CHAPTER 5
GENERAL GOVERNMENT TAX REVENUE AS AN AUTOMATIC FISCAL STABILISER IN SOUTH AFRICA

5.1 INTRODUCTION

Chapter 3 highlighted the generic business cycle properties of tax revenue and its potential as an automatic fiscal stabiliser. This chapter investigates the relevance of tax revenue as an automatic fiscal stabiliser in the South African economy by an empirical analysis of the role and impact thereof since the 1970s. In the next section, the sensitivity of tax categories with respect to output growth is calculated, the cyclical and structural components of tax revenue are estimated and the results are compared with other developing countries.

5.2 EMPIRICAL ANALYSIS OF THE ROLE OF TAX REVENUE AS AN AUTOMATIC FISCAL STABILISER IN SOUTH AFRICA

5.2.1 The cyclical and structural components

In practice, there are several methods for calculating the cyclical budget balance. One of the most widely used approaches in estimating the cyclically adjusted budget balance is the OECD's method (Van den Noord (2000)). The OECD has developed a technique that is internationally comparable, theoretically sound and relatively easy to employ and interpret. The results of the Van den Noord (2000) study are also widely quoted and therefore make it easy to compare results. The accuracy of the results obtained from this method, like other methods that are used for cyclical adjustment, depends on the underlying assumptions. In this case, it particularly applies to the estimation of the output gap and the budget elasticities.

Following the methodology of Van den Noord (2000), the cyclical components of tax revenue were calculated by subtracting the estimated structural components from their actual levels. The structural components are calculated from actual tax revenues, adjusted proportionally according to the ratio of trend output to actual output and the assumed built-in elasticities. Thus:

$$\frac{T_i^*}{T_i} = \left(\frac{Y^*}{Y}\right)^{\alpha_i} \quad (2)$$

where:

T_i^* = structural tax revenue for the i^{th} category of tax

T_i = actual tax revenue for the i^{th} category of tax

Y = level of actual output

Y^* = level of potential output

α_i = elasticity of the i^{th} tax category with respect to output growth ($\alpha_i > 0$)

Taxes are assumed to be increasing in output with a constant elasticity. The output gap was calculated as the percentage deviation of observed real GDP from trend real GDP and trend output was estimated by a Hodrick-Prescott (HP) filter (lambda = 100) (see Chapter 4). To allow for shifts in the composition of tax revenue and to capture the impact on the budget of changes in the composition of output, a distinction is made between direct taxes[5] and indirect taxes and the elasticity of each tax category with respect to output growth ($\eta_{Ti,Y}$) is calculated as the product of the elasticities of the tax categories with respect to their tax bases ($\eta_{Ti,Bi}$) and the elasticities of these tax bases with respect to output ($\eta_{Bi,Y}$). Thus:

$$\eta_{Ti,Y} = \eta_{Ti,Bi} * \eta_{Bi,Y} \quad (3)$$

The current income of households was selected as the tax base for direct taxes, while private consumption expenditure was selected as the tax base for indirect taxes. Annual data were firstly used in the regressions to estimate the average elasticity of the tax revenue components over the period 1970 to 2000[6]. The results, together with

[5] Consisting of taxes on net income and profits, donations tax, estate duty and taxes on payroll and workforce.

[6] The measurement of the responsiveness of budget components with respect to cyclical fluctuations in the economy is largely an unsettled issue as widely different methods are being employed. These methods include, for example, regression analysis, macroeconomic models with standard-shock simulations, structural VAR models, marginal and average tax rates or *a priori* assumptions. Since the elasticity estimates entail a large degree of bias, it is useful to perform a sensitivity analysis to compare the effect of different assumptions on the cyclically adjusted budget balance. Due to data constraints, limited information on all discretionary changes in the tax structure and to avoid extensive modelling,

correlation coefficients, are captured in Table 5.1[7]. The correlation coefficients between the cyclical components of tax revenue and output, as well as the tax elasticity coefficients, have the correct sign, indicating that tax revenue is procyclical. Tax elasticity coefficients, at a more disaggregated level, are reported in Table 5.2. The elasticity of the most important tax category (taxes on net income and profits) is larger than one, meaning that it increases more than proportionally with GDP. This reflects the built-in elasticity of the South African tax structure that could result in an increasing tax effort if no discretionary tax measure is used to offset this effect. Taxes on payroll and workforce are the most sensitive to changes in GDP, while property taxes demonstrate the weakest procyclical behaviour. Two of the smaller tax revenue categories (taxes on international trade and "other taxes"), however, move countercyclically, thereby offsetting the total stabilising effect of general government tax revenue.

