

EXECUTIVE SUMMARY

Introduction

The past 10 years has been challenging for economic and revenue forecasting. Two major developments in particular stand out. The first relates to rapid rates of industrialisation in Asia, particularly in China, which increased worldwide demand for natural resources and, in turn, underpinned a sharp sustained rise in commodity prices and a mining investment boom (Mining Boom Mark I). The second relates to the impact of the global financial crisis and its aftermath on the Australian economy and taxation receipts and the emergence of a second phase of the mining boom (GFC and Mining Boom Mark II).

In common with many forecasters in Australia and overseas, Treasury has experienced mixed success forecasting over this period. In particular, the identification and prediction of major turning points in economic activity recently has been a failing of most forecasters around the world. Against this backdrop of a volatile economic environment, and the time that has passed since the previous review, Treasury decided that it was again timely to formally take stock of the Department's forecasting practices, capability and performance.

The Review has:

- assessed the quality of Treasury's macroeconomic and revenue forecasts by examining the appropriateness of forecasting methodologies and, data permitting, comparing forecast accuracy with other forecasters, both in Australia and overseas, over periods between 1990-91 and 2011-12; and
- prepared two case studies, which relate to the most recent challenges confronting forecasters, namely Mining Boom Mark I (2003-04 to 2007-08) and the GFC and Mining Boom Mark II (2008-09 to 2011-12).

A Secretariat was established within Treasury for this purpose, overseen by an independent external reference group.

Treasury's Macroeconomic and Revenue Forecasting Methodology

The Review's terms of reference require the quality of Treasury's forecasts to be assessed by first examining the appropriateness of forecasting methodologies. With this end in mind, a high-level survey of international forecasting practices has been prepared that provides a benchmark against which to assess Treasury's forecasting methodology. The Review has assessed Treasury's forecasting processes against the criteria that Treasury:

- draws upon the full range of information in preparing its forecasts;
- utilises this information efficiently by drawing upon models/technical tools appropriate to the forecasting task; and
- has governance arrangements in place that provide quality assurance of its forecasts and ensure continuous evaluation of its methodology.

The Review finds that Treasury has made a substantial investment in its macroeconomic and taxation revenue forecasting capability over an extended period, recognising the need for specialist expertise and techniques in these areas that takes considerable time and resources to build and maintain. As noted below, in recent years Treasury has overhauled the data and methodology used to forecast taxation revenue.

The Review finds that Treasury's macroeconomic forecasting approach draws upon the full range of information and modelling techniques used by comparable official agencies overseas. It also finds that the relative weight placed on the various macroeconomic forecasting methodologies — including structural econometric models and equations, business liaison and judgement — is broadly appropriate.

Similarly, the Review finds that, where information is available, Treasury's revenue forecasting methodology is comparable to those of official agencies overseas. Forecasts of taxation revenue are built up from forecasts of individual revenue heads, which are based on Treasury's macroeconomic forecasts of the relevant economic base, along with mapping models. The mapping models are accounting frameworks that adjust for the differences between taxable and economic bases (for example the difference between economic and taxable income for companies).

The Review has made recommendations that would enhance Treasury's existing forecasting methodology, as follows:

Recommendation 1: Given the importance of information on economic conditions obtained from business liaison — and the capacity of this source to inform the forecasts — Treasury should investigate with the Reserve Bank of Australia more formal channels through which to exchange insights from their respective programs, such as during the quarterly joint forecasting rounds (without compromising the confidentiality of liaison contacts). Similarly, Treasury should also investigate whether further information can be drawn from the Australian Taxation Office's liaison with large corporate taxpayers for revenue forecasting purposes.

Recommendation 2: A detailed assessment of the role, and appropriate type, of Treasury's macro econometric model was beyond the scope of this Review. However, the Review believes it is important to embed the redeveloped TRYM model into the economic forecasting process, both as a complement to the existing forecasting framework and to facilitate analysis of the impact of shocks to the domestic economy.

Recommendation 3: Treasury should examine the feasibility of constructing a micro simulation model for forecasting personal income tax, as is the practice in the United States and United Kingdom.

The Review finds that Treasury has robust governance arrangements in place to quality assure its forecasts through a process of peer review. Treasury maintains an ongoing dialogue on the macroeconomic outlook with private sector forecasters, largely those employed in the financial sector. As part of the forecast round, Treasury's forecasts are first subject to internal review. They are then subject to the formal peer review of other government agencies. In particular, the macroeconomic outlook is discussed at the Joint Economic Forecasting Group (JEFG) meeting with representatives of the Reserve Bank of Australia, Australian Government central agencies and the Australian Bureau of Statistics. The revenue outlook is discussed at revenue conferences held with the Australian Taxation Office and the Australian Customs and Border Protection Service.

The Review also finds that Treasury's forecasting methodology operates in an environment of continuous internal evaluation and development, with forecast errors regularly reviewed, driving a quest for improvements in forecasting practices. In this regard, the Review notes that Treasury has employed an in-house technical specialist to ensure that its macroeconomic technical models/tools are at the cutting edge of macroeconomic forecasting practice, within the overall modelling strategy that Treasury has adopted.

2005 Review of Forecasting the Nominal Economy and Tax Revenue

The last major review of Treasury's forecasting performance was in 2005. It was commissioned in response to significant upward revisions to successive published forecasts of Australian Government taxation revenue over a number of years, which had drawn into question the quality of Treasury's forecasts at that time.

The major findings of the 2005 Review related to the revenue forecasts and revenue forecasting methodology and included that:

- the underestimation in Treasury's revenue forecasts appeared to reflect a series of conservative biases in the forecasting process that implied that forecast revenue growth was insufficiently sensitive to nominal GDP growth;
- Treasury had an inadequate understanding of the relationship between the nominal economy and taxation revenue; and
- Treasury's capacity to undertake meaningful analysis of taxation revenue had been severely hampered by underinvestment in taxation revenue data.

