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TREASURY WORKING PAPER

99/7

Automatic Fiscal Stabilisers

Kerryn Fowlie*

Abstract

This paper looks at the use of automatic fiscal stabilisers, particularly in relation to New Zealand's experience over the past business cycle. Allowing the automatic stabilisers to operate in response to cyclical fluctuations in output is likely to yield efficiency gains in a country with a sound fiscal position and a credible approach to medium-term fiscal stability. However, automatic stabilisation does increase the potential for fiscal ill discipline. A risk is that an imprudent Government could allow the automatic stabilisers to operate during a downturn and not bank the gains in the upturn. The discipline imposed by the FRA in New Zealand helps ensure that the Government acts prudently. And a sound underlying fiscal position ensures that when policy action is required, it can be undertaken in a measured manner. Reflecting this, the New Zealand Government has allowed the automatic stabilisers to operate to a greater extent during the most recent recession than during the 1991 recession.

**I would like to thank Heather Kirkham for her help with the data and the Appendix.*

Disclaimer: The views expressed are those of the author(s) and do not necessarily reflect the views of the New Zealand Treasury. The Treasury takes no responsibility for any errors or omissions in, or for the correctness of, the information contained in these working papers.

1. Introduction

A full business cycle has now passed since the New Zealand economy underwent an extensive set of fiscal reforms. The fiscal position is now substantially stronger than it was when it entered the 1991 recession. An analysis of the use of automatic stabilisation throughout this business cycle therefore seems appropriate.

When spending plans and tax rates are maintained without change in an economy experiencing a downturn, then lower tax revenues and higher spending on unemployment result in a deteriorating fiscal balance. If an economy is, by contrast, on the upswing of an economic cycle, then maintaining tax rates and spending plans results in rising tax revenue and lower unemployment benefits. These effects are known as automatic stabilisation. If an economy is in structural balance and the only shocks it faces are cyclical, automatic stabilisation will ensure that a country repays as much debt as it accumulates across a cycle.

Our arguments in this paper for the use of automatic stabilisers in a country with a sound fiscal position and stable macro economy are primarily centred on the optimality of tax and expenditure smoothing. Discussions on automatic stabilisation often focus on the additional benefit of smoothing out fluctuations in output. Sound and stable macro policies, in general, will undoubtedly help achieve this. And predictable fiscal policies are also likely to facilitate the operation of monetary policy. However the debate should not lose sight of the welfare gains that automatic fiscal stabilisation, through tax and expenditure smoothing, generates.

This paper is set out as follows. The next section looks at the optimality arguments for automatic stabilisation. Following this, we discuss how automatic stabilisers should operate in the face of different types of shocks. Section four looks at New Zealand's experience with automatic stabilisation over the past business cycle. An appendix is attached that describes how the New Zealand Treasury estimates the cyclically adjusted (or structural) balance.

2. The Optimality of Automatic Fiscal Stabilisation Over the Cycle

All countries have fiscal policies that cause the fiscal position to fluctuate with the state of the economy. The two most well known policies that have this effect are progressive taxation and the unemployment benefit. When economic activity is low, revenue from income and expenditure falls while expenditure on unemployment benefits rise. The resultant deficit is funded by either borrowing or running down reserves.

Our focus in this paper is directed towards the welfare gain that automatic stabilisation, through tax and expenditure smoothing, can generate¹. The costs

¹ Barro, R.J. (1979), On the Determination of the Public Debt, *Journal of Political Economy*, 87, 940-971

of variable tax rates arise from the avoidance and negative incentive effects of requiring high marginal tax rates some of the time. In addition, uncertainty over future tax rates hampers investment decisions. If these activities would otherwise be worthwhile, this avoidance reduces welfare.

The deadweight loss (DWL) of taxation increases more than proportionally to the tax rate. As a result it is less costly to use a constant tax rate to generate a given level of tax revenue than to have a low tax rate one year and a high tax rate the next. Although we are unaware of any empirical evidence currently available, it seems likely that similar arguments will apply to smoothing spending parameters such as benefit rates.

