Enhancing Sustainable Fiscal Policy in South Africa

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Samuel Sangawulo Jibao

SUMMARY

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In this study, fiscal sustainability is defined consistent with the government inter-temporal budget constraint framework which is related to the solvency of the government. Fiscal sustainability analysis in this context, therefore, considers the revenue side of the budget as well as the expenditure obligations. On the revenue side, the study highlights that fiscal authorities in South Africa continue to rely on income, profit and wealth taxes as they account for a larger share of government revenue compared to indirect taxes. However, immediately prior to the first democratic South Africa, there was a substantial shift from company taxes to personal taxes; a trend that has continued onto 2010. Analyses in this study show that the structure of the main taxes of South Africa compares less favourably to other emerging economies, and the worldwide averages. For instance, even though fiscal authorities have reduced the CIT rate from a high 50% to 28%, this rate is still higher when compared to other upper middle income economies and the rest of the world's average. The country compares no better either when the PIT rate is considered but its VAT rate compares favourably to that of the economies mentioned. Since the new

era, in particular between 2000 and 2010, fiscal authorities in South Africa focussed on the reduction and stabilisation of marginal tax rates for the major taxes as well minimising the complexity in tax administration by reducing the number of tax brackets. Despite such effort, the wedge between the statutory rates and the realised average tax rates for the three main taxes is a concern regarding the protection of the revenue base.

With regards to budget allocations, this study shows that collectively, expenditure on the social sector accounts for slightly below half of government consumption expenditure; specifically, however, there was a reduction in the proportional allocation to Education whilst at the same time the proportional allocations to Social Protection, Public Order and Safety and Social Grants increased. Defence expenditure was high pre-1994 and immediately after the first democratic election, but declined in the later years of the democratic South Africa. In general, the policy of fiscal prudence after 1994 resulted in a substantial decline in debt service cost, whilst the real growth rate of the economy increased considerably. Nevertheless, the former still exceeded the latter for most part of the period between 1994 and 2010. Having reduced its debt burden over the past decades, the South African government again finds itself facing a problem of rising debt due to an increase in the fiscal deficit.

On the basis of this background, this study addresses four broad questions, namely: (i) was the fiscal stance taken in the past, sufficient to attain fiscal sustainability in South Africa? (ii) How did fiscal policy in the past adjust to budget imbalances and to what extent did that affect fiscal sustainability? (iii) Which are the optimal ways to

protect the revenue base; and (iv) How does the current fiscal dispensation (i.e. composition of expenditure and tax) affect the economy and inter alia fiscal sustainability? Different econometric techniques, namely: the Smooth Transition Error Correction model; the Logistic quadratic model; the Currency Demand model and the Bayesian Structural Vector Auto Regression Model are applied in the analyses.

The findings of this study suggest that fiscal policy over the sample period has been sustainable but likely to be adjusted more quickly when the budget deficit exceeds 4.02% of GDP. However, the stabilisation policies by fiscal authorities are fairly neutral at deficit levels below the estimated threshold; that is, at deficit levels of 4.02% of GDP and below. The fiscal reaction speed of the South African government (i.e. increasing the tax burden) to lower the large deficit levels towards a band of tolerable values, indicate that they are indeed concerned about solvency. Thus, on the basis of this historical fiscal stance, it can be expected that fiscal policy will remain sustainable in the medium-term; and that the government's projection to reduce the fiscal deficit from a high 5.3% of GDP in 2010 to 3.0% in 2015 is plausible. In South Africa the main fiscal challenge, therefore, is to find ways through which the recent gains in fiscal solvency are not at the expense of the future revenue base. Consequently, the next objective in this study is to analyse one important element of protecting the revenue base, namely, possible leakages from it. In this regard, shadow economic activity is being investigated. This study finds that on average, the size of the South African shadow economy is 22.18% of GDP with estimated revenue evaded at about 7% of GDP.