In response to these findings, Treasury's Executive Board established a team to implement the review's recommendations that were designed to overhaul the data and methodology used to forecast taxation revenue. The team subsequently made major investments in the quality of revenue data sets and forecasting methodology. Over time, these investments enabled the development of improved models of individual heads of revenue which, in turn, has seen Treasury place more weight on these models to generate revenue forecasts and less weight on econometric approaches to estimating aggregate revenue.

The Review finds that Treasury has largely implemented the other recommendations of the 2005 Review, which were designed to improve the professional interactions between the economic and revenue forecasters; to enhance the skill sets of the revenue forecasters; and to increase the emphasis given to the nominal economy in the macroeconomic forecasting area.

Strengthening the Governance of Treasury's Forecasting Processes

Notwithstanding the generally robust nature of existing practices, the Review has made some recommendations that would strengthen existing governance arrangements in order to improve the credibility and transparency of Treasury's forecasting processes. These recommendations would also bring these arrangements more in line with the practices of official agencies overseas.

The importance of credible and transparent forecasts in supporting public confidence has been highlighted by current global economic uncertainty. Publishing forecasting models, data, and technical assumptions in order to open them up to external scrutiny provides greater transparency. It also allows for feedback and testing of assumptions, leading to model improvements over time, as well as enhancing the credibility of the model's forecasts. These considerations lead the Review to recommend:

Recommendation 4: Treasury should publish technical documentation that describes the data and the conceptual and econometric basis of models used for economic and revenue forecasting. A number of official agencies overseas have published technical documentation of their forecasting models.

Large forecasting errors can reduce the credibility of forecasts, particularly as they are viewed with the benefit of hindsight (which reveals information that was not available to the forecaster at the time

the forecasts were prepared). In this regard the Review notes that forecasting is an inherently difficult exercise and, on occasion, large forecasting errors are inevitable, especially at times of economic volatility. Regular public reviews of forecasting performance can help to provide perspective on forecast errors. They can also improve the transparency of the forecasting process. These considerations lead the Review to recommend:

Recommendation 5: Treasury should include in the Budget papers a high level review of the economic forecast errors (nominal and real GDP) for the previous financial year, as a complement to the existing discussion of revenue forecasting errors.

Recommendation 6: Reviews of Treasury's forecasting performance should be undertaken at least every five years to examine the causes of forecast errors and to help identify areas in which Treasury's forecasting methodology could be improved. These Reviews should be overseen by an independent external reference group.

Performance of the Nominal Economy Forecasts

The Review's terms of reference also require the quality of Treasury's forecasts to be assessed by comparing the accuracy of Treasury's forecasts with other forecasters, both in Australia and overseas. The Review has assessed Treasury's forecast performance against two desirable properties of forecasts:

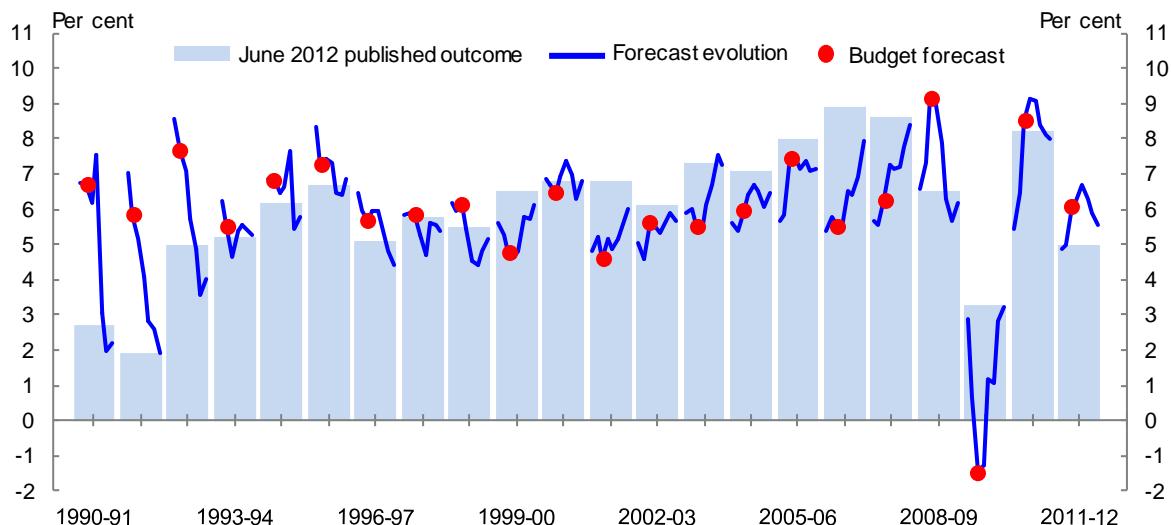
- the forecasts should be unbiased, that is to say the expected forecast error should be zero; and
- the forecasts should be accurate, that is the actual forecast errors should be minimised to the extent possible.

The Review finds that Budget forecasts of nominal GDP growth exhibit little evidence of bias over the past two decades, with the average Budget forecast error being insignificantly different from zero over this period. That said, an examination of the patterns in forecast errors reveals a more variable performance, with the forecast errors being correlated with the economic cycle (Figure 1). Hence, with the benefit of hindsight, Treasury has tended to underestimate growth during economic upswings and overestimate growth during economic downturns.¹ These have been broadly offsetting over the full sample.

This observation is not altogether surprising. 'It is in the nature of forecasting that errors will be larger around turning points in the economic cycle and smaller when the economy achieves stable, near-trend growth. Indeed, for most plausible stochastic processes driving GDP growth, optimal forecasts will exhibit the property that forecast errors are larger than average when growth outcomes turn out to be well-above or well-below trend'.²

¹ This may also reflect that Treasury can tend to remain too close to trend in forecasting growth, underestimating the size of peaks and troughs in the economic cycle.