Table 5.1 Correlation coefficients and elasticities of tax revenue components

Correlation coefficients between the cyclical components of taxes and output[8]	
Direct taxes	**Indirect taxes**
0.3	0.19
Elasticity of taxes with respect to output growth[9]	
Direct taxes	**Indirect taxes**
0.42**	0.19*

** (*) denotes significance at the 5 (10) per cent level

this study followed a methodology similar to that of Kiander and Virén (2000) and Lane (2002) to estimate the responsiveness of budget components with respect to output growth. The effects of alternative elasticity assumptions on the cyclical and structural budget components are also compared.

[7] The values reported should be interpreted as buoyancy coefficients rather than elasticities, since the analysis did not control for the impact of all discretionary changes in the tax structure.

[8] Estimates are based on Hodrick-Prescott filtered data.

[9] OLS estimation of $d(\log(B_{it})) = \alpha_i + \beta_{Bi} * d(\log(Y_{it})) + \varepsilon_{it}$ with AR(1) correction where Bi represents the respective tax component and Y represents GDP. The elasticity of direct taxes and indirect taxes with respect to output growth was calculated as the product of the elasticities of the tax categories with respect to their tax bases and the elasticities of these tax bases with respect to output. The current income of households was selected as the tax base for direct taxes, while private consumption expenditure was selected as the tax base for indirect taxes.

Table 5.2 Elasticity coefficients of individual tax categories with respect to output growth[10]

Tax category	Elasticity
Taxes on net income and profits	1.11**
Taxes on property	0.34
Taxes on goods and services	0.77*
Taxes on international trade and transactions	-0.27
Other taxes	-0.48
Social security contributions	1.16**
Taxes on payroll and workforce	1.96

** (*) denotes significance at the 5 (10) per cent level

The standard deviation of the cyclical components of tax revenue may provide additional insight as a rough indicator of how sensitive they are to the business cycle. Indirect tax revenue shows less marked deviations than direct tax revenue. Table 5.3 shows that the cyclical component of direct and indirect taxes varies on average by approximately 0,06 and 0,03 percentage points of GDP respectively in either direction around their means. The highest positive values for the cyclical components of direct and indirect taxes were recorded in 1989, while the lowest negative values were recorded in 1992 and 1993, respectively. The cyclical component of direct taxes is more than two times greater than the cyclical component of indirect taxes.

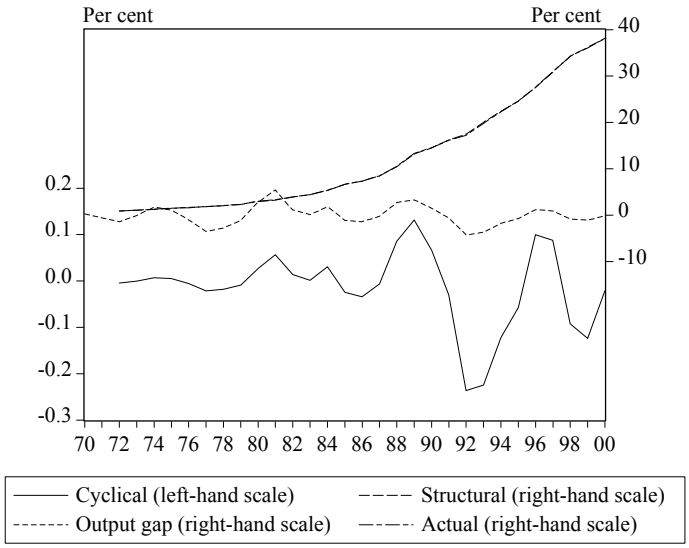
Table 5.3 Size and volatility of the cyclical components of tax revenues

Tax category	Volatility Standard deviation (% points of GDP)	Lowest negative component		Highest positive component	
		Value (as % of GDP)	Year	Value (as % of GDP)	Year
Direct taxes	0.06	-0.16	1992	0.09	1989
Indirect taxes	0.03	-0.07	1993	0.04	1989

[10] OLS estimation of $d(\log(B_{it})) = \alpha_i + \beta_{Bi} * d(\log(Y_{it})) + \varepsilon_{it}$ with AR(1) correction where Bi represents the respective tax component and Y represents GDP.