Further analysis shows that there is a strong positive relationship between the tax burden and shadow income but that this relationship is not symmetric. In South Africa, businesses and individuals are likely to react quicker when the tax burden changes fall outside the band of -3.64% to +2.13% of GDP but remains neutral as long as they are within this band. The implication of this finding is that, any attempt by the fiscal authorities to increase the tax burden to levels above the estimated threshold of 2.13% in order to close the budget deficit might trigger a significant response from the shadow economy thereby reducing the tax base and further worsening the fiscal deficit.

Next, the analysis shows that an increase in total government spending has a "crowding–in" effect as real GDP per capita and real private investment respond positively. When government expenditure is disaggregated into consumption and capital expenditure per capita, the analysis shows that a one standard deviation positive shock in government consumption expenditure per capita increases real GDP per capita with a multiplier effect of 0.22, which is higher than the growth multiplier effect (0.16) of government investment expenditure per capita. In addition, the effect of the total tax burden on the GDP and private investment is negative and persistent in the long-term (i.e. after 4 years). The net effect of fiscal policy, therefore, is that it is growth enhancing in the short and medium-terms leading to fiscal sustainability (since $r < g$) but in the long-term, the growth promoting effects of increased public intervention is offset by the growth inhibiting effects of increased taxes; hence, a threat to long-term fiscal sustainability.

The composition of the tax regime has a substantial influence on growth; whilst taxes on income and wealth reduce growth, indirect taxes have a positive effect on growth in the short and medium term.

On the basis of the above findings the following suggestions are proposed:

Firstly, the nature of fiscal policy in South Africa over the post-1994 period has shown to be successful from a fiscal sustainability perspective and should therefore be continued. However, the fact that government only seem to be pro-active in the case when the budget deficit exceeds the 4% margin and actually seem to be fairly neutral at deficit levels below this ratio should be noted. By implementing drastic tax increases in such a scenario could be detrimental to the growth of the revenue base. Conversely, tax relief at lower levels of the margin outlined, and even in times of surpluses could be growth enhancing and should be implemented actively.

Secondly, the 2012 medium-term budget document requesting for additional taxes to boost revenue might lead to further growth in the shadow economy, as the projected tax burden increase recommended is above the estimated threshold of 2.13% in this study. Such a reaction from shadow income poses a threat to long-term fiscal sustainability.

Thirdly, in their attempt to expand and secure the revenue base fiscal authorities in South Africa should consider further adjustments to the composition of the revenue base. The continuous reliance of the government on direct taxes is shown in this analysis to affect growth adversely, which could destabilise the fiscal gains already achieved. The results of this analysis, therefore, support the international trend towards a shift to indirect taxes from direct taxes.

Fourthly, expenditure priorities have to be carefully considered. Fiscal authorities should guard against populist spending patterns and prioritise those expenditures that result in capacity building and enhancing growth and employment. In this regard, the declining trend in expenditure on education and health has to be reversed. *A priori,* only by focussing its expenditures coupled with enhanced efficiency within such "productive" areas, would government be able to contribute towards enhancing growth which in turn is essential for long-term fiscal sustainability.

Thus, the analyses in this study show that in the short- and medium-term, there is no serious threat to fiscal sustainability in South Africa but long-term fiscal sustainability remains a challenge. To enhance long-term fiscal sustainability would require continuous adjustment of policies including the speed of policy adjustment, the stabilisation of the tax burden but with a redirection of focus from direct to indirect taxes; the protection of the revenue base, in particular a reduction in the existing level of tax revenue evaded and the reprioritisation of government expenditures.

A broader social and political context of fiscal sustainability has, however, not been included in this study. In a middle income country like South Africa where the role of government is politically and socially important and controversial, future research could explore how the quest to enhance fiscal consolidation can affect political and social stability which may in turn endanger the sustainability of fiscal policy. On the other hand quantifying the fiscal implications of expected developments such as demographic changes, development in health cost and public pension liabilities, could initiate future research on this topic should more relevant data becomes available.