² Gruen, D. and Stephan, D (2010), 'Forecasting in the Eye of the Storm', *Address to the NSW Economic Society*, 4 June.

Figure 1: Evolution of Nominal GDP Growth Forecasts

Note: In some years, the last forecast differs noticeably from the June 2012 published outcome. This is usually because of significant revisions to the estimated outcome between the first and most recent National Accounts releases.

The finding that Budget forecasts of nominal GDP growth exhibit little evidence of bias is in contrast with those of a recent study by Jeffrey Frankel of official government real growth rate (and budget balance) forecasts between 1985 and 2009 in 33 countries (including Australia).³ That study found that official agency forecasts tended to have a positive average bias (that is, forecasts on average higher than outcomes); are more biased in booms; and are even more biased at the three-year horizon than at shorter horizons. The data for Australia indicate little evidence of bias in this regard compared with other countries.

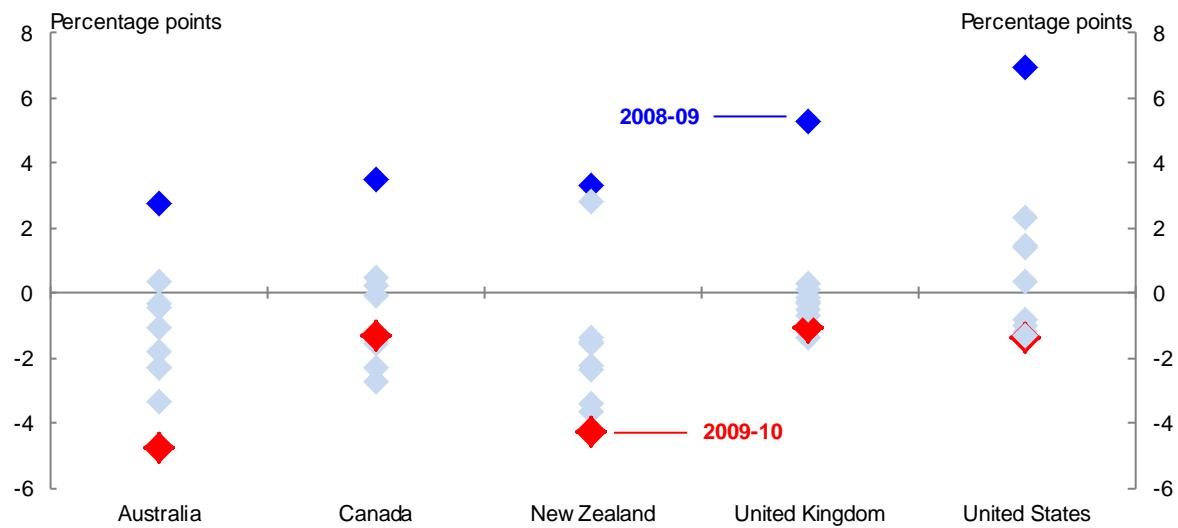
The Review also finds that Treasury's macroeconomic forecasts have been reasonably accurate. Over the past two decades, Budget forecasts of nominal economic growth have exhibited a mean absolute percentage error (MAPE) of 1.6 percentage points. Treasury's macroeconomic forecasting performance is comparable with that of other domestic forecasters. In fact, the overriding impression of the forecast errors of Treasury, the Reserve Bank and Deloitte-Access Economics (Access) is the similarity in the error patterns across agencies (with errors for each agency exhibiting significant variation across time).⁴

On the other hand, Treasury's forecasts are comparable with, or better than, those of official agencies overseas, although some caution is required in making cross country comparisons over a period as short as ten years, and given that official agencies prepare forecasts at different times in the year (Figure 2). Treasury's forecasts also compare favourably with statistical benchmarks generated by a naïve trend forecasting rule, which assumes that the series being forecast simply continues to grow at its recent average observed rate (one, three, five and ten-year moving averages of the forecast series were considered).

³ Frankel, J. (2011), 'Over-optimism in Forecasts by Official Budget Agencies and its Implications', *Oxford Review of Economic Policy* 27(4), pp 536-562.

⁴ The Review acknowledges the difficulty of drawing exact like-with-like forecast comparisons. The forecasting institutions run on different timetables, and forecasts made later will naturally have an advantage over those made earlier for a given reference period. For example, the timing of Treasury forecasts has tended to be optimised around the release of national accounts data, whereas for the RBA they are more likely to be optimised around the release of CPI data. This would contribute to the configuration of relative results for the two sets of forecasts. Results are likely to be sensitive to the choice of sub-periods.

**Figure 2: International Comparison of Budget Forecast Errors across Official Agencies
Nominal GDP Growth: 2001-02 to 2010-11**



Note: Australia's Budget is published in early May, two months before of the start of the Budget financial year; the United Kingdom's Budget is published in March, a month before the start of its Budget financial year; Canada's Budget is generally published in February/March, within its Budget calendar year, New Zealand's Budget is published in May, two months before its Budget financial year; and the United States' Budget is published in February eight months before the start of its Budget financial year.

Within these general findings, however, Treasury's macroeconomic forecasts exhibit periods of high accuracy, interspersed with occasional periods with large outliers. In particular, Treasury overestimated nominal GDP growth in the early 1990s, as the recession at that time, and the related rapid re-establishment of low inflation, was not forecast. More recently, Treasury has also underestimated nominal economic growth during Mining Boom Mark I and large nominal economy forecast errors were generated during the GFC.