The actual, structural and cyclical components of total tax revenue (as a ratio of trend GDP) are shown in Figure 5.1. A high correlation was found between the output gap and the cyclical component of general government tax revenue. Tax revenue responds more or less in line with changes in the output gap and it seems as if the automatic fiscal stabilisers associated with the tax system in South Africa were allowed to operate in both the up- and downward phases of the economic cycle. The results also illustrate a more prominent role for automatic fiscal stabilisers during the latter half of the sample period.

Figure 5.1 A comparison of actual, structural and cyclical tax revenue as a ratio of trend GDP[11]



5.2.2 Sensitivity analysis

The sensitivity of automatic stabiliser estimates to different assumptions determines their usefulness in policy-making (Tam and Kirkham 2001: 11). Alternative assumptions change the level of estimated stabilisers, making it difficult to accurately assess what the state of government finances is at a given point in time. A sensitivity analysis with respect to the automatic fiscal stabiliser estimates was carried out by means of alternative assumptions about the elasticity of each tax revenue component,

[11] The small size of the cyclical component makes it difficult to distinguish between the actual and structural components to the extent that there appears to be only three lines.

adjusted 50% either way from the current estimate. The estimation of the size of automatic fiscal stabilisers associated with general government tax revenue in South Africa is relatively robust with respect to alternative assumptions about tax elasticities. The maximum or minimum values for the alternative assumptions resulted in a maximum difference of 0,08 per cent and 0,04 per cent of trend GDP in the case of direct and indirect taxes, respectively. A unitary elasticity assumption for direct (indirect) taxes resulted in a maximum difference of 0,22 (0,31) per cent of trend GDP.

5.2.3 The responsiveness of total tax revenue to the output gap

Taylor (2000: 33) provides estimates of the responses of the total budget balance, and its structural and cyclical components to the output gap. Using the same methodology for South Africa, Table 5.4 shows estimates from bivariate regressions using the output gap (defined as the percentage deviation of real GDP from trend GDP) as the independent variable and total structural, cyclical and actual tax revenue (each expressed as a percentage of trend GDP), one at a time, as the dependent variable. This simple method was chosen in order to avoid extensive modeling that are required, for example, by large macroeconomic models that involve standard shock simulations. Therefore, there might be some trade-off between the simplicity of this approach and the accuracy of its results.

The impact of the output gap on discretionary fiscal policy (measured by structural general government tax revenue) and automatic fiscal stabilisers (measured by cyclical general government tax revenue) varies significantly according to the chosen sample period. The role of automatic stabilisers was much smaller than that of discretionary fiscal policy over the sample period. Regressions over two sub-samples (1970-1985 and 1986-2000) indicate that automatic fiscal stabilisers were much stronger in the latter half of the sample period, particularly since the 1990s. Estimated effects of variations in the output gap on total tax revenue and structural tax revenue are not significant in any of the reported time periods. The regression results for the period 1970-1979 support the findings of Heyns (1999) that the government relied strongly on discretionary policy action during the 1970s in an attempt to smooth out automatic fluctuations in government deficits.