Automatic fiscal stabilisation can also be justified on consumption smoothing grounds, particularly in relation to health and education expenditure. This is best illustrated by way of example. Consider an adverse shock that hits the economy thereby reducing household incomes substantially. This shock also causes a significant deterioration in the fiscal balance. If the Government chooses to cut health or education expenditure in order to arrest the deterioration in its finances, households would need to look for alternative ways to finance this expenditure. This may be impractical for a variety of reasons including liquidity constraints and the level of other expenditure commitments².

If the Government maintained health and education expenditure at the same level, it could borrow to fund the shortfall in its own finances in the place of households. A number of factors, such as fewer liquidity constraints and a lower risk premium suggest that the government could do this more cheaply than households. The Government is therefore likely to be more efficient at consumption smoothing through cyclical downturns than most households are.

The potentially large costs to rapidly changing core government spending parameters, spending levels or tax rates indicate that it is appropriate for a government to allow the fiscal balance to fluctuate over the cycle. That is, the Government can borrow any shortfall in revenue over expenditure as the economy slows so long as it repays the shortfall as the economy gathers strength. If the Government has perfect foresight, automatic stabilisation implies that it should aim to balance the budget across the cycle.

Caveats

However, it may not always be appropriate for the Government to allow automatic stabilisers to operate. Consider, for example, a country with a high initial stock of debt. If the amount of debt accumulated during a downturn in this country is excessively large, total debt servicing costs are more likely to increase to unsustainable levels than in a country with a low initial stock of debt. This can lead to an increase in the risk premium on government debt and a

² It is also likely to be impractical to quickly transfer a large burden of health and education expenditure onto the public.

subsequent increase in the cost of capital for the private as well as the public sector. Debt-servicing costs, in general, will increase. And vicious cycles are thereby created where more and more of the government's operating balance is required for debt repayment. Allowing automatic stabilisers to operate in a country without a sound fiscal position can create further structural problems in the medium-term.

Similar arguments can be made with respect to large automatic stabilisers. If cyclical fluctuations in tax revenue and government expenditure are very large, the debt dynamics following a cyclical downturn could place pressure on the medium-term fiscal position. The growth prospects of the economy could be inhibited because of a higher risk premium and a potential loss in investor confidence. Consequently, structural adjustment may be required.

Credibility, Transparency and Fiscal Discipline

Allowing the fiscal position to fluctuate with the cycle can also increase the potential for fiscal ill discipline. One of the main risks is that imprudent governments could allow the automatic stabilisers to operate during a downturn and not bank the gains during the upturn. That is, the Government could allow the fiscal balance to deteriorate as a result of a cyclical downturn but then still cut taxes or increase expenditure as the fiscal balance improves during the upturn. Fiscal disciplinary measures, such as New Zealand's Fiscal Responsibility Act (FRA), help ensure that governments are acting prudently and establishing a track record for a consistent fiscal strategy that will improve their credibility.

By increasing the transparency of the Government's policy actions, the FRA imposes a considerable amount of fiscal discipline on the New Zealand Government. The FRA imposes no binding limits on the level of the deficit, as with the Maastricht criteria for example. However temporary departures from the principles of the Act must be explained, as well as the approach and the time the Government intends to take to return to its principles.

One of the principles of the FRA is that the Government will run operating surpluses until prudent debt levels are reached. If the Government consciously chooses to allow automatic stabilisers to operate in response to cyclical downturns in output, it must therefore also commit that the subsequent cyclical upturn will restore the fiscal position to its original state. The disclosure requirements of the Act, in particular the requirement that the Government project and publish fiscal trends over a ten-year period at least, provides the public with a means to assess whether the Government can meet its commitments. If not, the disclosure requirements make it clear that policy action is required to maintain the credibility of the Government's fiscal policy. In this sense, transparency imposes disciplines on government behaviour without mandating sanctions for breaching pre-imposed deficit limits. Transparency therefore helps reduce the potential for fiscal ill-discipline and inconsistent fiscal strategies over the cycle.