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CHAPTER ONE: INTRODUCTION AND BACKGROUND

1.1 Introduction

Developments that followed the sub-prime crisis have led to a renewed debate on fiscal sustainability. The massive degree of fiscal intervention with corresponding increases in deficits and debt is a concern. From a fiscal perspective, maintaining a stable long-term relationship between expenditure and revenue is one of the key requirements for a stable macroeconomic environment and a sustainable economy. Furthermore, if fiscal positions are perceived to be unsustainable over the long term, the reaction of the markets from which government finances its borrowing requirement may trigger a fiscal crisis much sooner than might be expected by fiscal planners (Canagarjah, Brownbridge and Dumitru 2012). Under the present condition of the world economy, huge internal (or external) imbalances might lead to a hard landing for countries that appear to be insolvent (Baharumshah and Lau, 2007). Thus, as debt problems have been at the centre of many recent crises in the world, fiscal sustainability analysis has now become important when assessing macroeconomic policy.

This Chapter outlines the meaning of fiscal sustainability as presented in the literature and further reviews the background information about fiscal policy changes in South Africa in relation to other high middle income countries and the rest of the world. This information forms the framework upon which the other chapters are built. The Chapter also presents the problem statement, the objective of the study, the hypotheses to be tested and the outline of the study.

1.2 Defining fiscal sustainability

In the public economics literature, fiscal sustainability is defined with respect to both static and inter-temporal budget constraints. A static budget constraint is satisfied if the public sector is able to finance its current expenditures with its revenues and new borrowing, and meet or rollover its maturity liabilities. This implies that it is not liquidity constrained. The inter-temporal budget constraint on the other hand, is often formulated with respect to conditions for solvency that require that the present discounted value of future primary budget balances should at least be equal to the value of the outstanding stock of debt. According to this definition, the public sector cannot be a debtor, and the private sector cannot be a creditor, in present value terms. Any debt incurred should eventually be fully paid (Hamilton and Flavin, 1986:808-819).

In what came to be a leading contribution in the field of fiscal sustainability, Blanchard (1993:309) argued that the main issue is whether or not the current course of fiscal policy can be sustained with public debt not exploding or imploding. If debt tends to explode, government will have to increase taxes, reduce expenditure, monetise or even repudiate the debt. According to Easterly and Schmidt-Hebbel (1994:68-70) public debt is also the central issue of fiscal sustainability. However, their concern was ‘sustainable deficit levels’ rather than fiscal sustainability. To them, a sustainable deficit level is one that is consistent with a stable debt to GDP ratio.

In contrast to Blanchard (1993), Easterly and Schmidt-Hebbel (1994), Zee (1988: 666) argued that a sustainable level of public debt is one that allows the economy, in the absence of unanticipated exogenous shocks, to converge to a steady state. With

this view, fiscal sustainability is closely related with the level and the change in the level of public debt, and in particular the change in the public debt relative to output or income. A more flexible definition of fiscal sustainability adopts a weak solvency condition and allows the government to be a net debtor in present value terms up to a maximum level (Croce and Juan-Ramon, 2003). However, above the said threshold the government will have to alter its fiscal stance and generate a primary surplus in order to reduce the debt towards the threshold.

Fiscal sustainability is, therefore, affected by the revenue side of the budget as well as by expenditure flows. On the revenue side, many countries trapped into deep budget deficits or public debt are calling for higher taxes or other public sector revenues to deal with the resulting debt increase. Such fiscal action may trigger growth in the shadow economy, which can lead to an erosion of the tax base, a decrease in tax receipts and thus to a further increase in the budget deficit. Thus, a weak tax effort resulting from an extensive level of tax evasion and/or weaknesses in tax policy might be a threat to fiscal sustainability.