Experience suggests that these extreme events are particularly difficult to forecast. In these circumstances, large forecast errors may not necessarily indicate poor forecasting practice. Instead, they may reflect a more volatile and less predictable economic environment. Even if more resources were allocated to economic forecasting, it is not clear this would produce more accurate outcomes. In this regard, it is worth observing that all official agencies failed to forecast the onset of the GFC in 2008-09 and then appeared to overstate its effect on activity in 2009-10, albeit to a varying degree (Figure 2). Case studies have been prepared, outlined below, that discuss Treasury's forecasting performance in the face of the two major recent forecasting challenges, namely Mining Boom Mark I and the GFC and Mining Boom Mark II.

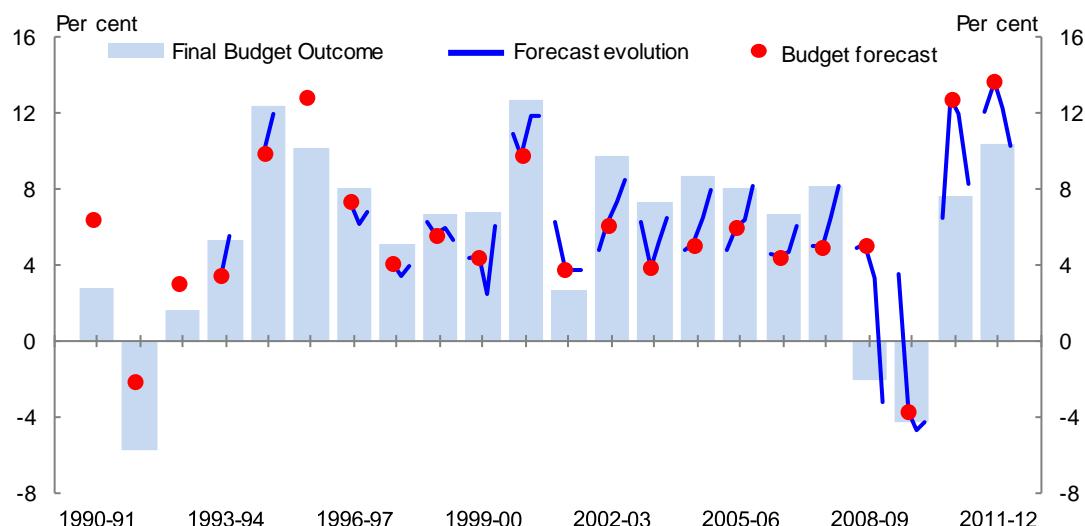
The Review has also found that Treasury's forecasts of GDP deflator growth are less accurate than those of real GDP growth. There were extended periods in the 1990s where Treasury's forecasts of GDP deflator growth were overestimated. In contrast, for periods in the 2000s outcomes were underestimated. In the 2000s, this substantially reflected the difficulty of forecasting commodity prices. These observations lead the Review to recommend that:

Recommendation 7: Treasury should invest relatively more resources in understanding and forecasting GDP deflator growth and its components, in particular, commodity prices, and hence in nominal GDP growth.

Performance of the Taxation Revenue Forecasts

The Review finds that Budget forecasts of taxation revenue have also exhibited little evidence of bias over the past two decades, with the average Budget forecast error being insignificantly different from zero over this period. That said, as was the case with the macroeconomic forecasts, an examination of the patterns in forecast errors reveals sustained periods where Treasury has under and over-forecast revenue, with offsetting impacts over the full sample (Figure 3). In part, this has reflected patterns in the nominal economy forecast errors. While the 2005 Review found that the underestimation of taxation revenue in the first half of the past decade appeared to reflect a series of conservative biases in the forecasting process, methodological improvements appear to have removed these biases. Using the improved methodologies, remaining underestimation of revenue over that time period appears to reflect errors in forecasts of the nominal economy and asset prices, although as discussed in the case study on the GFC and Mining Boom Mark II, there are continuing issues with company tax revenue forecasts.

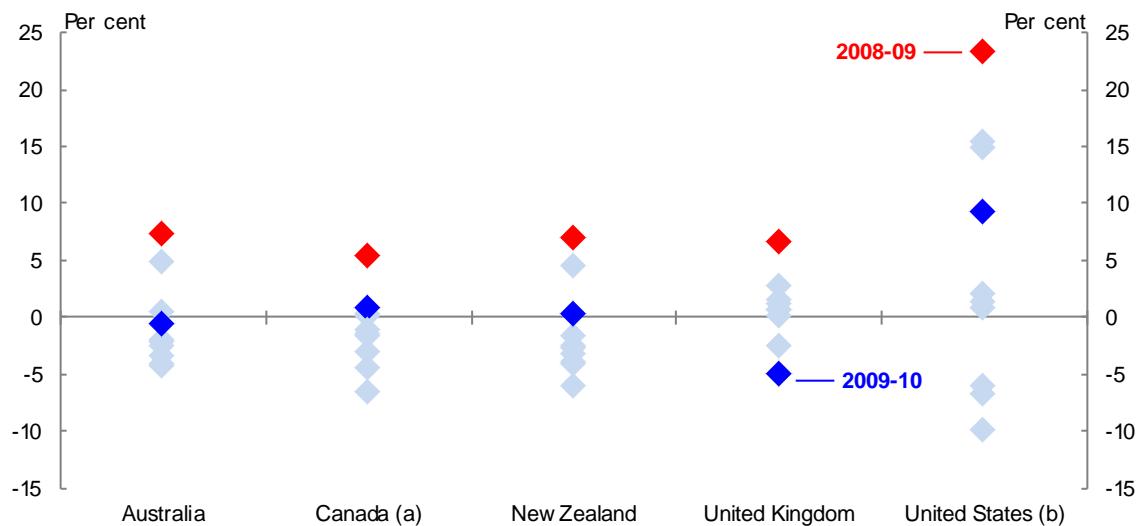
Figure 3: Evolution of Taxation Revenue Growth Forecasts



Taking into account the high degree of difficulty inherent in preparing revenue forecasts, the Review finds that those of Treasury are reasonably accurate. Over the past two decades Budget taxation revenue forecasts have exhibited a MAPE of 2.7 percentage points. This means that the average absolute Budget forecast error is around \$8 billion (in 2011-12 dollars). Treasury's forecasting performance is comparable with that of Access, which is the only other domestic forecaster that has published a significant history of taxation revenue forecasts. As was apparent with the macroeconomic forecast comparison, the overriding impression of the forecast errors of Treasury and Access is the similarity in the error patterns across agencies (with errors for each agency exhibiting significant variation across time).