3. Automatic Stabilisation in the Face of Different Shocks

The state of a government's finances and credibility are an important factor to considering whether automatic fiscal stabilisation is an appropriate course of action. This then raises the question of what governs when automatic stabilisers should be allowed to operate in a country with a sound fiscal position and stable macro-economy. When is fiscal consolidation a more appropriate course of action?

Traditional analysis argues it is appropriate for a country to allow the fiscal position to automatically fluctuate counter-cyclically with the state of the economy. As discussed in section two, this analysis is usually correct when shocks to a country's economy are cyclical. It can also be applied to shocks that are only temporary.

An adverse but temporary shock will reduce nominal tax revenue in the economy initially. However as long as automatic stabilisers are left to work on the upside, in the medium-term most lost revenue will be regained. The underlying (or structural) fiscal balance will therefore be largely unaffected.

If shocks are long-lasting, however, a country will find that changes in its fiscal position resulting from the changes in the economy are larger so requiring a larger adjustment to the Government's fiscal policy. Consider, for example, a drop in the rate of labour market productivity throughout the economy. Economic growth would slow and this could initially cause a rise in public debt levels. If the drop were permanent, the Government would not be able to repay the debt accumulated. If an adjustment were not made, debt would continue to accumulate across the cycle, prompting the emergence of vicious debt cycles.

In this were the case, some discretionary measures would clearly be required. Structural changes, such as permanent cuts to expenditure or efficiency gains, would need to be made to ensure that debt did not accumulate indefinitely and that the country's growth prospects were not further impeded.

Decision Making Under Uncertainty

Assessing the nature of a shock at its onset is, however, fraught with difficulties. No government has perfect foresight. It is often difficult to project how long a shock is likely to last. Even deciphering what has actually caused a sharp downturn or upturn in growth can be difficult.

These difficulties are compounded by problems involved in estimating the level of the structural balance, that is, where the Government's budget balance would have been if the impact of the business cycle had been removed from the fiscal balance.

Measures of the structural balance depend critically on estimates of potential output. This is because:

- the output gap = (actual GDP – potential GDP)/potential GDP; and
- the cyclically adjusted balance (CAB) adjusts revenue and expenses based on estimated sensitivities to the output gap.

Potential growth can be estimated in a variety of ways, and although the trends in output are broadly consistent between the methods, the level of potential GDP at a particular point in time is likely to vary significantly. This variance flows through into estimates of the CAB.

In addition, current measures of potential output have shown a tendency to follow movements in actual output with a lag. How well the structural balance removes the effect of the cycle is therefore questionable. As a consequence basing policy decisions solely on projections for the structural balance is often difficult.

Given the difficulties involved in predicting the nature and duration of a shock, the New Zealand Treasury has developed a Long Term Fiscal Model to project fiscal trends over a ten-year period. Different scenarios illustrate what the fiscal position might look like under a range of economic and fiscal policy assumptions. Each year a Fiscal Strategy Report is published in which the consistency of these “progress outlooks” is assessed in relation to the Government’s long-term objectives for fiscal policy and the requirements of the FRA.

The progress outlooks provide us with another means of analysing the soundness of the fiscal position. New information is incorporated into each progress outlook published and this can alter the outlook for the medium-term fiscal position. Policy is adjusted according to these changes. If, for example, following an adverse shock the ten-year progress outlooks show that progress towards our net debt target has been seriously affected, some structural tightening is likely. Conversely, if progress outlooks indicate surpluses will rise consistently and substantially over the ten-year period, tax cuts or priority expenditure increases may be considered.

The difficulty of decision-making under uncertainty reinforces the importance of a sound starting position for, and a medium-term focus to, fiscal policy. A robust underlying position provides the fiscal authority with more time to analyse the nature and likely impact of a shock without seriously harming the growth prospects of the economy. If action is required but delayed due to uncertainty, debt is less likely to accumulate to unsustainable or economically damaging levels. A sound starting position for fiscal policy thereby enables better quality analysis of a shock and lowers the risk of misidentification. It also helps ensure that if mistakes are made, they do not necessitate a sharp fiscal adjustment.