On the expenditure side, fiscal policies entail the distribution of resources, both across society at a given point in time and between different sectors in the economy. Barro (1990:103-125) demonstrates in his representative firm production function that the fiscal structure, defined as the composition of government expenditure and taxation, and the overall size of government have a substantial influence on economic growth. Since the pioneering contributions of Barro (1990), King and Rebelo (1990) and Lucas (1990), several studies (for example, Colombier (2008); Ghosh and Gregorious (2008: 484-518); Bose, Haque and Osborn (2007:533-556);

Gupta, Clemens, Baldacci and Mulas-Granados (2005:411-63); Kneller, Bleaney and Gemmell (1999); Devarajan, Swaroop, and Zou (1996:313-44) have extended the analysis of taxation, public expenditure and growth, demonstrating that government can contribute to increasing the economy's growth rate by converting into productive expenditures that part of private income that it absorbs through taxes. Thus, if healthier people are more productive, then expenditures on public health satisfy these requirements. The same holds true for expenditures on education, research and resource development. *A priori,* lower real GDP growth will reduce the growth of the tax base and hence makes it more difficult to achieve an improvement in the primary fiscal balance.[1]

The sustainability, structure and stability roles of fiscal policy are therefore not independent (Barker, Buckle and Clair, 2008). The structure of fiscal policy has important implications for fiscal sustainability and the effectiveness of the stabilisation role of fiscal policy. For instance, the size and structure of the tax base determine the level of resources available for government expenditure and hence impact on sustainability. On the other hand, the design of the tax and welfare systems will impact on the size and operation of automatic stabilisers and the contribution of fiscal policy to macroeconomic stability (Barker, Buckle and Clair, 2008).

[1] In general, given tax rates and effective tax administration, growth in GDP leads to growth in revenue collected.

1.3 A review of South Africa's fiscal policy changes

This Section provides a historic overview of the dynamics of fiscal policy in South Africa between 1960 and 2010. The analysis in this section is relevant as it provides an insight into the fiscal structure of the country and forms a framework for the other Chapters that identify and investigate areas that may enhance the country's fiscal sustainability. It is divided in five parts. Part 1.3.1 focuses on tax reform measures in this period and also compares the outcome of the reform measures with other emerging economies, Sub-Saharan countries and the rest of the world. Part 1.3.2 deals with expenditure changes and its composition. Part 1.3.3 reviews South Africa's fiscal balance whilst Part 1.3.4 deals with debt positions of South Africa. Part 1.3.5 highlights the fiscal as well as demographic and social characteristics of South Africa. As in other sections the selected indicators are compared to similar indicators in some other economies.

1.3.1 Tax reform measures in South Africa

The tax reform measures in South Africa between 1960 and 2010 were guided by the recommendations from three main commissions, namely, the Franzsen Commission of 1967, the Margo Commission (1987) and the Katz Commission (1994). In 1967, the government of South Africa instituted a commission headed by Franzsen with the mandate to enquire into the system of taxation and the financial structure in South Africa, as well as the fiscal and monetary policies pursued at the time, with the specific view to submitting recommendations to promote economic growth and financial stability. This Commission published its findings and recommendations in three reports during the period 1968 to 1970 with far-reaching consequences for the South African tax system, including the abolition of super

income tax introduced during World War II, together with the smoothing of the rate of progression at lower income levels and the introduction of the country's first general sales tax as a step towards the ultimate adoption of the present value-added system of indirect taxation. In 1968 this Commission was the first to recommend a separate capital gains tax on profits arising from the sale of shares and fixed property (other than residential property) as the principal components of the proposed tax base. This recommendation was rejected by both the Margo and the Katz Commissions with the justification that the said tax is administratively costly and has a low revenue potential. A capital gains tax was however introduced in 2001 as recommended by the then Minister of Finance and was meant to effectively broaden the direct tax base applicable to individual taxpayers and companies but above all, to address the issue of horizontal equity of taxation (Budget Review, 2001).

Unlike the Franzsen Commission, the Margo Commission produced only one report. The commission was tasked by the government to look into the tax structure of the country. Key among the recommendations in this report were the introduction of separate income taxes for men and women, that married and unmarried persons be given the same primary rebate and that there be a move towards a simpler income tax structure with fewer, broader bands and lower marginal rates. One major tax policy change before the next Commission report was the replacement of sales tax with Value Added Tax in 1991.