Table 5.4 Estimated response of total tax revenue to the output gap

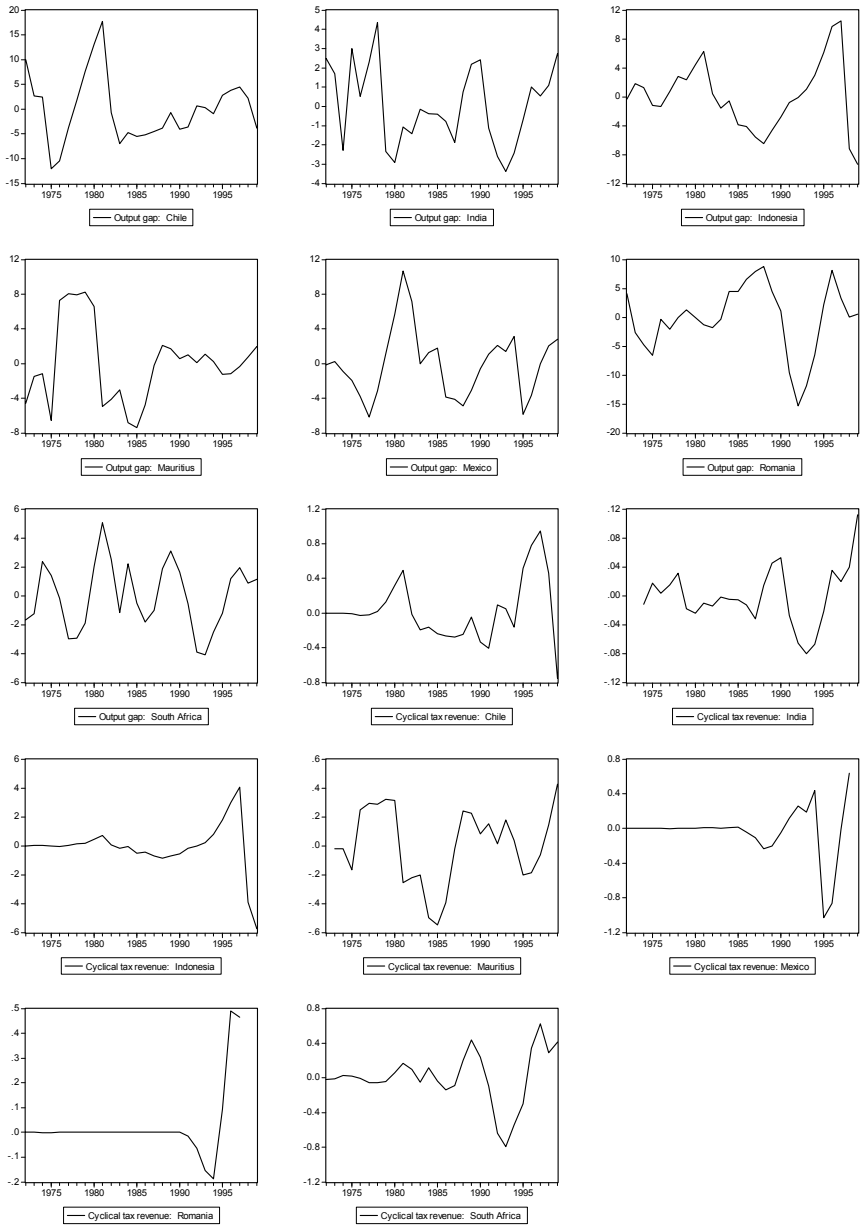
Sample period	Structural component	Cyclical component	Actual
1970-2000	-0.98 (1.49)	0.03 (0.00)	-0.95 (1.48)
1970-1985	0.26 (0.39)	0.01 (0.00)	0.27 (0.39)
1986-2000	-2.45 (3.01)	0.05 (0.00)	-2.36 (-0.78)
1970-1979	-0.49 (0.27)	0.01 (0.00)	-0.44 (-1.82)
1980-1989	1.44 (0.84)	0.02 (0.00)	1.46 (0.84)
1990-2000	-4.98 (4.03)	0.06 (0.00)	-4.92 (4.03)
Note: Standard errors in parentheses			

5.2.4 International comparisons

This section compares South Africa's tax elasticity, tax to GDP ratio, output gap and cyclical tax revenue with six other developing countries, namely Chile, India, Indonesia, Mauritius, Mexico and Romania[12]. Figure 5.2 shows that the size of South Africa's output gap is broadly similar to that of India, but smaller compared to the other countries. South Africa, India and Romania recorded their largest negative values in their output gaps in the early 1990s. Except for Indonesia, Mexico and Romania, the trend in cyclical tax revenue for each country is broadly similar to their respective output gaps. With the exception of Indonesia, there are no major differences in the size of cyclical tax revenue between the various countries. Cyclical tax revenue in South Africa, India, Mexico and Romania reached its largest negative values in the early 1990s.

[12] Data on tax revenue refer to the consolidated central government of each country.

Figure 5.2 A comparison of output gaps and cyclical tax revenue[13]



[13] As a ratio of trend GDP.

The tax elasticity and tax to GDP ratios of each country are captured in Table 5.5. South Africa has the highest average tax to GDP ratio, followed by Chile and Indonesia. The South African minimum tax to GDP ratio is also the highest among the reported countries. Mauritius has the smallest average tax to GDP ratio and the lowest minimum. The highest maximum value of 33,0 per cent was recorded by Romania in 1992. Mauritius has the largest tax elasticity, followed by Romania and South Africa.