4. New Zealand's Experience Through the Past Business Cycle

A full business cycle has now passed since the New Zealand economy underwent an extensive set of fiscal reforms. In 1991, the economy entered recession with a structural deficit around 3% of GDP, net public debt close to 50% of GDP and the Government had very little fiscal credibility. The economy picked up strongly through the mid-1990s. Following the fiscal consolidation, New Zealand's structural position improved substantially. And a series of tax cuts and priority expenditure increases ensued. By 1998, the economy was running a structural surplus of around 2.3% of GDP and net debt had been reduced to around 24% of GDP. Five years of fiscal surpluses had substantially improved the Government's track record. And the discipline imposed by the FRA, enacted in 1994, suggested that this improvement would last.

The 1991 Recession

By 1990, it was becoming obvious that New Zealand's fiscal position was not sustainable. Although fiscal consolidation had been pursued during the late 1980s, progress had been uneven at best. Moreover the government debt position had continued to deteriorate. At the same time, the economy was slipping into recession as the world economy slowed, business confidence was falling and the agricultural sector was weakening. Consequently, the deterioration in the fiscal position was gathering speed. In the 1990 Post Election Briefing, net debt was projected to rise above 50% of GDP on unchanged fiscal policies.

In December 1990, the Government announced a number of sizeable expenditure reductions³, which included substantial reductions in benefit payments. The expenditure cuts announced were designed to save \$245 million (0.3% of GDP) in the 1990/91 fiscal year and around \$1 300 million (1.8% of GDP) over the full 1991/92 fiscal year. This, in conjunction with further fiscal consolidation measures announced in the 1991 Budget, caused the structural deficit to be virtually eliminated in the 1992/93 fiscal year. Increasing surpluses were recorded in the years thereafter.

Questions have been raised as to whether the 1991 fiscal consolidation tipped the New Zealand economy into recession. While no empirical analysis has been done to date on the impact on output of the consolidation, it does seem likely that the initial announcement in December 1990 contributed to the sharp downturn in confidence. Both the speed and the extent of the consolidation surprised markets and monetary policy was given little time to react. However, despite the fragile state of the economy in 1991, the Government was not in a position to adjust its finances smoothly. The medium-term fiscal position was already very weak. A vicious debt circle was emerging and inaction would likely have necessitated an even more severe fiscal adjustment sometime in the future.

³ Economic and Social Initiative – December 1990, Statements to the House of Representatives

A credible commitment to consolidation, however, had the potential to increase confidence in the New Zealand economy. In retrospect, it appears to have successfully achieved this. The expenditure cuts and further consolidation measures announced in the 1991 Budget preceded a period of very strong economic growth. Interest rates fell throughout 1991. In particular, long rates in New Zealand fell around 200 basis points more than international rates in the first half of 1991 indicating a fall in New Zealand's risk premium. The pick-up in confidence in the first half of 1991 more than compensated for the fall at the end of 1990. Both consumption and investment spending subsequently rose. The Government's fiscal credibility improved substantially, which helped lead to an upgrade in New Zealand's credit rating from AA- to AA+ within the space of five years.

The 1993 to 1996 Upturn

Projected improvements in the fiscal position can be quite substantial during a cyclical upturn, as witnessed by New Zealand throughout the mid 1990s. In mid-1995, the Government was projecting a rise in the operating surplus to nearly 8% of GDP if expenditure and tax plans were unrevised. Towards the end of 1995, the Government announced it would divert some of its excess funds away from debt repayment and towards a package of tax cuts and priority expenditure increases. This fiscal easing was further augmented by \$5 billion worth of new spending spread over 1997/98 to 1999/2000, which formed part of the Coalition agreement between the two parties of the newly elected Government. Despite this structural change, forecasts at that time indicated that the Government would make steady progress towards its debt objective.