Treasury's revenue forecasts are comparable with, or better than, those of official agencies overseas over the past decade (Figure 4). Treasury's forecasts also display less bias than some official agencies over this period. It is worth observing that all official agencies overseas significantly over-predicted revenue for 2008-09, the year of the onset of the GFC. The pattern in 2009-10 is less clear: Australia, Canada and New Zealand made quite accurate forecasts, while the United Kingdom overestimated the impact of the GFC on taxation revenue and the United States underestimated its impact.

**Figure 4: International Comparison of Budget Forecast Errors across Official Agencies
Taxation Revenue: 2001-02 to 2010-11**



(a) Canadian data exclude the 2002-03 Budget forecast, which are not available.

(b) Adjusted for post-Budget policy change.

Note: Australia's Budget is published in early May, two months before the Budget financial year; Canada's Budget generally published in February/March, around one month before the Budget financial year; New Zealand's Budget in May, two months before the Budget financial year; the United Kingdom's Budget in March, one month before the Budget financial year; and the United States' Budget in February, eight months before the Budget financial year.

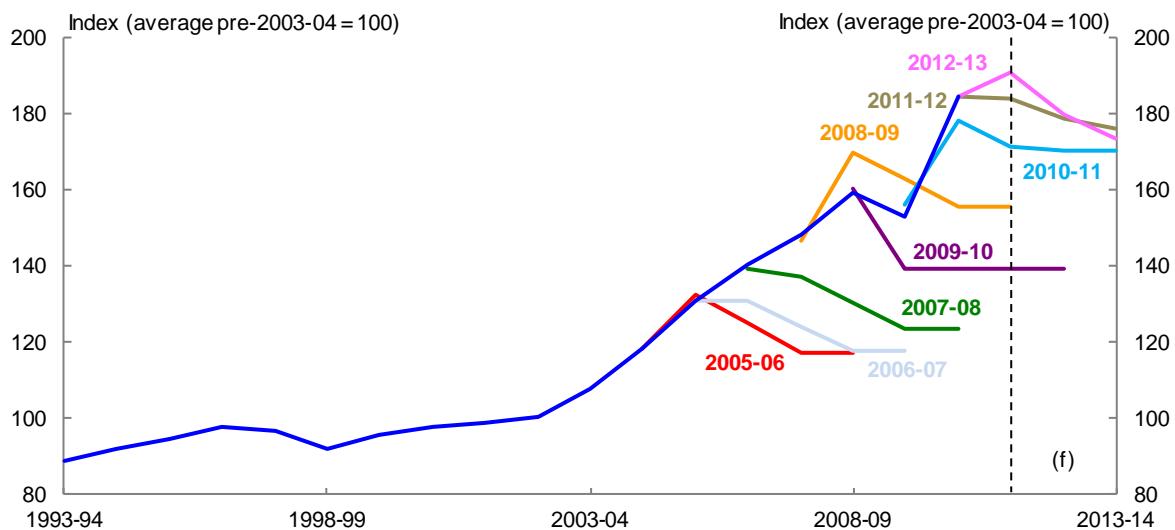
Treasury's taxation revenue forecasts also outperform those generated by a naïve trend forecasting rule, which assumes that the series being forecast simply continues to grow at its recent average observed underlying rate (one, three, five and ten-year moving averages of the forecast series were considered).

A major contributor to the errors in the taxation revenue forecasts are the errors in the macroeconomic forecasts. However, there are additional sources of error that reflect tax-specific factors, such as the timing of the receipt of revenue. As a consequence, the taxation revenue errors are generally larger than the macroeconomic errors. Over the past two decades, the MAPE for the Budget revenue growth forecasts has been around one percentage point higher than the MAPE for the Budget nominal GDP growth forecasts. That said, overall the taxation revenue forecast errors are reasonably well correlated with the nominal economy forecast errors.

The Review also finds that the heads of revenue with the largest forecast errors in recent years have been company tax and capital gains tax. Unsurprisingly, these are also two of the most volatile revenue heads, and they have been particularly challenging to forecast during the GFC and its aftermath. This is discussed in more detail in the case studies.

Case Study 1: Mining Boom Mark I

Rapid rates of industrialisation in Asia, particularly in China, increased worldwide demand for natural resources and, in turn, underpinned a sharp sustained rise in mining output prices through the mid-2000s, and a mining investment boom. In common with many other forecasters, Treasury underestimated the extent of the consequent increase in Australia's terms of trade through the mid-2000s, which led to the underestimation of nominal economic and taxation revenue outcomes (see Figure 5 and 1 and 3, above).

Figure 5: Budget Forecasts of Australia's Terms of Trade

Note: The figure plots the forecast level of the terms of trade against outcomes, with the forecast level derived from forecast growth rates of the terms of trade from successive Budgets, beginning with the 2005-06 Budget.

The Review finds that Treasury's terms of trade forecast errors largely reflected misjudgements of the evolution of the Chinese economy and the mining sector during this period, although, it would perhaps also be fair to conclude that Treasury had adopted a conservative approach to forecasting commodity prices over these years. The misjudgements contributed to commodity prices exceeding Treasury's expectations. The first of these was Treasury consistently underestimating economic growth in China, drawing heavily upon Consensus Economics forecasts, and hence the underlying strength of demand for iron ore and metallurgical coal. Chinese economic growth was underestimated on average by 2½ percentage points per annum over the period 2003 and 2007.

