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Automatic Fiscal Stabilisers: Implications for New Zealand

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Abstract:

Automatic fiscal stabilisers, or the cyclical components of the budget balance, are larger in New Zealand than in the average OECD country, reflecting both higher sensitivity to the economic cycle, and a more volatile cycle. Fiscal vigilance is especially important in New Zealand. Large projected operating surpluses could easily disappear if lower economic outcomes are mistakenly assumed to be cyclical. But, automatic stabilisers are difficult to use in a policy framework as empirical estimates of the cyclical budget balance vary significantly. While the estimated trend in automatic stabilisers is broadly similar, the level varies significantly, such that at any point in time a 'structural surplus' may be dependant on the estimation method.

CONTENTS

1. INTRODUCTION

The operation of fiscal policy has changed considerably during the past 50 years. Concerns about using discretionary fiscal policy have resulted in greater emphasis on the role of automatic fiscal stabilisers to smooth the economic cycle. Discretionary changes in fiscal policy have been increasingly assigned to medium to long-term objectives (see for example Taylor, 2000).

This paper investigates the relative size of automatic stabilisers in New Zealand, and draws policy implications. The difficulty of using automatic stabilisers for fiscal management, given their variability under different estimation techniques, is discussed.

Section 2 of this paper provides an overview of the literature and evidence around the effectiveness of automatic stabilisers. Section 3 compares the size of automatic stabilisers in New Zealand with other OECD countries. The policy implications for New Zealand are discussed in light of the Fiscal Responsibility Act (1994) and its prudence requirements in section 4. Alternative estimation techniques are compared and the results are found to be highly sensitive to output gap estimates in sections 5 and 6. Section 7 concludes while the Appendix provides further technical detail.

2. AUTOMATIC FISCAL STABILISERS – A THEORETICAL OVERVIEW

The actual government budget balance includes structural (invariant to the cycle) and cyclical components, and can be represented as:

Actual budget balance = structural + cyclical[1]

The operation of automatic fiscal stabilisers assumes that the government holds tax and benefit payment <u>rates</u> constant over the economic cycle. The alternative is to change tax and benefit rates each year sufficient to maintain constant dollar <u>values</u> of tax and spending to ensure that the government accounts balance each year across the economic cycle.

Effects on the economy

Automatic fiscal stabilisers are the variation in the budget balance as a result of an exogenous aggregate demand or real GDP shock (represented by *cyclical* above). For example, an exogenous cyclical shock such as a contraction in aggregate private sector demand, will tend to reduce tax revenue while increasing unemployment benefit spending, thereby reducing the government's budget balance. The consequential automatic increase in government spending is likely to help mitigate the effect of the initial adverse shock on aggregate demand.

The stronger this automatic stabiliser effect is, the less need there is for discretionary fiscal policy action as a result of the cycle. This is important if discretionary policies are subject to irreversibility problems (Goff, 1998) and if they adversely affect the credibility of fiscal policy.

There is also a widely held view that automatic fiscal stabilisers act more rapidly than other stabilisation tools. Automatic fiscal stabilisers do not involve the "inside lag" that typically

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[1] A more detailed description of the calculation can be found in Section 5 and the Appendix.

accompanies a discretionary change in fiscal policy. It is also argued that they involve a shorter "outside lag" that typically characterises monetary policy.[2]

Furthermore, automatic stabilisers "insure" individuals against the impact of potential job loss. Cohen and Follette (1999) argue that the government is better placed to provide this insurance to individual taxpayers as it can diversify across all taxpayers.

Automatic stabilisers also help liquidity-constrained households smooth consumption, which they are not able to do themselves as they are unable to borrow against future labour income. Temporary tax rate changes, which would be required if automatic stabilisers were prevented from working, would directly impact on the consumption of liquidity constrained households, even though households know the tax rate change is likely to be reversed.[3]

Limits on use

Correctly identifying the type of shock as either permanent or temporary is important to ensure the government reacts appropriately. If a shock is permanent, but treated as temporary then the fiscal stance would be inappropriate – either too tight or too loose. Determining the nature of the shock can be difficult, suggesting that budget prudence is advisable. The experience of the UK provides an example. In 1993/94 the actual level of output was over 9 per cent lower than the illustrative projections for that year in the 1990 Financial Statement and Budget Report (FSBR), leading to a sharp deterioration in public finances (HM Treasury 1997).

Additionally, automatic stabilisers need to be allowed to run on both the up and down sides of the cycle (Fowlie, 1999). There is a temptation for governments to spend the upside gain of economic cycles and then have to finance the fiscal cost of a downturn through borrowing. This can lead to ratcheting debt levels over time (Skilling, 2001).

As automatic stabilisers may impact on domestic interest rates, Pesaran and Robinson (1997) argue that cyclical government borrowing is undesirable if a government has to make significant demands on the domestic capital market.

Discussion on effectiveness

Macro-econometric models have been used to estimate the effect automatic stabilisers have on the real economy. OECD simulations (1999a) using the INTERLINK model estimate that automatic stabilisers reduced output volatility in the 1990s by between 25-33 per cent in the US and France, 50 per cent in the Netherlands, and 33 per cent for New Zealand.

A number of studies have examined the effect of automatic fiscal stabilisers on the US economy. Cohen and Follette (2000) using the US Federal Reserve Bank model suggest that automatic fiscal stabilisers partially damped aggregate demand shocks but do not offset aggregate supply shocks. A general real business cycle model simulation by Christiano and Harrison (1999) shows the gains from automatic stabilisers in the tax

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[2] "Inside lag" refers to the time taken to implement a change in policy; while "outside lag" refers to the time it takes to affect the economy once implemented.
[3] New Zealand macro-econometric models generally assume a proportion of liquidity-constrained households between 25% and 30% (Rae, 1994, and Black et al 1997); the Federal Reserve Bank model assumes 10% of US households are constrained (Cohen and Follette 2000).

system are largely through their effect on reducing output volatility.[4] Romer (1999) claims that automatic fiscal stabilisers contribute 0.85 percentage points to the real growth rate in the year following troughs.

