

TREASURY'S FORECASTING PERFORMANCE

Introduction

Treasury carries out regular internal monitoring of its forecasting performance. Since mid-2002 we have been undertaking a more comprehensive analysis of our economic and fiscal forecasting records. This report presents the key results of that analysis, updating the report published in 2003¹.

Key Results

Economic forecasts

- Forecasts of GDP (real and nominal) and CPI inflation are unbiased, i.e. on average, they tend to be neither too low nor too high. The accuracy measures of these forecasts, e.g. the root mean square errors, compare favourably with the accuracy measures of forecasts made by other forecasting agencies in New Zealand.

Tax forecasts

- Forecasts of tax revenue and receipts are unbiased.
- We have also investigated the proposition that, given a perfect macroeconomic forecast, the tax forecasts would be persistently too low. We have found no evidence to suggest that this is the case.

Fiscal balance

- The Crown's operating balance is mostly the relatively small difference between two very large components, i.e. revenue less expenses. Small errors in the forecasting of these can translate into relatively large errors in the net operating balance.
- Furthermore, certain elements of the operating balance are not forecast and this needs to be allowed for in the analysis. Examples of non-forecast items include Government Superannuation Fund (GSF) pension liability movements, foreign exchange gains and losses, and gains and losses on assets sales.
- Adjusting for these non-forecast items, operating balance forecasts are unbiased.
- The mean absolute errors of Treasury's operating balance forecasts compare favourably with the mean absolute errors of fiscal balance forecasts made by other similar agencies in the UK and the USA.

Net cash flows

- Current-year forecasts of the net movement in cash tend to be too low. This looks to be chiefly the result of forecasts of operating expenditures, benefit expenditures and physical asset purchases tending to be too high (as spending tends to occur later than originally planned).

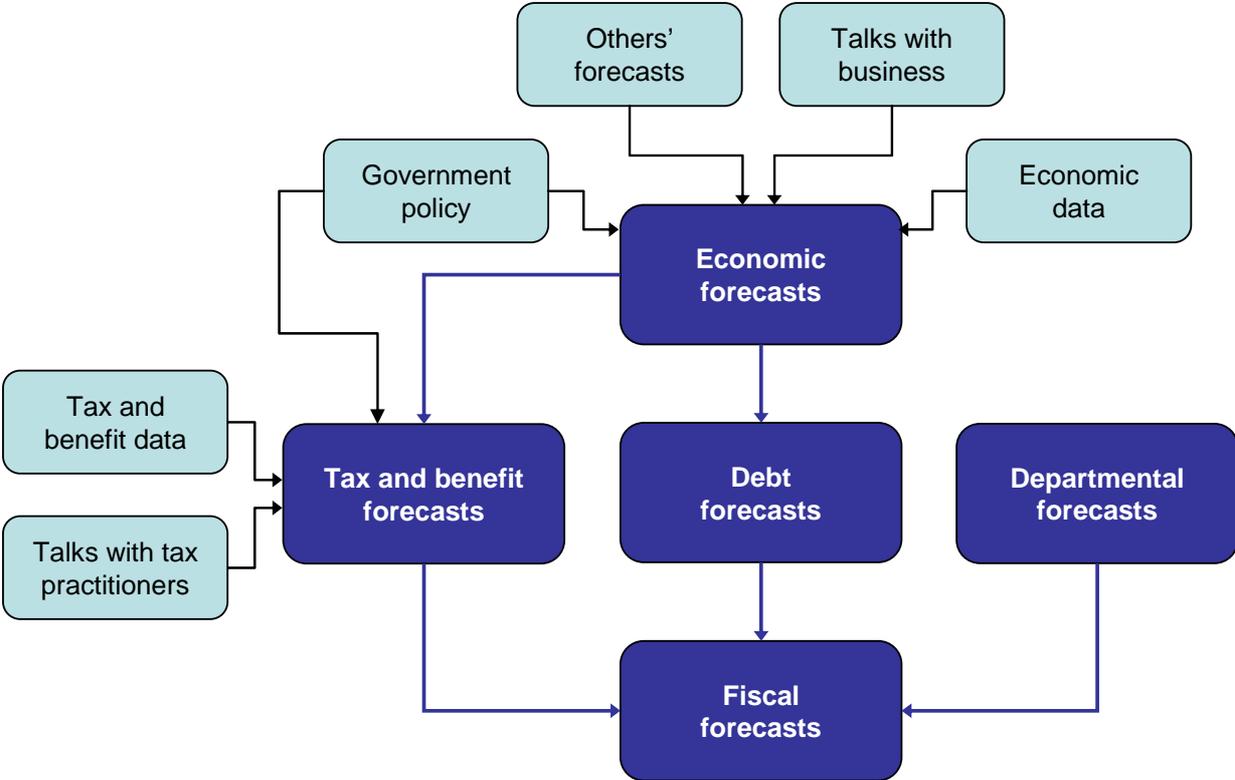
¹ See Treasury's Forecasting Performance at www.treasury.govt.nz/forecasts/performance/

Why analyse forecast performance?

We want to be able to determine if Treasury’s forecasts are any good. How accurate are they? Is the information that they provide useful? If the forecasts are wildly inaccurate, then what can we do to improve the forecasting processes?

We would also like to know if Treasury is consistently under-forecasting or over-forecasting. Under- or over-forecasting can have some potentially damaging consequences. For example, persistently under-forecasting the Crown’s operating balance means that the government may decide not to proceed with spending initiatives that it could have actually afforded, or persistent over-forecasting may cause the government to spend money that it can’t really afford to, causing debt levels to increase. So if forecasts of some elements do tend to be always too high or always too low, then we would certainly want to do something to correct this.