Whether the extent of the reduction in the operating surplus at this time was appropriate is still difficult to determine. Estimates of the CAB have deteriorated since 1997, but New Zealand has also been affected by a number of other shocks discussed below. The appropriateness of the Government's actions depends on whether the projected improvement in the fiscal surplus actually reflected a permanently higher level of economic activity in the New Zealand economy. If the improvement was primarily cyclical, not allowing fiscal surpluses to consolidate may have slowed progress towards the debt target by more than was necessary. And the structural reduction in the fiscal surplus may have, in hindsight, been larger-than-desired.

The 1998 Recession

The New Zealand economy suffered a reasonably sharp slowdown during the first half of 1998, as regional droughts, the Asian economic downturn and financial market volatility came on top of an economy already slowing as a result of tighter monetary policy. The downturn, in conjunction with the move in the mid-90s towards more expansionary fiscal policy, caused the Government's operating surpluses to shrink and debt repayment slowed. Small deficits were forecast for the first time in six years.

In considering to what extent automatic stabilisers should be allowed to operate during the 1998 recession, the Government had to take account of two concerns. First, although the Government had made considerable progress towards its fiscal targets for expenditure and debt it had yet to meet them. This suggested that, in the face of the 1998 downturn, the Government needed to be cautious to convince the public that it remained committed to reaching its medium-term fiscal targets. Allowing too much automatic stabilisation could, although perhaps unjustifiably, have had an adverse impact on the credibility of fiscal policy.

Second, the Government recognised that the shocks hitting the economy in the first half of 1998 had the potential to have a relatively serious and long lasting impact on the New Zealand's growth prospects and ability to continue debt repayment in the medium-term. The medium-term fiscal position was already looking less robust, and the structural balance had begun to deteriorate slightly. Faced with this uncertainty, the Government considered it would be prudent to err on the side of caution and undertake some fiscal consolidation immediately.

The consolidation totalled around \$750 million per annum spread over 1997/98 to 1999/2000, and wound back a portion of the earlier fiscal easing. It comprised two main parts. Fiscal forecasts for the New Zealand Government are prepared based on set spending intentions for the following three years. In mid-1998, savings were made by reducing the unallocated portion of these spending intentions, thereby cutting the provision the Government had made for spending over the following three years.

At the end of 1998, the "Policies for Progress" package was announced. This included measures primarily designed to strengthen the medium-term fiscal position. One of the main fiscal savings of this package was a change to superannuation policy. The change was estimated to save the Government \$2.1 billion over the following ten years. Though it provided the Government with only limited short-term savings, the savings in the medium-term were far more substantial.

The policy changes announced during the course of 1998 were aimed at restoring the medium-term fiscal position. They were not designed to fully offset the effect of the automatic stabilisers. New Zealand's underlying fiscal position was considered sufficiently sound to enable some automatic stabilisation in response to the downturn without detrimentally harming the credibility or growth prospects of the economy. Instead, the changes bought the Government more time to assess the nature of the shock. At the same time, the focus on strengthening the medium-term fiscal position was expected to support investor confidence in the New Zealand economy.

Change in New Zealand's Approach Over the Cycle

The consolidation since 1991 has been largely successful. The Government has made considerable progress towards its long-term fiscal targets, although it has yet to meet them. A track record of consistent surpluses and debt repayments has enhanced the Government's credibility. And the discipline imposed by the FRA should help ensure that this continues.

The success of the consolidation has meant that the New Zealand authorities are now able to adjust policy in a more measured way to an adverse shock. When the underlying fiscal position is stronger, the need for hasty fiscal responses is reduced. As more information about the size and nature of a shock is received, policy can be adjusted accordingly. In 1998, for example, the first \$300 million per annum of the expenditure reductions was announced in the May 1998 Budget. In July, as it became obvious that the international situation was worse than originally anticipated, the Government announced a further \$300 million per annum in savings. And in September, as the progress outlooks began to show some deterioration in the medium-term fiscal position, the "Policies for Progress" package was announced.