Blanchard (2000) suggests that the results are not surprising given the assumptions in most of the models. The OECD INTERLINK model is New-Keynesian in the short run, ensuring a role for automatic stabilisers, while the US Federal Reserve Bank model rules out Ricardian equivalence in the consumption function specification.

However, Blanchard (2000) notes if automatic stabilisers work then output volatility should be smaller in countries with larger governments. Scatter plots of government size and output variability for OECD countries show the expected inverse relation. In addition, consistent with Romer (1999), he observes that government size has increased over the past century and output volatility has fallen as well. Karras and Song (1996) find a negative relationship between output volatility and size of government, significant at the 10% level for 24 OECD countries over 1960 to 1990. However, larger automatic stabilisers are not necessarily preferable, as the size may indicate a high tax burden or an overly generous benefit system, both with potentially large deadweight costs.

3. THE SIZE OF AUTOMATIC FISCAL STABILISERS IN NEW ZEALAND AND THE OECD

This section examines the size of automatic stabilisers in New Zealand relative to the average OECD experience. Governments generally allow automatic stabilisers to operate to some extent, given the economic benefits. However, the size of automatic stabilisers is important for government budget planning and to be able to judge progress towards fiscal targets throughout the cycle.

New Zealand results

OECD calculations over the 1992-2000 period show that automatic stabilisers (that is the cyclical component of the fiscal balance) tend to be more negative in New Zealand during a recession, but with a limited upside in a boom relative to the rest of the OECD (see Figure 1). For example, in the early 1990s recession automatic stabilisers were 3.2% of GDP in New Zealand, compared with 1.6% in the United Kingdom, while the mid-1990s peak in automatic stabilisers was only 0.5% for New Zealand compared with 0.7% for the United Kingdom. [5]

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[4] In addition, for a selection of articles on automatic fiscal stabilisers in a real business cycle framework, see Hairault, Henin and Portier (1997).
[5] The UK estimate that a 1% increase in output relative to trend will increase the budget by 0.4% of GDP in year one and 0.3% in the following year. See HM Treasury (1999b).

Figure 1. A cross country comparison of the cyclical component of the Government operating balance: OECD model
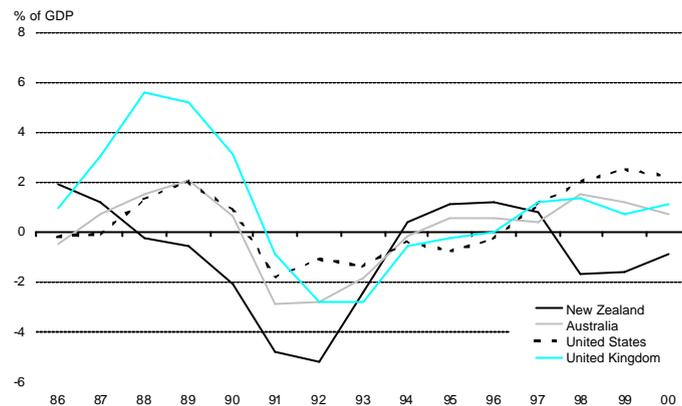
Source: OECD Economics Department (1999a)

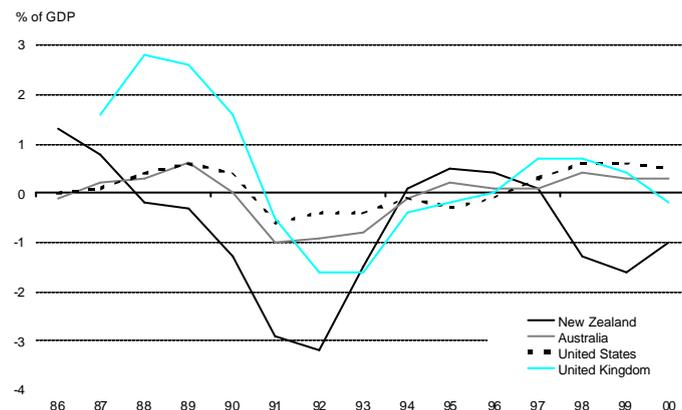The relatively large size of New Zealand's automatic stabilisers reflects both higher responsiveness of government spending and revenue to deviations from trend growth and larger deviations from trend growth.

Figure 2. A cross country comparison of output gaps

Source: OECD (1999b)

The high correlation between OECD output gap and automatic stabiliser estimates is clear from comparing Figures 1 and 2. While New Zealand was undergoing substantial reforms over 1986-2000 (Silverstone, Bollard and Lattimore, 1996), volatile economic growth is not unusual in New Zealand. Over 1960 to 1990 New Zealand's economic growth was volatile relative to other OECD countries with a standard deviation of 3.06% compared to the average of 2.22% (Karras and Song 1996).

The two main influences on the size of the responsiveness of the budget balance to the cycle are the relative size of the government sector and the tax and expenditure elasticities. If the government represents 40% of the economy, then it is intuitive that automatic stabilisers will be larger as a percent of GDP, than if the government is only 10% of the economy. Van den Noord (2000) finds that size of the government sector explains just under 50% of the sensitivity in 1999.

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Figure 3. Importance of size of government, extract from Van den Noord (2000)

Figure 1. Cyclical sensitivity of the fiscal position and government size, 1999
Per cent of GDP
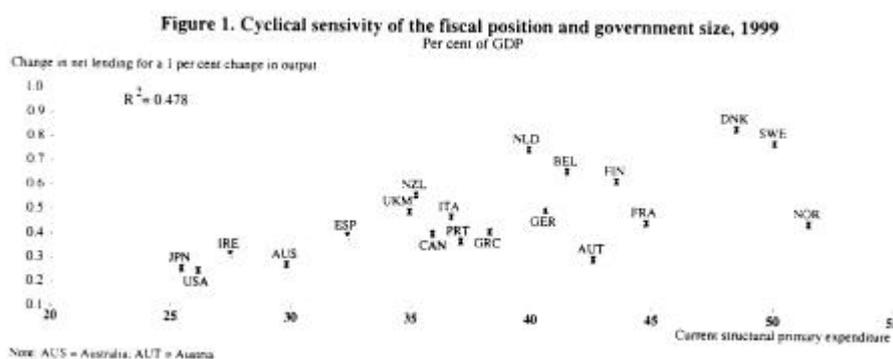
The elasticity magnitudes for New Zealand are higher than the OECD average, and New Zealand's main trading partners as Table 1 shows. However, Belgium, Denmark, the Netherlands and Sweden all have total semi-elasticities of around 0.7 or more.

