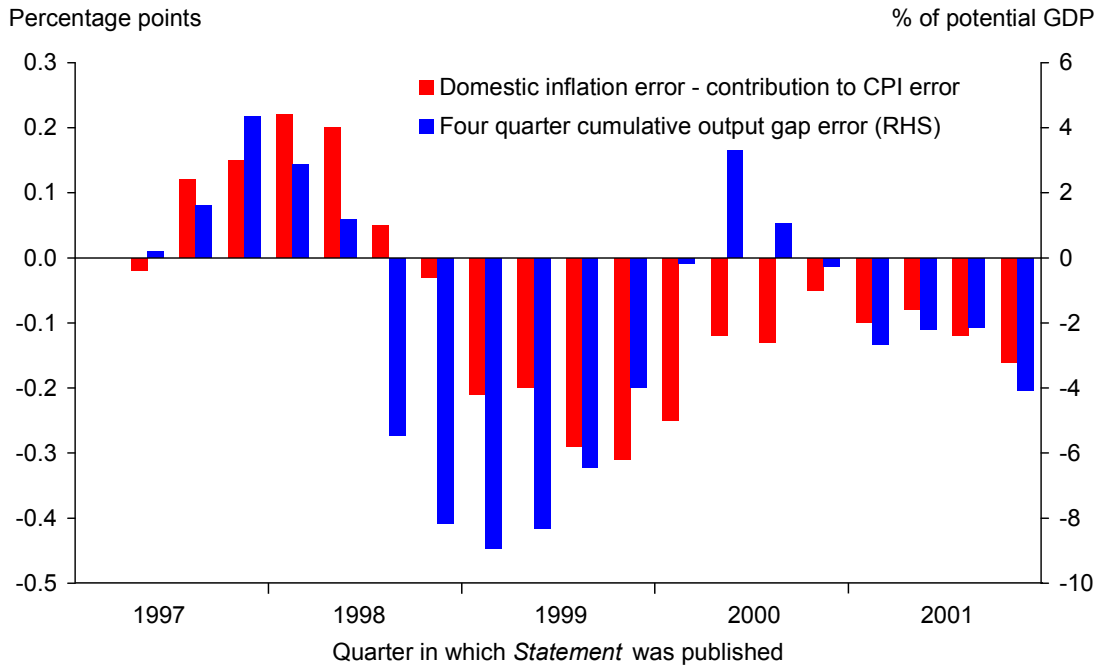
[6] This graph does not include forecasts before the March 1998 *Statement*.

September, wherein we assumed that confidence and activity would take a more sustained hit than appears to have eventuated.

The recent turnaround in net migration is also likely to be a source of upside risk to the forecasts of domestic inflation associated with the first three Statements of 2001. This follows from our assessment in the March 2002 Statement that our strong net migration position will add more to demand than to supply, which in turn suggests upside risk to earlier output gap forecasts.

Figure 5
Errors in forecasting the output gap and domestic inflation



Some part of the forecast errors discussed above is probably due to ex post data revisions. But in addition to data issues, our understanding of exactly how the economy works is imperfect, and evolves over time. Particularly relevant here is the relationship between activity and domestic inflation.

4 Conclusion

In general terms, there are a number of possible sources of the bias in our CPI forecast errors. One source of bias could be a string of consecutive economic shocks that all surprise in one direction. In this sample, we saw three such shocks: the aftermath of the Asian crisis; the confidence shock between the end of 1999 and mid-2000; and 11 September.

Another possible source of errors or bias is data problems. For example, revisions to data or a lack of reliable timely data may affect the accuracy of forecasts. As suggested above, revisions to GDP data have affected our forecasts, but it is too early to tell whether this effect contributed significantly to the bias in our sample.

An imperfect understanding of the way the economy works is likely to be a source of forecast errors and possibly bias. During the sample period, we changed the way we thought about, and forecast, the relationship between activity and domestic inflation, for example, and also the relationship between the exchange rate and inflation. It is, of course, inevitable that the

economy itself has been evolving in the way it copes with shocks, and the way those shocks are transmitted. Slowness to pick up these changing relationships could be a source of bias.

The examination here is a cursory one, and the sample period (from 1997) is not long enough to allow strong conclusions to be drawn. The tentative conclusions we can draw are limited to:

- First, it appears that our over-prediction of the exchange rate led us to under-predict tradables inflation, and this is likely to have contributed to our bias in forecasting CPI inflation.

- Second, following three economic shocks to the New Zealand and world economies, we have under-predicted the strength of the New Zealand recovery. This has led us to under-predict domestic inflation, and so CPI inflation.

Appendix: special factors

This appendix lists the items that are excluded from the CPI as special factors. Petrol prices have been excluded on the basis of their extreme volatility during this period. The excluded items are identified as components of tradables or domestic inflation. Before 1999, the main 'special' influence on the CPI was interest costs, which are excluded from our measure of the CPI. In comparison to the effect of interest costs in this period, other items had only a small effect on CPI inflation. Thus, we have not stripped individual items out of the CPI before 1999.

March 1999 Statement forecast of March 2000 inflation
Items excluded are petrol prices (tradable), and prescription charges (non-tradable) (following a move to prescribe more fully subsidised drugs).

June 1999 Statement forecast of June 2000 inflation
Items excluded are petrol prices (tradable), and tobacco and cigarette prices (tradable) (following an extraordinary rise in the excise tax on these items).

September 1999 Statement forecast of September 2000 inflation
Items excluded are petrol prices (tradable), and tobacco and cigarette prices (tradable) (following an extraordinary rise in the excise tax on these items).

December 1999 Statement forecast of December 2000 inflation
The item excluded is petrol prices (tradable).

March 2000 Statement forecast of March 2001 inflation
Items excluded are petrol prices (tradable), and rents for Housing New Zealand properties (following the implementation of the income-related rental policy) (tradable).

June 2000 Statement forecast of June 2001 inflation
Items excluded are petrol prices (tradable), rents for Housing New Zealand properties (tradable) (following the implementation of the income-related rental policy), and dwelling insurance (tradable) (following a rise in the fire service levy).

September 2000 Statement forecast of September 2001 inflation
The item excluded is petrol prices (tradable).

December 2000 Statement forecast of December 2001 inflation
The item excluded is petrol prices (tradable).

March 2001 Statement forecast of March 2002 inflation
Items excluded are petrol prices (tradable), and electricity prices (non-tradable) (following the drought).

June 2001 Statement forecast of June 2002 inflation
Items included are petrol prices (tradable), and electricity prices (non-tradable) (following the drought).

September 2001 Statement forecast of September 2002 inflation
Since we do not produce component-level forecasts this far ahead, no items have been excluded.

December 2001 Statement forecast of December 2002 inflation
Since we do not produce component-level forecasts this far ahead, no items have been excluded.