The table below illustrates the extent of automatic stabilisation, defined as the difference between the cashflows from operations and the CAB⁴, since the early 1990s. As the Crown did not produce accrual accounts until 1992, estimates of the automatic stabiliser effects prior to this are not available.

Table 2: Size of Automatic Stabilisers (%GDP(E))⁵

1992	1.41%
1993	1.45%
1994	0.23%
1995	-0.26%
1996	-0.18%
1997	-0.03%
1998	0.50%
1999	1.31%
2000	1.42%
2001	1.30%
2002	0.71%

⁴ Details of how the cyclically adjusted balance is estimated are included in the Appendix.

⁵ Based on DEFU 1998 Projections

5. Conclusion

On theoretical grounds the case for allowing automatic stabilisers to operate in response to cyclical fluctuations in output is strong. If a country has a robust fiscal position and a credible Government, smoothing tax rates and spending parameters across the cycle is likely to generate greater welfare gains than attempting to balance the budget at every point in the cycle. If, however a country's fiscal position is not robust or its Government not seen to be credibly committed to prudent fiscal policy, the potential destabilising effects of excessive debt accumulation should be considered before the automatic stabilisers are allowed to operate.

The New Zealand economy has undergone a significant period of fiscal reform over the 1990s. In 1991, it was clear that the fiscal position was unsustainable. Fiscal policy had little credibility and allowing the automatic stabilisers to operate to any great extent would likely have exacerbated the vicious debt cycles already emerging. By 1998 New Zealand had made considerable progress towards meeting its long-term targets, although it had yet to meet them. The stronger starting position meant that a hasty response to the deterioration in the Government's finances was not necessary. The Government considered it prudent to allow some automatic stabilisation. However, in order to maintain the credibility it had gained and sustain investor confidence, measures were undertaken to improve the robustness of the medium-term fiscal position.

One of the most important lessons learnt through this business cycle is the importance of allowing automatic stabilisers to operate on the upside as well as the downside. It is difficult to say whether the extent of the fiscal expansion in the mid-1990s was appropriate. However by highlighting the difficulty of decision-making under uncertainty, this experience has reinforced the need for a robust underlying fiscal position, credibility and a medium-term focus to fiscal policy.

The discipline imposed by the FRA in New Zealand helps to ensure that the Government maintains a prudent fiscal strategy across the cycle. The FRA requires the Government to project and publish fiscal trends over at least a ten-year period. If these outlooks indicate that the Government is not making satisfactory progress towards its long-term fiscal targets, the disclosure requirements make it clear that some policy action is necessary to maintain the credibility of the Government's fiscal policy. If, however, the medium-term position is strong, the Government need not adjust policy in response to cyclical fluctuations in its fiscal balance.

Measuring the Cyclically Adjusted Balance⁶

The New Zealand Treasury has developed a Cyclically Adjusted Balance (CAB) model that estimates what a government's budget balance would be if the impact of the business cycle was removed from the fiscal position. The difference between the CAB and the cashflows from operations estimates the size of the automatic stabilisers.

Potential Output using STAMP

The most important step in calculating the CAB is the output gap, measured as potential output less actual (or forecast) output. We use the STAMP model (Structural Time Series Analyser, Modeller and Predictor) to estimate this.

This method models real production GDP as a function of labour inputs, capacity utilisation, and a stochastic trend. The model estimated was:

$$GDP = \alpha + \beta T + \theta \ln(PWA \bullet (LF / PWA) \bullet (Emp / LF) \bullet (Hours / Emp)) \\ + \omega \ln(CUBO) + \sigma GST + seasonals + \varepsilon$$

where:

<i>GDP</i>	=	ln(actual real production GDP)
<i>T</i>	=	Stochastic time trend
<i>PWA</i>	=	Working age population
<i>LF</i>	=	Labour force
<i>Emp</i>	=	Employment
<i>Hours</i>	=	Hours worked
<i>CUBO</i>	=	New Zealand Institute of Economic Research measure of capacity utilisation
<i>GST</i>	=	Dummy for the introduction of GST in September 1986

On estimation of an acceptable equation, potential output can be calculated by substituting "optimal" data for capacity utilisation and labour contributions.