Table 1. Tax and expenditure elasticities – a cross country comparison

Country	Corporate Tax	Personal Tax	Unemployment and other spending	Total fiscal balance**
New Zealand	0.9	1.2	-0.4	0.57
Australia	1.6	0.6	-0.3	0.28
Canada	1.0	1.2	-0.2	0.41
United States	1.8	0.6	-0.1	0.25
United Kingdom	0.6	1.4	-0.2	0.50
OECD Average	**1.3**	**1.0**	**-0.3**	**0.49**

Sources: Van den Noord (2000), Table A.1. p19.
** Semi-elasticity: impact of a 1% increase in GDP on the fiscal balance as a per cent of GDP.

4. POLICY IMPLICATIONS AND LEGISLATIVE FRAMEWORK

Three factors that affect the operation of automatic stabilisers in New Zealand are their relatively large size, the Fiscal Responsibility Act 1994, and the proposed New Zealand Super Fund. These factors mean that continual monitoring of the fiscal position and outlook is important, even after the Government's debt target is met.

In New Zealand the Fiscal Responsibility Act 1994 sets "principles of responsible fiscal management". The use of automatic stabilisers, provided the fiscal position is sound, is facilitated by principle (b) of the Act which states that operating expenses must equal operating revenue over a 'reasonable' period. 'Reasonable period' can be interpreted as the economic cycle. The principle helps ensure that the 'upside' gain is saved for the downside.

Since the introduction of the Act, fiscal outcomes and the use of automatic stabilisers have been broadly consistent with the principles. Fowlie (1999) discusses how the discipline imposed by the Act was reflected in Government decisions. Automatic stabilisers were allowed to operate to a greater extent in the 1998-99 recession than during the 1991 recession in light of the improved fiscal position.

However the relatively large size of automatic stabilisers in New Zealand implies caution in allowing automatic stabilisers to operate. The economic outlook needs to be monitored to

ensure the fiscal position is not jeopardised by a structural shock that is thought to be cyclical.

Structural surpluses are important under the proposed scheme to partially pre-fund the future cost of superannuation. The scheme requires cash surpluses of up to $2 billion a year (2% of GDP) to be put aside in a privately managed Super Fund. In the build-up to the 'full' contribution rate, structural surpluses will need to increase (see 2000 Fiscal Strategy Report and 2000 Budget Policy Statement).

5. METHODOLOGICAL DIFFERENCES BETWEEN OECD AND NEW ZEALAND ESTIMATES

The estimated size of automatic stabilisers vary with the method used. The New Zealand Treasury uses a version of the two-step approach, which combines elasticities with output gaps. The section below compares and contrasts the approaches, and explains the reasons behind the Treasury's current methodology.

The two step approach to estimate automatic stabilisers is widely used internationally (see for example Banca D'Italia, 1999). Alternative approaches, such as using the Structural Vector Auto-Regression (SVAR) approach (see Dalsgaard and de Serres 1999), do not require a cycle estimate, however the discretionary fiscal policy effects on the budget balance are often difficult to separate out.

Measuring the budget balance

The Treasury's Cyclically Adjusted Balance (CAB) model uses the operating balance from the Statement of Financial Performance for the New Zealand government as its budget balance estimate. The Statement is prepared on an accrual accounting basis. Large one-off items (eg gains on sale of assets) and the effect of liability revaluations are subtracted from the operating balance to improve the structural balance's measure of discretionary fiscal policy.

In contrast, the OECD calculations use a cash measure of government revenue and spending that excludes financing and investment transactions. As a result, the trend in the cyclical and structural components of the operating balance will be similar, but the level will be different.

Figure 4. Government budget balance measures
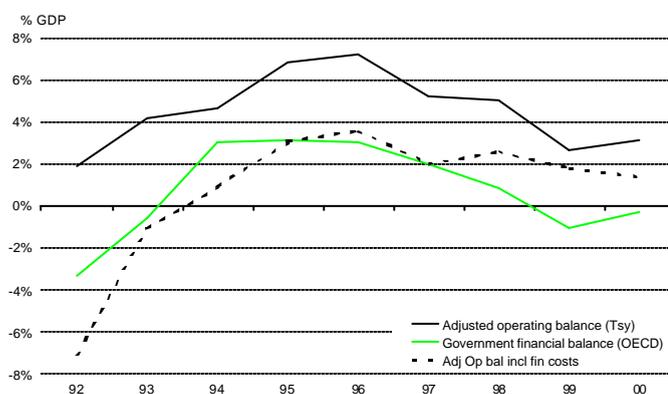
Sources: The Treasury and OECD Economics Department (1999a)

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Measuring the cyclical component of output

There are several methods that can be used to calculate the cyclical component of output (Gibbs, 1995). Fitting a linear trend through actual GDP is the simplest approach, but this fails to adequately capture permanent changes in growth. The UK Treasury (1999b) uses a co-incident indicator, which is a variant of this approach. Potential growth is a linear interpolation between on-trend points, which are estimated using a range of cyclical indicators. For uncompleted cycles, the UK Treasury interpolate a deliberately cautious trend growth rate, currently 2 ¼%.

Other methods include smoothing GDP data to fit a trend, with the Hodrick-Prescott (HP) filter, being the most common method. The HP filter smoothes variations from trend to minimise the sum of squared deviations of output from its trend, subject to a smoothing factor that penalises squared variations in the growth of the trend series.[6] Problems with this approach include the restrictive assumptions on the nature of economic shocks that occur, and that it is affected by the estimation end point (see Guay and St-Armant, 1996).

The production function approach uses the relation between capital and labour inputs to estimate potential output. Problems include specification of the production function, difficulties in measuring the rate of technological change, and how it interacts with labour and capital. The production function method for New Zealand has suffered until recently from a lack of an official capital series.