Table 5.5 A comparison of tax elasticities and tax to GDP ratios, 1972 to 2000

Country	Elasticity[14]	Tax to GDP ratio		
		Average	Maximum	Minimum
Chile	1.1**	17.9	22.5	11.3
India	0.28	9.8	11.0	8.0
Indonesia	1.47**	15.6	19.4	10.9
Mauritius	0.63	6.7	10.3	2.0
Mexico	0.98**	12.7	15.4	8.1
Romania	0.88**	14.9	33.0	5.1
South Africa	1.07**	21.9	26.6	16.5
Source: IMF, GFS CD-ROM (November 2002) and WEO Database (April 2003); and own calculations				

** (*) denotes significance at the 5 (10) per cent level

This section therefore illustrates that although the size of South Africa's output gap is smaller compared with most of the other developing countries (lowering the relative strength of South African automatic fiscal stabilisers), its tax to GDP ratio and its tax revenue elasticity with respect to output growth is larger compared with the six-country averages (increasing the relative strength of South African automatic fiscal stabilisers) to the extent that the country's cyclical tax revenue is in line with most of the other developing countries.

[14] OLS estimation of $d(\log(B_{it})) = \alpha_i + \beta_{Bi} * d(\log(Y_{it})) + \varepsilon_{it}$ with AR(1) correction where Bi represents the respective country's tax revenue and Y_i the respective GDP.

5.2.5 Cyclical and structural components estimated using quarterly data, 1992 to 2000

In order to cross-check the robustness of the estimates, the cyclical components of tax revenue were also calculated by means of quarterly data. The elasticity and correlation coefficients are captured in Table 5.6, while Table 5.7 documents elasticity estimates at a more disaggregated level. The first interesting observation in terms of the quarterly estimates compared with the annual estimates is the fact that the correlation coefficient between the cyclical component of indirect tax revenue and output in the quarterly model is negative. Similar to the annual results, the elasticity of direct taxes with respect to output growth in the quarterly model also proved to be larger than that of indirect taxes. The elasticities of individual tax categories calculated from quarterly data show that taxes on net income and profits, social security contributions and taxes on payroll and workforce proved to be the most sensitive to changes in output. The major difference observed between the results of quarterly and annual estimates is the fact that the elasticity of taxes on property is much larger in the case of quarterly data, while the elasticity of "other taxes" is positive in the quarterly estimate compared to the negative elasticity observed in the annual results.

Table 5.6 Correlation coefficients and elasticities of tax revenue components (quarterly data)

Correlation coefficients between the cyclical components of taxes and output[15]	
Direct taxes	**Indirect taxes**
0.01	-0.01
Elasticity of budget components with respect to output growth[16]	
Direct taxes	**Indirect taxes**
0.14	0.00

[15] Estimates are based on Hodrick-Prescott filtered data.

[16] OLS estimation of $d(\log(B_{it})) = \alpha_i + \beta_{Bi} * d(\log(Y_{it})) + \varepsilon_{it}$ with AR(1) correction where Bi represents the respective tax component and Y represents GDP. The elasticity of direct taxes and indirect taxes with respect to output growth was calculated as the product of the elasticities of the tax categories with respect to their tax bases and the elasticities of these tax bases with respect to output. The current income of households was selected as the tax base for direct taxes, while private consumption expenditure was selected as the tax base for indirect taxes.

Table 5.7 Elasticity coefficients of individual tax categories with respect to output growth (quarterly data)[17]

Tax category	Elasticity
Taxes on net income and profits	3.29*
Taxes on property	4.22
Taxes on goods and services	1.68*
Taxes on international trade and transactions	-0.92
Other taxes	1.06
Social security contributions	8.87*
Taxes on payroll and workforce	11.68

* denotes significance at the 5 per cent level

The size and volatility of the cyclical component of tax revenue calculated by quarterly data are reported in Table 5.8, while Figure 5.3 portrays the cyclical, structural and actual tax revenue components as a ratio of trend GDP. Since the elasticity of indirect taxes with respect to output growth obtained from the quarterly estimates are zero, the total cyclical component of tax revenues can be ascribed to direct taxes. The cyclical component of direct taxes varies on average around 0,01 percentage points of GDP in either direction around its mean. This is much smaller compared to the results obtained from the annual data. The lowest negative value for the cyclical component of direct taxes was recorded in the first quarter of 1993, while the highest positive value was recorded in the fourth quarter of 1996.

[17] OLS estimation of $d(\log(B_{it})) = \alpha_i + \beta_{Bi} * d(\log(Y_{it})) + \varepsilon_{it}$ with AR(1) correction where Bi represents the respective tax component and Y represents GDP. Y was lagged by two quarters in the case of taxes on net income and profits, taxes on property, and other taxes.