On the supply side, Treasury also overestimated the speed at which global mining production would respond to the rise in mining output prices. Treasury's assessment was based on mining companies' global projections for investment, production and export volumes, which consistently exceeded actual outcomes. In Australia this partly reflected infrastructure bottlenecks and the impact of natural disasters. This misjudgement saw Treasury's forecasts for export volumes consistently overstated over the period 2003-04 to 2008-09.

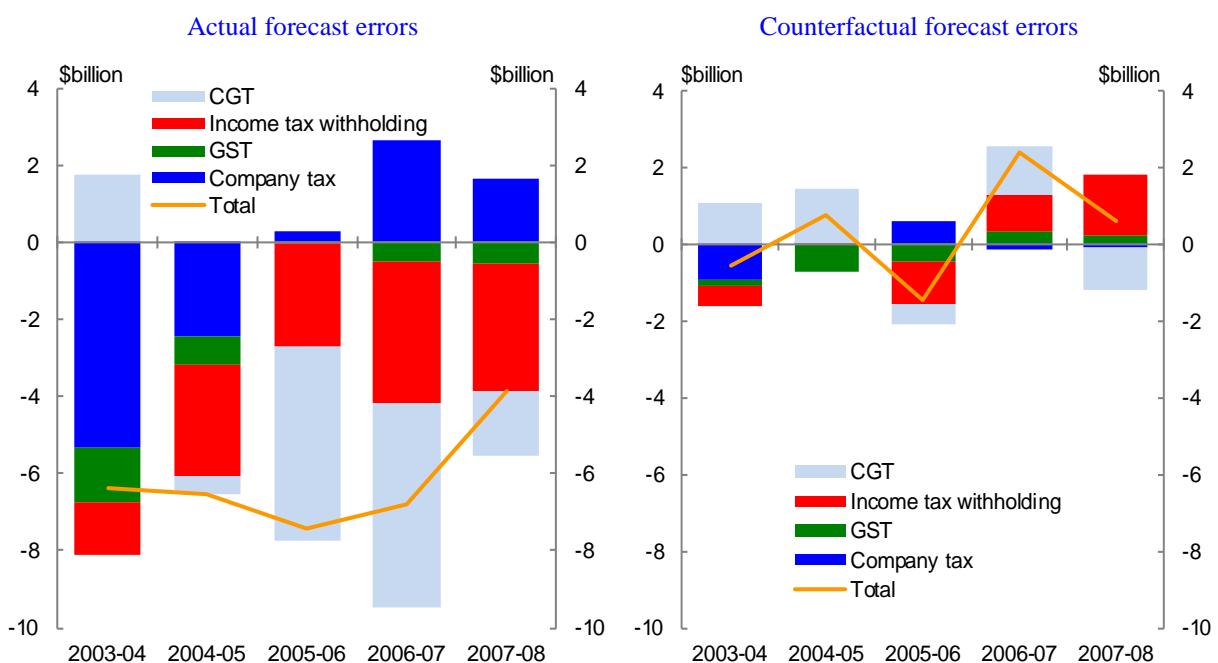
In response to these forecast errors, Treasury has substantially expanded its capability to forecast commodity prices and volumes by investing in a deeper understanding of the prospects for the Chinese and Indian economies, on the demand side, and developments among competing mining producers, on the supply side. In particular:

- as part of the JEFG process, a balance of payments subcommittee has been established to draw upon the expertise of the Bureau of Resources and Energy Economics to forecast the outlook for bulk commodities;
- a dedicated unit has been established within Treasury that focusses on the Chinese economy and Treasury representation in Asia has been enhanced by opening up a new post in India;
- Treasury's business liaison program has been refocused to place greater weight on the mining industry; and
- a major project is underway which uses detailed projections of commodity supply and demand to model the likely outlook for commodity prices through the medium-term.

The Review finds that Treasury also underestimated taxation revenue over this period. This reflected large forecast errors in the income tax withholding, company tax and capital gains tax revenue heads (Figure 6, left hand panel). To examine the extent to which these errors reflected forecast errors of nominal economic growth and outcomes for asset prices, a counterfactual exercise has been undertaken that prepared revenue forecasts over Mining Boom Mark 1 using actual, rather than forecast, nominal economic outcomes and asset prices.

On the basis of the counterfactual exercise, the Review finds that most of the revenue forecasting errors over this period could be attributed to errors in the nominal economy forecasts, rather than any systematic tendency to underestimate revenue during a boom period (Figure 6, right hand panel). While this provides some confidence in the integrity of the revenue forecasting methodology, this is not to downplay the inherent difficulty of forecasting revenue during this volatile period, and in particular the difficulty of forecasting sharp sustained rises in commodity prices and asset prices (such as house and equity prices).

Figure 6: Contribution to Budget Taxation Revenue Forecast Error by Major Head of Revenue



Note: The counterfactual exercise uses a more refined model for forecasting capital gains tax (CGT) than was available at the start of Mining Boom Mark I. The model was implemented from 2006-07, following a review of the CGT forecasting framework, which was undertaken due to the large forecasting error in CGT revenue in 2005-06.