At present the New Zealand Treasury typically uses a structural time series model (STAMP) to calculate potential output. STAMP is used to model real production GDP as a function of labour inputs, capacity utilisation, and a stochastic trend.[7] From this regression, potential output can be calculated by substituting long run data for capacity utilisation and labour contributions. The approach avoids some of the problems of specifying a production function, while still capturing structural changes that affect productive capacity.

The Reserve Bank uses a multivariate filter (MV) approach for estimating the output gap, although they also monitor Structural Vector Auto-Regression (SVAR) and Unobserved Components (UC) estimates of the output gap.[8] The multivariate filter is similar to the HP filter, but minimises weighted variations in inflation, unemployment and capacity utilisation from their long run trend values as well as output.

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[6] The smoothing factor is typically set at 1600, but is at the discretion of the user. The smaller the smoothing factor chosen the more closely potential output will follow actual output.

[7] Structural Time Series Modeller and Predictor. STAMP allows the decomposition of a series into its trend, seasonal, cyclical and error components. For the statistical theory, see Harvey (1989) and Harvey and Shephard (1993). Diebold et al (1996) and Judge (1996) provide independent reviews of STAMP.

[8] See Claus, Conway and Scott (2000). SVAR models use labour market (full time employment) and capacity utilisation information. UC decomposes actual output into an unobserved trend (potential output), a trend-reverting component (output gap) and random noise.

Figure 5. Alternative output gap measures (% of potential GDP)
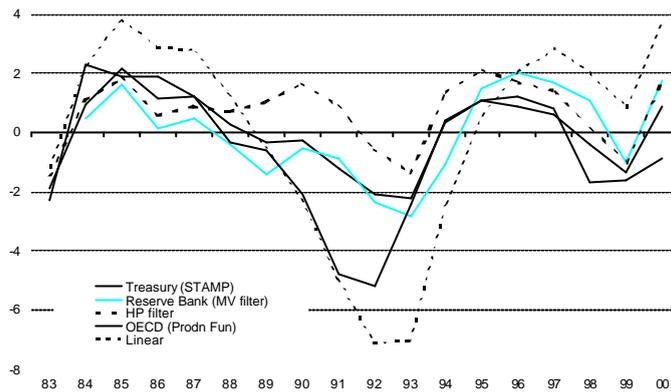
Source: Reserve Bank of New Zealand's May 2000 Monetary Policy Statement, The Treasury and OECD (1999b)

Comparison of the different methods in Figure 4 shows that the methods all produce similar trends, but point in time estimates vary considerably. For example, in 1992 there was a 6.5% point difference between the high and low output gap estimates. However the similar trends do provide comfort that the general story holds fairly consistently over time.

Measuring tax and expenditure elasticities

Within the broad two-step framework, OECD nations currently use three different methods to calculate the elasticity of taxation and expenditure items to the economic cycle (OECD, 1999a Annex 3).

- Regressions: Regress observed tax proceeds and public expenditure on discretionary changes in tax or benefit rates, a trend and a cyclical term (eg output gap).

- Macro-econometric model: based on the standard-shock simulations calibrated to show the impact of a 1% cyclical increase in output on budget variables (see Cohen and Follette, 2000).

- Hybrid approach: calculate the elasticities of tax base with respect to cyclical economic activity through regression analysis and the elasticity of tax receipts with respect to the relevant base extracted from the tax code. The two elasticities are then combined.

Both the Treasury and the OECD use the third approach (see the Appendix for details on the Treasury approach and Van den Noord 2000).

A comparison between the New Zealand Treasury and the OECD estimates shows that the differences between the two sets of estimates are small. The OECD Secretariat estimates slightly higher elasticities for income tax and GST.

*Table 2: New Zealand tax elasticities – a comparison*

	Treasury Estimates	OECD Estimates
Company Tax	1.10	0.9
Income Tax	1.12	1.2
Indirect Tax (GST)	1.10	1.2

Sources: Appendix of current paper, van den Noord (2000), Table A.1. and OECD (1999a), Table A.1.

Summary

Despite the level difference in the estimates of the size of automatic stabilisers, the trend is similar between Treasury and the OECD estimates. The majority of the difference between the OECD and Treasury calculation of the size of automatic fiscal stabilisers is the alternative estimates of the output gap (see Figure 6).

Figure 6. Automatic fiscal stabilisers – Treasury[9] and OECD estimates
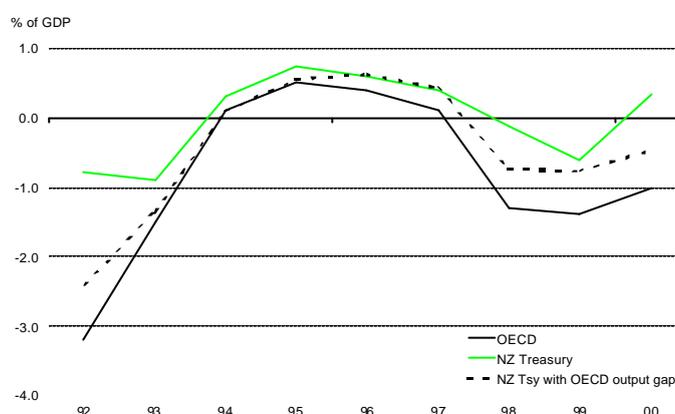
Source: OECD (1999a) Table 1, Annex 1, p3 and New Zealand Treasury.

6.   SENSITIVITY ANALYSIS

The sensitivity of automatic fiscal stabiliser estimates to assumptions determines their usefulness in a policy environment. The sensitivity testing shows that alternative assumptions change the level of the estimated automatic stabilisers – making it hard to categorically state that the government is running a 'structural surplus' at a given point in time. But a consistent trend makes it possible to state whether the structural position in improving or deteriorating.

The sensitivities tested are:

- Government budget balance estimates
- output gap estimates
- elasticities
- lags in tax collection

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[9] Finance costs are excluded from the Treasury calculation in Figure 7 to be consistent with the OECD estimates. They are not generally excluded in Treasury estimates. Neither does Treasury cyclically adjust debt and finance costs. While adjusting for the cyclical effects on finance costs would provide greater conceptual purity, there are offsetting influences. For example during a recession, a cyclical deficit increases debt and subsequent financing costs, but interest rates and inflation are likely to be lower than normal. See Bagrie (1996) for detail on calculation.