How Treasury Forecasts



Twice each year, Treasury produces economic and fiscal forecasts. The first forecast each year is usually prepared for the government’s annual Budget and published as the Budget Economic and Fiscal Update around May or June. The second forecast is usually released in December, a week or two before Christmas, published as the December Economic and Fiscal Update. In an election year, there may be another forecast published four to six weeks before the general election, called the Pre-Election Economic and Fiscal Update.

Treasury starts by preparing an economic forecast. This is produced by the macroeconomic forecasting team, which devotes four to six weeks to the task at each forecasting ‘round’. The economists will examine recent economic data, examine the forecasts produced by other New Zealand economic forecasters and discuss the state of the New Zealand economy with many business people around the country. They will then run a variety of forecasting models to produce forecasts of many macroeconomic variables, such as gross domestic product

(GDP) and Consumer Price Index (CPI) inflation. These forecasts typically cover the next four to five years.

While being an end product within itself, the economic forecast is also an input into other parts of the forecasting process. Treasury's tax forecasting team uses various elements of the economic forecast to predict future tax revenues. The benefit forecasters at the Ministry of Social Development (MSD) and Inland Revenue (IRD) use parts of Treasury's economic forecasts, e.g. the labour market and CPI inflation, to predict future benefit payments. Treasury's Debt Management Office uses the economic forecasts in settling on a bond programme.

While all of this is going on, all departments plus SOEs and Crown Entities are also preparing their forecasts of revenues and expenses for the next few years.

Treasury's Budget accountants pull together the tax, benefit, departmental, SOE, Crown Entity and DMO forecasts into one big fiscal forecast. They produce forecast financial statements for the current year and the following four years. These statements contain such things as Statements of Financial Performance, Statements of Financial Position and Statements of Cash Flows, similar to what any company would produce.

Perhaps the key variable that comes out of all this is the operating balance. This is the difference between revenues and expenses and may be thought of as being analogous to a business's profit. In a similar manner to a business proprietor reinvesting profits back into the business, so too the Government reinvests any operating surpluses back into New Zealand by, for example, making contributions to the New Zealand Superannuation Fund to contribute to future New Zealand Superannuation payments, purchasing assets such as buildings and defence equipment, and funding student loan advances to help students access tertiary education. The performance of forecasts of the Crown's operating balance is analysed in some detail in this report.

A more complete description of Treasury's forecasting process can be found at <http://www.treasury.govt.nz/forecasts/process/>.

How can we analyse forecast performance?

Essentially, there are two desirable properties that we would like the forecasts to have. We would like the average forecast errors, i.e. the difference between the actual outcomes and the forecasts, to be zero, which would indicate that, on average, the forecasts are neither too low nor too high. We would also like the variance of the forecast errors to be as small as possible, which would indicate that, on average, the forecasts stay within some relatively small distance of the actual outcomes.

To test the first property, we examine the average of the forecast errors over time. It is extremely unlikely that this will equate to exactly zero, so we perform a further test on this average to test if it is 'significantly different' from zero. If it is significantly different from zero, we conclude that, in all likelihood, the forecasts are biased, tending to be either too high or too low, on average. If the average is not significantly different from zero, then we conclude that we do not have enough evidence to suggest that the forecast is biased, which is not quite the same as saying that the forecasts are unbiased.

The term 'biased' does not imply that Treasury is deliberately pitching its forecasts one way or another. Rather, it merely indicates if Treasury's forecasts are persistently too high or too low. This could be happening for a variety of reasons. For example, a forecasting model may be biased because it is missing a key variable or is based on flawed data. Note that, in some

cases, it may be better to use a biased model instead of an unbiased model, as described in the annex to the report.

To test the second property, we examine measures of the magnitude of the errors such as mean absolute error (MAE) and root mean square error (RMSE). These measures are also described in the report's annex.

Caveats

The analysis covers the period 1991 to 2004 for the economic forecasts, and 1994 to 2004 for the fiscal forecasts. We started from 1991 for the economic forecasts as this is the earliest year for which we have reliable historical forecast data and we start from 1994 for the fiscal forecasts as 1994 marked the introduction of accrual accounting for the Crown accounts. This yields relatively small samples of observations and so we are unable to get precise estimates of the mean forecasting errors.

Some of the analysis suggests that there may be correlation of forecasting errors over time. That is, we get runs of persistent under-forecasting or over-forecasting, indicating that a positive (or negative) forecasting error in one year may increase the likelihood of a positive (or negative) forecasting error in the following year. However, a reliable test of such correlation usually requires a data series of at least 30 observations, but we typically only have 10 to 15 observations, for the reasons given above. Therefore, we cannot reliably test for correlations of errors over time.

Because of these two problems caused by the relatively short data series, it is difficult to draw strong conclusions from the analysis.

It is important to recognise that Treasury's forecasts assume no change in Government policy and make technical assumptions about the long-run equilibrium values of certain variables (e.g. the exchange rate). This means that the forecasts will not capture all information relevant to future economic and fiscal outcomes.

It is also important to realise that the forecasting models and methods have changed over time as science and technology have advanced; we now have more sophisticated forecasting techniques than we did ten years ago, and desktop computing power has also increased dramatically. Thus, we are not testing the performance of a particular forecasting model, but of an evolving forecast process. This will have had some effect on the forecasting errors, but we are unable to quantify any such effects.

The analysis is restricted to forecast performance and does not consider any policy implications.

Where to from here?

Treasury will continue to monitor the performance of its forecasts. When the annual Crown Financial Statements are released each year, we will update and publish the forecast performance statistics along with some commentary. We will also produce further reports such as this one in the future, although it is not our intention to do this every year.