Figure 5.3 A comparison of actual, structural and cyclical tax revenue as a ratio of trend GDP (quarterly data)[18]

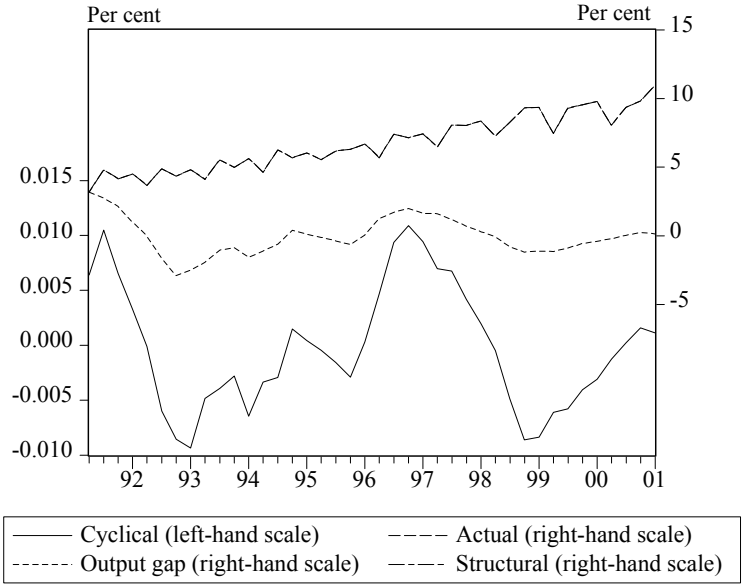


Table 5.8 Size and volatility of the cyclical component of direct tax revenue (quarterly data)

	Volatility Standard deviation (% points of GDP)	Lowest negative component		Highest positive component	
		Value (as % of GDP)	Year	Value (as % of GDP)	Year
Direct taxes	0.01	-0.01	1993 Q1	0.01	1996: Q4

Table 5.9 shows that the quarterly data support the fact that the role of automatic fiscal stabilisers was much smaller than that of discretionary fiscal policy during the 1990s. The quarterly data also prove to be useful, as they provide additional insight into the response of tax revenue to the output gap in the 1990s that could not be captured in the annual estimates. The coefficient of the structural component of tax revenue has switched from a perverse countercyclical negative coefficient in the first half of the 1990s to a rather sizeable positive coefficient in the latter half of the 1990s.

[18] The small size of the cyclical component makes it difficult to distinguish between the actual and structural components to the extent that there appears to be only three lines.

Whereas the annual data could only show that the role of automatic fiscal stabilisers was stronger in the latter half of the annual sample period (1986-2000) and particularly since the 1990s, the quarterly data provide additional insight by showing that the impact of automatic fiscal stabilisers was stronger towards the latter half of the 1990s.

Table 5.9 Estimated response of tax revenue to the output gap (quarterly data)

Sample period	Structural component	Cyclical component	Actual
1991:2-2001:1	-0.21 (0.83)	0.00 (0.00)	-0.21 (0.83)
1991:2-1996:1	-0.71 (0.41)	0.00 (0.00)	-0.70 (0.72)
1996:2-2001:1	0.94 (1.84)	0.01 (0.00)	0.94 (1.84)
Note: Standard errors in parentheses			

5.3 SYNOPSIS

Correlation coefficients between the cyclical components of direct and indirect tax revenue and output, as well as elasticity coefficients, show that tax revenue in South Africa moves procyclically. Direct taxes are more volatile and more sensitive to changes in GDP compared to indirect taxes. Moreover, the cyclical component of direct taxes is more than double that of the cyclical component of indirect taxes.

Cyclical changes in South African general government tax revenue are relatively small and provide no significant evidence of automatic stabilisation over the period 1970 to 2000. The results show a small positive response of the automatic fiscal stabilisers to the output gap. Regressions over sub-samples indicated the prominent role played by discretionary policy with deliberate attempts to smooth out automatic fluctuations during certain periods.

The potential of tax revenue as an effective automatic fiscal stabiliser in South Africa should not be overlooked. Results show a high correlation between the output gap and automatic stabiliser estimates. Automatic fiscal stabilisers were employed symmetrically over the cycle and results showed that automatic fiscal stabilisers

became increasingly important towards the end of the sample period. The estimated automatic fiscal stabilisers also proved to be relatively robust with respect to alternative assumptions of tax elasticities and no major differences were observed between the results obtained from annual and quarterly data.

A comparison with six other developing countries, namely Chile, India, Indonesia, Mauritius, Mexico and Romania, shows that the size of South Africa's cyclical tax revenue is more or less in line with five of the six countries and the trend in cyclical tax revenue for most of the countries (including South Africa) is broadly in line with their respective output gaps.