Government budget balance estimates

The New Zealand Treasury uses an adjusted operating balance as the base as discussed above. In contrast, the OECD uses the (cash) Government financial balance from SNA (System of National Accounts) data to ensure consistent country comparisons. The different level estimates of the government budget does affect the level of the estimated structural balance but as discussed above it is the changes in the structural balance rather than the level which is more informative.

The different estimates do affect the size of automatic stabilisers, but as shown in Figure 7, over 1992 to 2000 most of the difference between OECD and Treasury estimates of automatic stabilisers come from alternative output gap and elasticity assumptions.

Figure 7. Automatic stabilisers – NZ Treasury and OECD
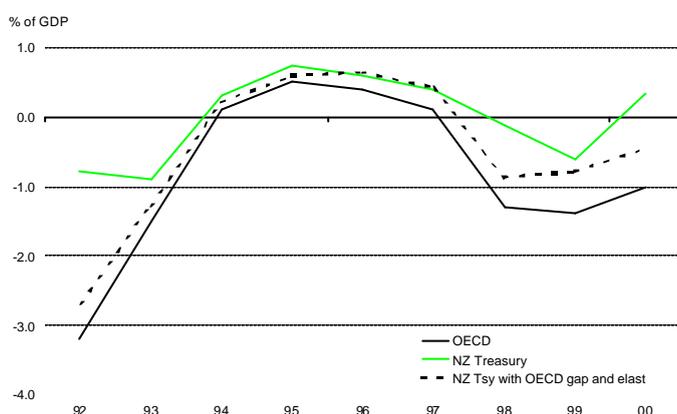
Source: The Treasury and OECD (1999a)

Output gap estimates

As pointed out in Section 5, at any one point in time, output gap estimates may vary by a reasonably wide margin. For example, output gap estimates for the 2000 June quarter (when first released) included:

Linear	3.3%
HP filter	1.3%
STAMP	0.1%
MV filter	-0.2%

Source: The Treasury and The Reserve Bank of New Zealand website

In addition, the output gap estimates for a point in time change significantly. The June 1998 quarter was estimated at –2.5% under by the STAMP method and by the Reserve Bank at the time of release, however latest estimates by both methods have revised this to –1.6%.

Figure 8 shows the implications of the alternative output gap estimates for the estimation of the automatic stabilisers

Figure 8. Estimates of automatic stabilisers under alternative output gap measures
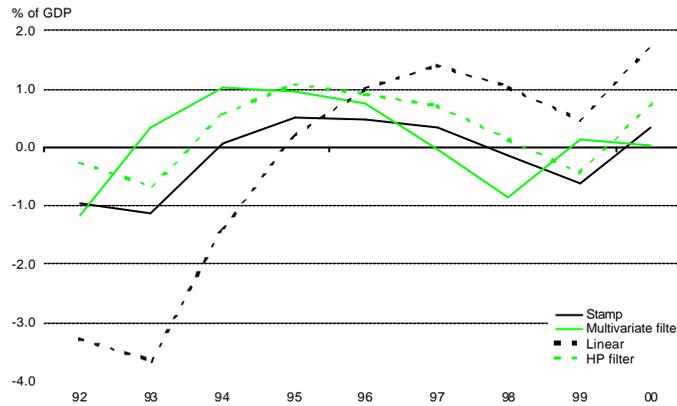
The linear estimate attributes more of the fluctuation in output to the cycle and as a result the estimated automatic stabilisers are larger. In contrast, the STAMP estimate of trend follows actual output more closely, reducing the cycle estimate and therefore the size of automatic stabilisers.

Figure 9. Actual GDP and Potential GDP estimates
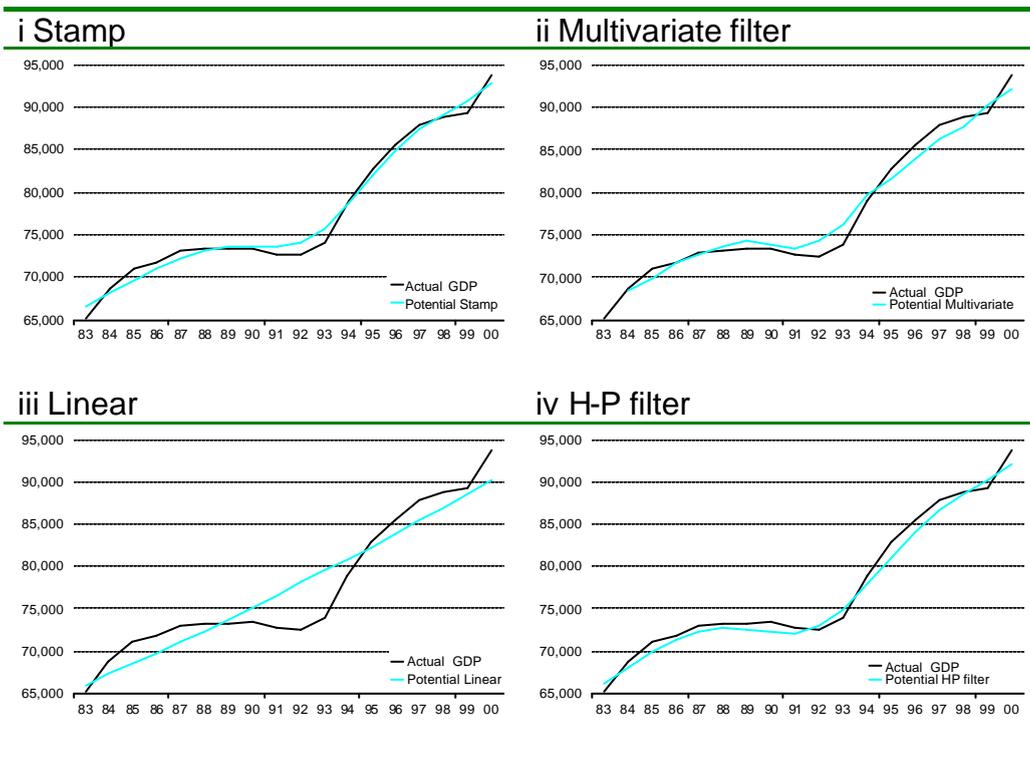
Elasticities

The elasticities used by the New Zealand Treasury and the OECD have varied over the past five years, especially for company tax, as listed in Table 3.