- the actual series for employment was replaced with the estimated non-inflationary rate of employment (1-NAIRU)⁷;

⁶ The Cyclically Adjusted Balance, Internal Treasury Paper, 1997

⁷ Estimates of the NAIRU for New Zealand using a conventional Phillips curve yields implausible results. The NAIRU was estimated using a simple smoothing technique to provide an estimate of trend unemployment, and then subjectively adjusted after analysis of supplementary labour market information. Additional information included, demographic factors, relative minimum wages, the degree of unionisation of the work-force, and benefit levels. The chosen NAIRU increases from around 2% in 1980 to a peak of 7.5% prior to the introduction of the Employment Contracts Act. The NAIRU declines to 6.5% by June 1996 following declines in structural unemployment. Clearly the resulting NAIRU is highly subjective, however it was necessitated by the absence of better estimates of the NAIRU (which is a major task in itself).

- hours per employee was replaced with average hours per employee over the sample period;
- the actual series for labour force participation was replaced with the average rate of participation over the period;
- the actual series of capacity utilisation was replaced by a series in which all observations were equal to the non-inflationary level of capacity utilisation.

Elasticities

The effect of the business cycle on the operating balance is calculated by combining the output gap with revenue and expense elasticities as described below.

Revenue

Cyclically adjusted revenue at time t is measured by the elasticity (ϵ) of the item i with respect to changes in output, adjusted for tax collection lags:

$$revenue_{it}^* = revenue_{it} \bullet [\theta \bullet (1 + \epsilon_i \bullet gap_t) + (1 - \theta) \bullet (1 + \epsilon_i \bullet gap_{t-1})] \quad (1)$$

where the asterisk denotes the adjusted value and the gap is defined by:

$$gap_t = (GDP_t^* - GDP_t) / GDP_t^* \quad (2)$$

and θ represents the fraction of tax receipts in any given year which results from income over the same year.

Table 1: Elasticities and Lag Weights

	Elasticity	Lag weight (t)	Lag weight (t-1)
Individual Income Tax ⁸	1.12	0.9	0.1
Company Tax	1.0	0.8	0.2
Other Direct Tax	1.0	0.9	0.1
GST	1.0	0.9	0.1
Excise Duties	1.0	0.9	0.1
Other Indirect Tax	1.0	0.9	0.1
Interest Income	0	0	0
Dividend Income	1.0	1.0	0

⁸ The elasticity is greater than one, reflecting the graduated nature of the New Zealand individual income tax system.

SOE/CE surplus	1.0	1.0	0
Other Income	1.0	1.0	0

The elasticities reflect the historical responsiveness of revenue components to movements in economic activity. As with any elasticity estimates they are open to considerable debate and uncertainty.

Expenses - Unemployment

Cyclical unemployment is estimated via an Okun's law approach. Cyclically adjusted unemployment is derived using the output gap and the Okun coefficient (β), which is assumed to be 2.0⁹.

$$U_t^* = U_t - \left(\frac{1}{\beta}\right) \bullet (-gap)_t \quad (4)$$

where:

U = actual unemployment rate

U^* = benchmark unemployment rate

Cyclically adjusted unemployment expenditure is assumed to move proportionally to the ratio of unemployment to benchmark unemployment.

$$une_t = av.benefit_t * beneficiaries_t * \left(\frac{U_t^*}{U_t}\right) * 52 \quad (5)$$

where:

une = unemployment expenditure

$av.benefit$ = average weekly benefit

$beneficiaries$ = number of unemployment beneficiaries

⁹ Okun's results suggested a 3-to-1 link between output and unemployment. Results for New Zealand are slightly higher, possibly reflecting significant structural reform.