Like the other commissions mentioned above, the Commission of Enquiry into certain aspects of the tax structure of South Africa in 1994, known as the Katz Commission, was appointed by the government with a mandate to investigate the

appropriateness and efficiency of the tax system and make recommendations on its improvement taking into account internationally accepted tax principles and practices (First Interim Report, 1994:1). This Commission produced nine interim reports. Based on the recommendations of these reports, the democratic government has embarked on major fiscal reforms since 1994, ranging from institutional to the rationalisation and harmonisation of tax rates and brackets. The first institutional reform in tax administration took place on October 18, 1995 when the Cabinet approved the restructuring of the Inland Revenue and Customs and Excise Directorates in the Department of Finance (now the National Treasury) into an autonomous revenue collection agency, known as the South African Revenue Service (SARS). According to Grote (2008), these changes put SARS in a strong position to obtain its key objectives of collecting all national taxes, duties and levies, by attracting and retaining competent staff, utilising modern information technology and adopting efficiency-enhancing organisational structures thereby protecting the revenue base.

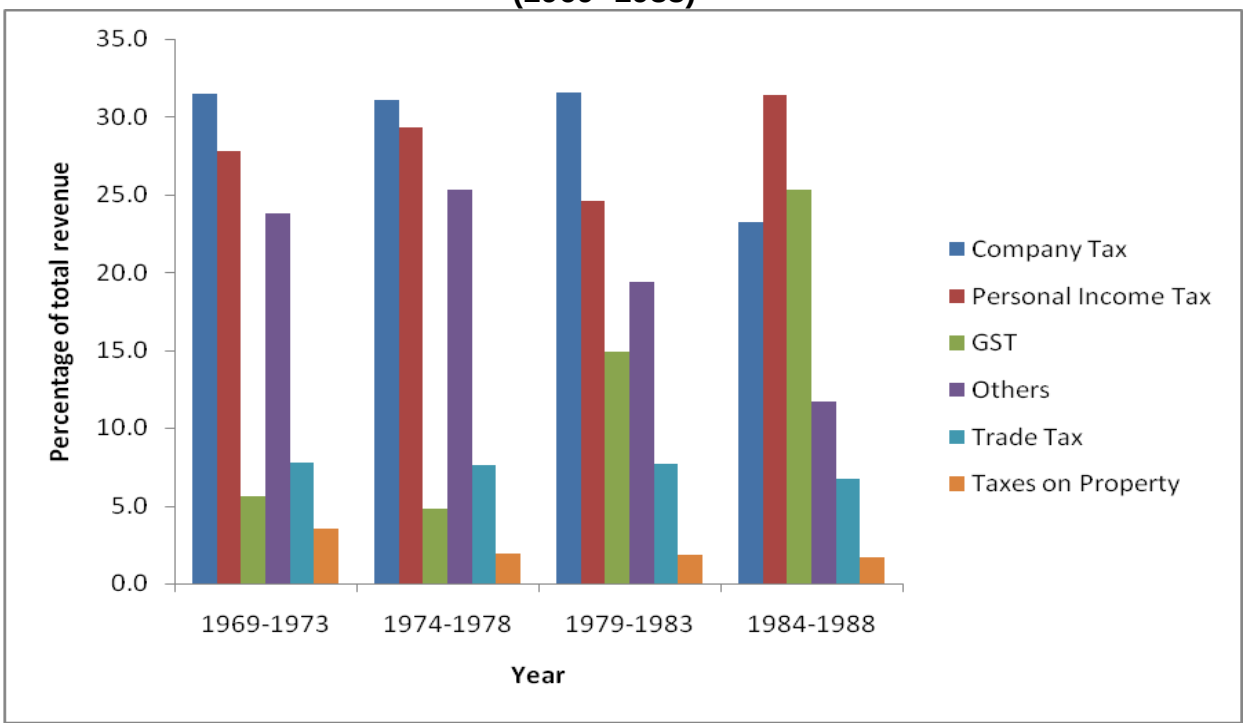
1.3.1.1 Outcome of the reform measures

This Section discusses the tax policy structure resulting from the different Tax Commissions and also focuses on the contributions of major taxes in the economy with the aim of providing an insight into the extent to which the Tax Commissions have changed the fiscal landscape of the country. It also compares the tax performance of South Africa to that of some other economies. In order to deal with the different periods covered by different Commissions, a distinction is made between the periods 1969-1988; 1989-1993; and the period post-1994.