Table 3: Alternate revenue elasticity estimates

	Treasury December Update 2000	Treasury Budget Update 2000	Treasury Bagrie 1996	OECD Van den Noord 2000	OECD Chouraqui et al 1990
Individual income tax	1.12	1.12	1.25	1.2	1.2
Company tax	1.1	1	2.5	0.9	2.5
Withholding tax and other direct	1	1	1		
GST	1.1	1	1	1.2	1
Excise duties	1	1	1		
Other indirect tax	1	1	1		
Interest, profits and dividend income	1	1	1		
Other revenue	1	1	1		

Both the Treasury and OECD estimates of automatic stabilisers assume constant elasticities across the estimation period, but over the 1990s New Zealand's individual income tax rates flattened and import tariffs (included in excise duties) were either reduced or removed. The elasticities presented in Table 3 may have been correct for the period they were estimated in.

We tested the sensitivity of automatic stabilisers to the three largest tax components (individual tax, company tax, GST). The elasticity for individual tax and GST was adjusted 50% either way from the current elasticity that the New Zealand Treasury uses. For company tax, the elasticities tested were 0.5, 1.5 and 2.5 (see Table 4).

The Treasury Cyclically Adjusted Balance (CAB) model cyclically adjusts unemployment expenditure by first estimating cyclical unemployment using an Okun coefficient of 0.5. Estimates of the Okun coefficient vary. Harris and Silverstone (1999) argue that the long run Okun coefficient for New Zealand is 0.41, while the Reserve Bank imposes 0.33 (Claus et al 2000), similar to the 0.35 coefficient estimated by Gibbs (1995), and the range Okun (1962) originally estimated of 0.35-0.4.

Table 4: Elasticity ranges tested in sensitivity analysis

	Individual income tax	Company tax	GST	Okun coefficient
LOW	0.56	0.5	0.5	0.25
Current setting	1.12	1	1	0.5
HIGH	1.68	2.5	1.5	0.75

Figure 10. Sensitivity of the cyclical component of the operating balance to alternative elasticities.
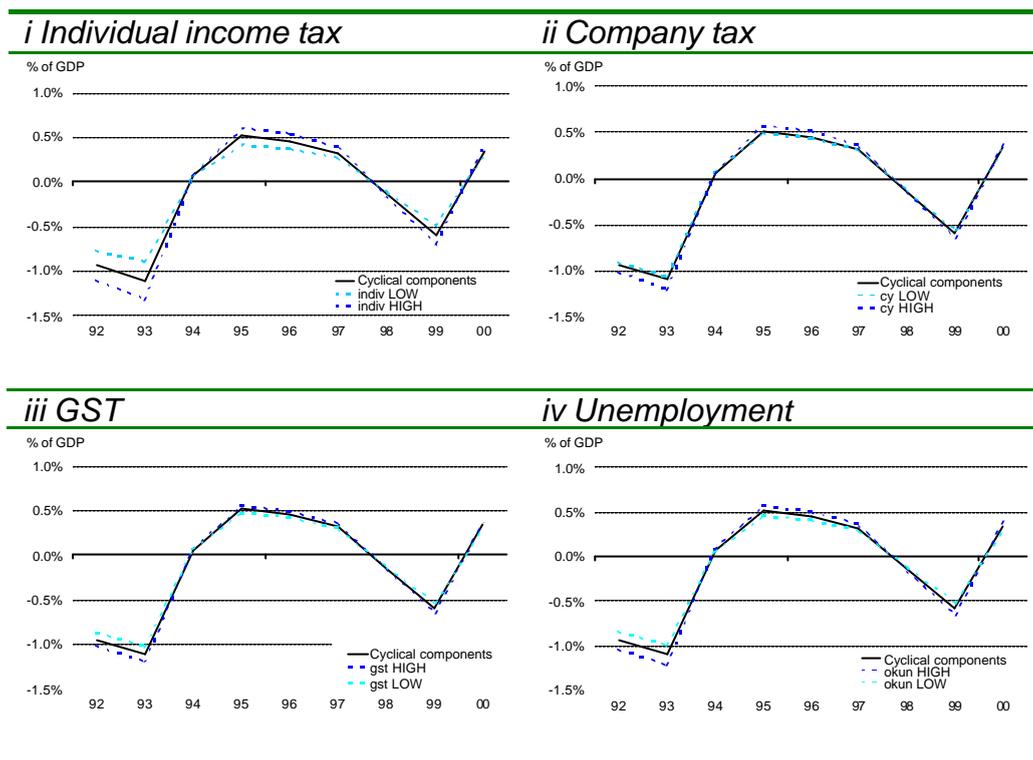
The sensitivity analysis in Figure 9 shows that the calculation of automatic fiscal stabilisers is relatively robust with respect to the elasticities for the largest components. If all the elasticities are set to either the maximum or minimum value the largest difference is 0.5% of GDP in 1993, while the average difference is only 0.1%.

Table 5. Maximum effects of changing individual elasticities (% GDP)

Elasticity	Maximum difference in AFS
Individual income tax	0.2
Company tax	0.1
GST	0.1
Okun coefficient	0.1
All changed	**0.5**

It should be kept in mind that the following assumptions are made in the CAB model in estimating the size of automatic fiscal stabilisers:

- Interest revenue is assumed to be insensitive to the economic cycle.
- Surpluses or deficits from State Owned Enterprises and Crown Entities move with the cycle, but with an elasticity of one.
- Other expenditure (eg health, education) aside from unemployment is not adjusted for the cycle.

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Lag weights

Tax rules may allow tax payment or recognition to be deferred for one or more periods. The three main tax types were tested, with the slowest lag for each being set at 0.5, the fastest at 1. The lag weight represents the fraction of tax receipts in any given year that results from income in that same year.