Case Study 2: The Global Financial Crisis and Mining Boom Mark II

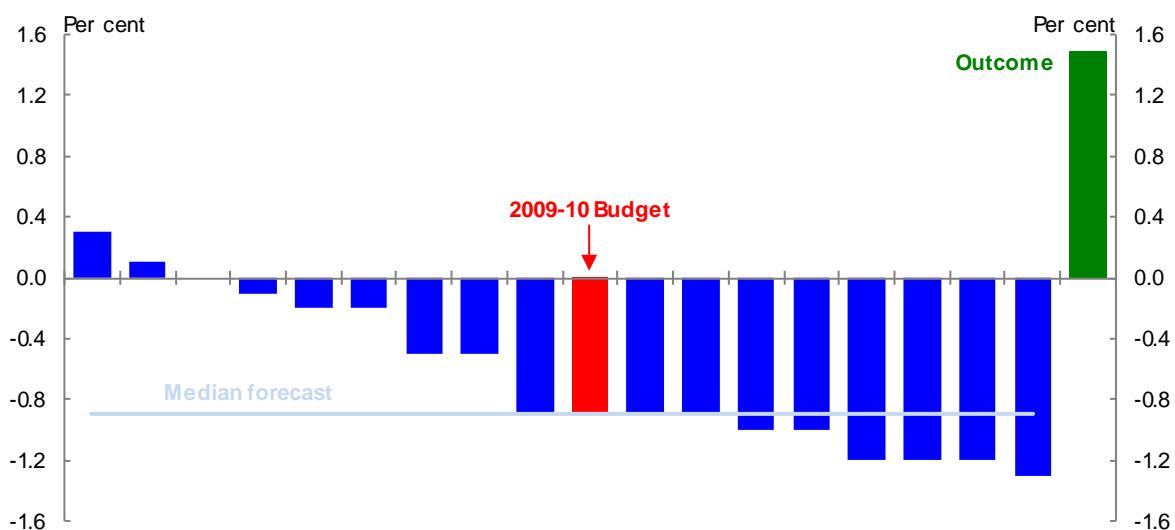
The world economy experienced a severe financial and economic shock in the second half of 2008. The Global Financial Crisis (GFC) began in 2007 with the US sub-prime crisis and the crisis intensified dramatically in September 2008 with the collapse of Lehman Brothers. During this period, financial conditions deteriorated rapidly, financial and real asset prices collapsed, and business and consumer confidence fell steeply. The GFC saw the world economy change course sharply from a five-year period of above-trend growth to the deepest recession since the Great Depression. As the impact of the GFC has subsided, Australia's terms of trade rebounded and reached a new record high in 2011-12, albeit against a backdrop of global uncertainty and more cautious households.

The Australian economy performed better than other advanced economies during the GFC. Although financial conditions were stressed, the financial system held up remarkably well; the economy slowed,

but did not fall into recession; and while unemployment rose, it did so by far less than in many other advanced economies. The strong performance of the Australian economy largely reflected the strength of the Australian financial system and public finances; the rapid deployment of fiscal stimulus measures; the first effects of a significant easing in monetary policy; and a pickup in demand from China which partly offset pronounced external weakness elsewhere. More broadly, it also reflected improved policy and institutional arrangements in Australia following a quarter century of reforms that have made the Australian economy much more resilient to external shocks.⁵

Treasury did not predict the degeneration of the US subprime crisis into the GFC in 2008-09 and subsequently overestimated the impact of the crisis on economic growth in 2009-10. This created large macroeconomic and revenue forecast errors (Figures 1 and 3, above). In particular, in the 2009-10 Budget, at the height of a period of significant global and domestic pessimism, Treasury forecast a recession in that year that did not eventuate. At the time, Treasury's forecast was around the median of the range of forecasts surveyed by Consensus Economics in mid-April (Figure 7). Treasury's forecast for a recession in 2009-10 was underpinned by a moderate expected decline in household consumption and a sharp decline in business investment and exports. In the event, household consumption continued to grow, and the contraction in business investment and exports in 2009-10 was considerably less than forecast.

Figure 7: Forecasts of Real GDP Growth in 2009 (as at April 2009)



Source: Consensus Economics (Survey date 14 April 2009), Treasury (Budget, 11 May 2009).

The Review finds that Treasury's forecasting error for economic growth in 2009-10 largely reflected misjudgements of the efficacy of Australia's policy response and the relatively early, and strong, recovery in economic growth in most of our major trading partners throughout 2009.⁶

Rapid and substantial monetary and fiscal policy stimulus played a critical role in increasing effective demand and the early recovery of consumer and business confidence in Australia. In particular, the stimulus appears to have been large enough and sufficiently rapid to convince consumers and businesses that the domestic slowdown would be relatively mild. This, in turn, led consumers and businesses to continue to spend and led businesses to cut workers' hours rather than laying them off,

⁵ McDonald, T, and Morling, S, 2011, 'The Australian Economy and the Global Downturn, Part 1: Reasons for resilience', *Economic Roundup*, Issue 2, pp 1-31.

⁶ Gruen, D, and Stephan, D (2010), 'Forecasting in the Eye of the Storm', *Address to the NSW Economic Society*, 4 June.

which in turn helped the economic slowdown to be relatively mild.⁷ While the stimulus was explicitly factored into Treasury's forecasts, it was also a contributing factor to the 2009-10 Budget forecast errors.