Table 6: Lag ranges tested in sensitivity analysis

	Individual income tax	Company tax	GST
LOW	1.0	1.0	1.0
Current setting	0.9	0.8	0.9
HIGH	0.5	0.5	0.5

The calculation of automatic fiscal stabilisers is not very sensitive to the lag weights used, apart from individual income tax.

Table 7: Difference in automatic stabiliser estimates from changing lag assumptions

	Maximum difference in AFS (% of GDP)
Individual income tax	0.2
Company tax	0.0
GST	0.1
All changed	**0.3**

Implications of sensitivity testing

The widely different point-in-time output gap estimates produce quite different point-in-time estimates of automatic stabilisers. As a result relying on automatic stabiliser estimates for budgeting and decision making is difficult as a given budget deficit may be entirely cyclical (remedial action is not required) or entirely structural (remedial action required), depending on the output gap method used. For example in 1994 the multivariate filter estimated that the budget balance was benefiting from the economic cycle by 0.3% of GDP, while the linear trend showed a cost of the cycle of 3.7% of GDP.

Therefore only the trend in the structural balance and automatic stabiliser estimates should be used for policy purposes. For example, the structural balance has fallen/risen over time demonstrating a looser/tighter fiscal policy is being run. International comparisons of automatic stabilisers are still meaningful provided that a consistent methodology is being applied across each country.

7. CONCLUSION

This paper examined a number of issues concerning automatic fiscal stabilisers. A theoretical overview of the effectiveness of automatic fiscal stabilisers was given, the benefits and costs involved in their operation, and the resulting implications for policy described.

The caution for New Zealand is that our cycle and the budget response to the cycle both tend to be larger than the OECD average. While there are benefits of allowing automatic stabilisers to operate, it is of great importance that economic shocks are monitored carefully, so that if an adverse cyclical shock turns out to be structural, the budget balance is not left to absorb this shock. While the 1994 Fiscal Responsibility Act requires the

government to constantly monitor the fiscal outlook, and debt is at its lowest in over two decades, there exists a potential for this position to easily reverse.

Another factor which makes prudent action more difficult is that the calculation of automatic stabilisers vary significantly depending on the estimation method. The size of automatic stabilisers is most sensitive to the estimated output gap – making any interpretation at a given point in time difficult. However given the generally similar trends in automatic stabilisers and the structural balance it is possible to say whether the fiscal position is improving or deteriorating.

APPENDIX: THE NEW ZEALAND TREASURY'S CAB MODEL

The Treasury cyclically adjusted balance (CAB) model can be used to estimate the (annual) size of automatic stabilisers in three steps:
- calculate size of output gap
- calculate sensitivity of tax and unemployment spending to the output gap
- combine output gap and elasticities to estimate automatic stabilisers

This model was first developed in Bagrie (1996).

1. Calculation of the output gap

The most important step in calculating the CAB is the output gap, measured as:

Actual GDP – Potential GDP
  Potential GDP

Treasury uses a variety of methodologies to assess potential output. The CAB model uses the STAMP programme (Structural Time Series Analyser, Modeller and Predictor). The programme is based on the following function:

Observation = trend + seasonal + cycle + irregular

The model estimated using quarterly data is:

Equation A.1

$$actGDP = a_1 + a_2 \ln(Hrs) + a_3 \ln(CUBO) + bT + seasonals + e$$

where:

actGDP	=	ln(actual real production GDP)
Hrs	=	Hours worked a week (HLFS, actual)
CUBO	=	New Zealand Institute of Economic Research measure of capacity utilisation
T	=	Stochastic time trend

The estimation period starts in 1980 Q1. The coefficients are re-estimated as additional quarterly data becomes available. The coefficient for hours worked (α_2) is typically around 0.25 and the CUBO coefficient (α_3) is around 0.42.

The actual GDP estimation equation (A.1) is equivalent to:

Equation A.2

$$actGDP = a_1 + a_2 \ln(WAP * (LF/WAP) * (Emp/LF) * (hrs/Emp)) + a_3 \ln(CUBO) + bT + seasonals + e$$

Potential output is calculated by substituting long run averages, for capacity utilisation and labour contributions in the above equation. The expanded equation becomes:

Equation A.3

$$potGDP = a_1 + a_2 \ln(WAP * LR\_LFPR * (1 - LRunemp) * LR\_hrs\_e'ee) + a_3 \ln(LR\_CUBO) + bT + seasonals + e$$

WAP	=	working age population
LF	=	labour force
LRunemp	=	smoothed actual unemployment, using the HP filter
Emp	=	employment
LR_CUBO	=	smoothed CUBO, using the Hodrick-Prescott filter.
LR_LFPR	=	average labour force participation rate over the estimation period.
LR_hrs_per e'ee	=	average of total hours worked / total employment over estimation period.

The long run unemployment and CUBO estimates were derived using a Hodrick-Prescott filter. Long run unemployment has previously been interpreted as the NAIRU (non accelerating inflation rate of unemployment) and subjectively smoothed through the unusually high levels in the early 1990s. Using the HP estimates for long run unemployment reduces the size of automatic stabilisers calculated over 1991-1997, but by no more than 0.2% of GDP in any one year.

Figure A.1 Revised unemployment assumptions
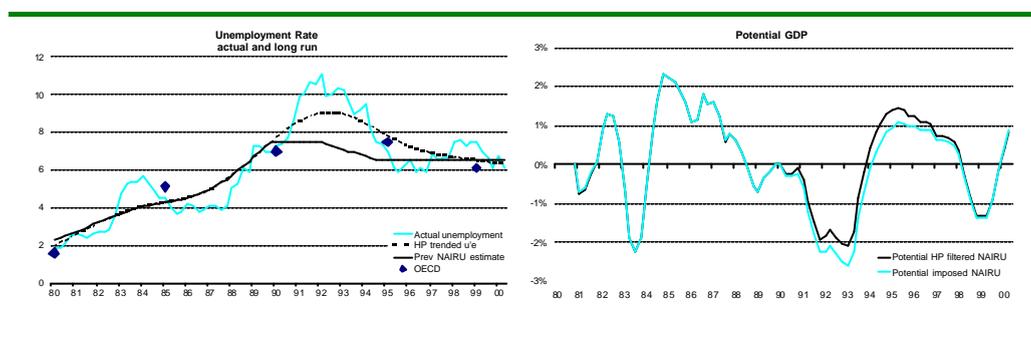
Source: The Treasury, OECD (2000)

2. Elasticities

The effect of the economic cycle on the operating balance is calculated by multiplying the output gap by revenue and expense elasticities.

Revenue

The responsiveness of revenue to output depends on two effects:

- the responsiveness of the tax type to a change in its base
- the responsiveness of the tax base to a change in output.

The chain rule gives the following link between variations in tax and output.

$$e_{T,Y} = e_{T,B} {}^* e_{B,Y}$$

where T is the tax type, B is its base and Y is nominal GDP. The elasticities are estimated directly for the three largest tax types, and set at one for other tax types.

As output increases, tax increases, but the increase in each tax base may not be proportional. This base shift reflects the possibility that factor income shares may fluctuate, reflecting a change in the existing economic structure.

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The following bases were used for the different tax types:

Personal income
COE   compensation of employees
PY   compensation of employees plus entrepreneurial income

Corporate income
OS   operating surplus national accounts definition
COS   operating surplus less non-corporate income (eg farm)

GST base
CONRI   private consumption plus total residential investment in current dollar terms

The output elasticity with respect to the base ($e_{B,Y}$) is calculated two ways:

- The annual percentage change in the appropriate tax base as a ratio of the percentage change in income GDP is calculated for each year of 1984-2000. These estimates are variable, but are averaged over the period.
- The log of tax base is regressed on log GDP.[10]

Table A.1 Output elasticity with respect to tax base

	Average 84-00 ex 91/92	Average 93-00	Average 95-00	Regression 83-00, ex 91/92
COE	0.8	0.8	0.9	0.8
PY	0.9	0.9	1.1	0.9
OS	1.2	1.2	1.0	1.1
COS	1.1	1.1	0.6	1.1
CONRI	1.1	1.2	1.4	1.1

The regression estimates are used for the output elasticity ($e_{B,Y}$) while the tax elasticity with respect to the base ($e_{T,B}$) is set to 1 for flat taxes (corporate and GST). TAXMOD[11] estimates the base elasticity at 1.29 for individual taxes, allowing for the recent top tax rate increase to 39%.[12] Table A.2 shows the resulting total elasticities.

Table A.2 Output elasticity of tax revenue

	Tsy2000[13]	OECD1999a
Individual tax	1.12 = 1.29*0.87	1.2
Corporate tax	1.10 = 1.0*1.1	0.9
GST	1.10 = 1.0*1.1	1.2

---

[10] The recession years of 1991 and 1992 are dummied out as the annual estimates are very noisy around this period. This has only a small effect on the estimated elasticities.

[11] A model of the NZ population designed to forecast data and model policy proposals related to income, tax and transfers.

[12] The OECD estimates compared against the revised Treasury estimates in Table A.2 do not include the effect of the tax rise.

[13] The estimated output elasticity with respect to tax base used in Table A.2 is the rounded version of the regression estimates in Table A.1, where 0.87 is the average over 1995-200 for COE.

Traditionally these elasticities have been combined with lags, to allow for the possibility that income may not always be recognised in the same period that GDP increases. It also reflects that tax years and the government fiscal year end do not always align.[14]

Dividend and other income are also adjusted for the economic cycle, reflecting that company profits underlying the dividend income also moves with the economic cycle. The elasticity is set at 1. Interest income is assumed to be insensitive to the economic cycle.

Thus cyclically adjusted revenue is calculated as:

$$cycadj'd\_revenue_{it} = revenue_{it} * [q * (1 + e_{T,Y} * -gap_t) + (1-q) * (1 + e_{T,Y} * -gap_{t-1})]$$

where θ represents the lag.

Table A.3 Summary of revenue assumptions

	Elasticity	Lag weight (θ)	% of total revenue (1999/2000)
Individual Income Tax	1.12	0.9	43%
Company Tax	1.1	0.8	11%
Other Direct Tax	1.0	0.9	5%
GST	1.1	0.9	24%
Excise Duties	1.0	0.9	6%
Other Indirect Tax	1.0	0.9	4%
Interest	0	1.0	2%
Dividends	1.0	1.0	1%
Other income	1.0	1.0	4%

Expenses - Unemployment

Cyclically adjusted unemployment is derived using the output gap and the Okun coefficient (-1/β), which is assumed to be 0.5.

$$U_t^* = U_t - (\frac{1}{b}) \bullet (gap)_t \tag{4}$$

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.

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

where: *une* = unemployment expenditure
av.benefit = average weekly benefit
beneficiaries = number of unemployment beneficiaries

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[14] In light of the sensitivity of the automatic stabilisers to the lags used, as calculated in this paper, the lag weights will be dropped in future calculations.

3. Automatic stabilisers calculation

The following table presents the size of automatic stabilisers, assuming that the NZ economy was 1% above trend in 1999/2000 (lag effects are ignored for simplicity).

Table A.4 Calculation of automatic stabilisers

	Outpt gap	Elastic'y	Actual ($m)	Cyclically adjusted (structural) ($ m)	Automatic stabilisers ($m) Calculation	Result
Individual tax	1%	1.12	15,776	15,599	=15,776*1%*1.12	177
Company tax	1%	1.1	4,158	4,112	=4,158*1%*1.1	46
GST	1%	1.1	8,871	8,773	=8,871*1%*1.1	98
Other tax	1%	1	5,230	5,178	=5,230*1%*1	52
Unemplymt[15]	1%	-0.5 (Okun)	UR = 6.4% UB=1,538	1,658	UR=6.4%-1%*0.5=5.9 UB=1,538*(5.9/6.4)-1,538	-120
TOTAL			**32,497**	**32,004**		**493**

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[15] This represents the unemployment component of the Community Wage. The Community wage also includes sickness and training components.

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