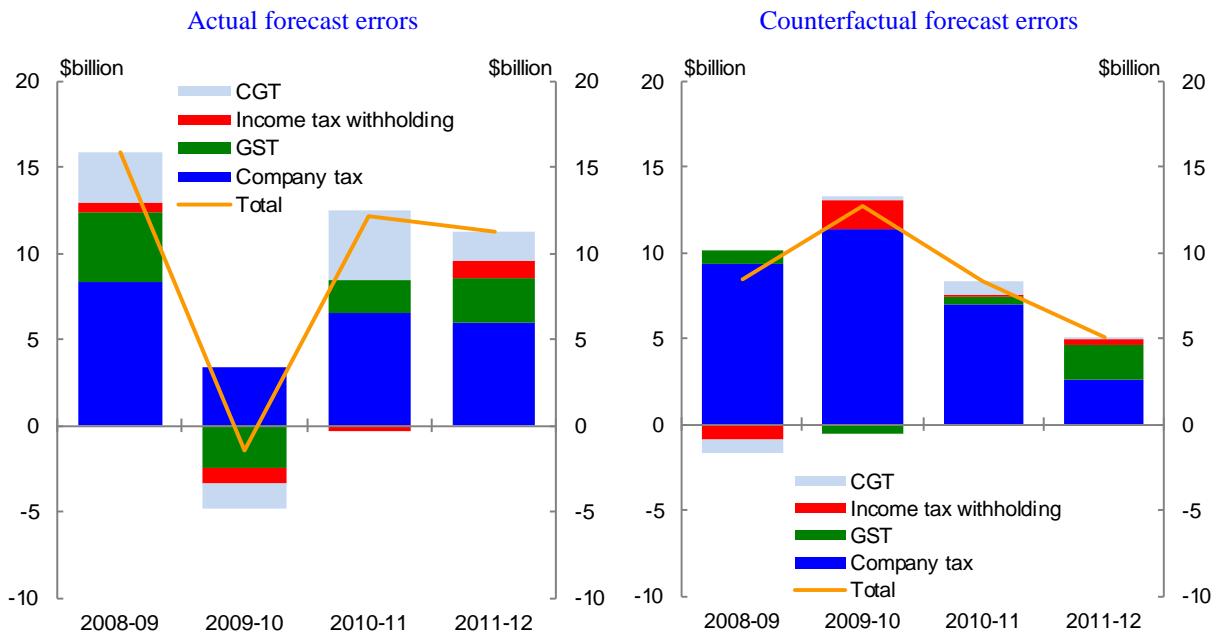
The Australian economy also benefited from the earlier-than-expected, and stronger-than-expected, recovery in economic growth in most of our major trading partners throughout 2009, which in turn was driven by substantial macroeconomic policy stimulus in those countries. In particular, Chinese economic activity shifted into more commodity-intensive sectors, particularly infrastructure spending, associated with the Chinese government's stimulus packages. This supported the domestic outlook for exports and business investment.

The Review observes that the large forecasting errors seen during the GFC highlight the fact that during such extreme events the evolution of the economy is fundamentally less predictable than at other times. As noted, above, a number of official agencies overseas had large forecasting errors during this period (Figure 2). That suggests a case for greater use of risk assessments around the central forecasts, rather than necessarily a major overhaul of forecasting procedures. This leads the Review to make the following recommendation.

Recommendation 8: Scenario analysis is useful as a way of assessing the risks around the economic and revenue forecasts. Simulation models have an important role to play in this regard and further development of Treasury's suite of models may be required to deliver this capability, including in relation to the international economic outlook.

The Review finds that Treasury overestimated revenue growth during the GFC and Mining Boom Mark II. This reflects large forecast errors in the company tax, GST and CGT revenue heads (Figure 8, left hand panel). To examine the extent to which these errors reflected forecast errors in nominal economic growth, a further counterfactual exercise has been undertaken that uses actual, rather than forecast, nominal economic outcomes and asset prices to generate revenue forecasts over this period. The Review finds that the errors for most revenue heads are reduced significantly in the counterfactual (Figure 8, right hand panel). However, in contrast to the Mining Boom Mark I counterfactual, there are significant residual forecast errors in the company tax revenue head, indeed the company tax revenue errors are amplified in the first two years of the counterfactual.

⁷ Treasury estimates that economic growth would have been negative for three consecutive quarters absent fiscal stimulus.

Figure 8: Contribution to Budget Taxation Revenue Forecast Error by Major Head of Revenue

The reasons for the company tax forecast errors are a matter of concern and continue to be investigated. They are likely to reflect in part the poor performance of the company tax forecasting model in cases where sectors of the economy are growing at very different rates, as was observed during the GFC and Mining Boom Mark II. This occurs in two ways:

- First, the company tax forecasting model does not distinguish between the different characteristics of different sectors, such as the capital intensive nature of the mining sector. In this regard, a significant driver of the weaker-than-expected outcomes for company tax was stronger-than-expected growth in depreciation deductions, relating to a surge in mining investment in response to the mining boom.
- Second, the company tax forecasting model does not take sufficient account of companies that operate on substituted accounting periods, in particular the large financial companies that operate on an accounting year ending in September and the large mining companies whose accounting year ends in December. This makes it more difficult to accurately estimate the timing of the receipt of cash payments of corporate tax on underlying corporate profits.

In response to the perceived source of these forecasting errors, Treasury is currently developing a three sector company tax model which splits the economy into mining, finance and insurance and other sectors. This approach better takes account of the different characteristics of these sectors for taxation purposes, for example, the capital-intensive nature of the mining sector, and the measurement of the income of the finance sector in the National Accounts. This approach also makes better allowance for substituted accounting periods.

Notwithstanding these developments, because of the difficulty Treasury has had forecasting revenue, in particular company tax revenue, but also capital gains tax revenue, the Review recommends that:

Recommendation 9: Treasury should give further consideration to the appropriate balance between the top-down versus bottom-up approaches to forecasting revenue.

Recommendation 10: Treasury, in conjunction with the ABS as necessary, should explore further ways of improving the current methodology for forecasting corporate tax, and also

consider alternatives to the current methodology, which could perhaps be used to complement existing approaches.

Recommendation 11: The technical specialist with deep financial market experience employed by Treasury should be tasked with improving the accuracy of the technical assumptions for equity and housing prices that are used to generate the capital gains tax revenue forecasts.

Conclusion

Macroeconomic and revenue forecasting is a core Treasury function. It informs Treasury's advice across a broad spectrum of policy areas. It is a complementary activity to policy formulation and costing.

There is a high degree of difficulty inherent in preparing forecasts. The economic environment has become more volatile recently and profound structural changes are occurring domestically and internationally that are making the forecasting task more difficult.

While the Review has made a number of recommendations for improvements to the forecasting process, the Review finds that Treasury approaches the forecasting task in a very professional manner and the forecasts it generates are broadly as accurate as those of both domestic forecasters and those generated by comparable agencies in countries with similar institutional arrangements as Australia.