1.3.1.2 Trends in the tax structure and revenue collection in South Africa (1969- 1988)

The average revenue collections as percentage of total revenue between 1969 and 1988 are shown in Figure 1.1. Because of data limitations on marginal tax rates, analysis of the tax structure in Tables 1.1 and 1.2 only starts from 1980. The share of the respective taxes to total revenue collected data series was obtained from the South African Reserve Bank online statistical query (Historical macroeconomic times series information, series codes KBP4425J-KBP4437). There was no Value Added Tax (VAT) between 1969 and 1990 and therefore data on General Sales Tax (GST) was reported for this period.

Figure 1.1: Trends in the average contribution of taxes to total revenue (1969- 1988)



Source: ratios calculated using data from www.reservebank.co.za.

Figure 1.1 shows that from 1969 to 1983, companies shouldered an increasingly dominant share of the direct tax burden compared to individuals and other tax sources. Whilst company taxes on average contributed 31.5% to total revenue

between 1969 and 1973, individual taxes' contribution was 27.8%, that from trade taxes 7.8%, GST (5.6%) and other taxes (23.8%) in the same period. Company taxes' share to total revenue continued to be larger than other taxes between 1979 and 1983. However, in the period 1984 to 1988 there was a shift from company taxes to personal income taxes in the composition of direct taxes. Another significant change in the revenue composition was the drastic increase in the contribution of GST from 14.9% in the pre-period to 25.3% between 1984 and 1988.

Table 1.1: Trends in the Personal Income Tax structure (1980-1988)

Year	Maximum marginal tax rate	Minimum marginal tax rate	Number of tax brackets
1980	50	9.6	17
1981	50	9.6	17
1982	50	12	16
1983	50	12	16
1984	50	14.4	15
1985	50	16	21
1986	50	16	21
1987	45	15	18
1988	45	14	19

Source: Arendse, Jordan, Kolitz and Stein (2000)

Table 1.1 shows that between 1980 and 1986 the minimum PIT rate significantly increased from 9.6% to 16.0% or by 66.7% but declined to 15% and 14% in 1987 and 1988, respectively. The maximum rate remained constant at a high 50.0% between 1980 and 1986 but also declined to 45% in 1987. In a similar vein the

number of tax brackets showed an increasing trend between the period 1980 and 1986 from 17 to 21 tax brackets but it declined to 18 in 1987. The statutory rate for CIT also showed an increasing trend from 40.0% in 1980 to 42% between 1982 and 1984 (Table 1.2a). It is suspected that such an increase in the tax burden and the complexity in the tax administration as shown by the growing number of tax brackets (Table 1.1) during this period could have had implications for fiscal sustainability.

Table 1.2a: Implicit and statutory tax rates (1980-1984)

Year	PIT			CIT		
	Statutory rate (Average)[2]	Implicit rate	% of statutory rate collected[3]	Legal rate (Basic rate)	Implicit rate	% of statutory rate collected
1980	29.8	6.3	21.2	40	25.4	63.6
1981	29.8	7.9	26.6	40	26.5	66.2
1982	31.6	9.2	29.2	42	29.7	70.6
1983	31.6	10.4	33.0	42	27.7	65.9
1984	31.6	11.1	35.0	42	24.5	58.4
Average	30.9	9.0	29.0	41.2	26.8	64.9

Source: author's computation using data from Arendse, *et al.*(2000)

[2] These are aggregate average tax rates as distinct from the effective marginal tax rates that are commonly used in studies of household income, income distribution and taxation. It is computed as the sum of the statutory rate in each tax bracket divided by the number of brackets.
[3] It is computed as the ratio of implicit tax rate to the statutory tax rate.

Table 1.2b: Implicit and legal tax rates (1985-1988)

Year	PIT			CIT		
	Statutory rate (Average)	Implicit rate	% of statutory rate collected	Statutory rate (Basic rate)	Implicit rate	% of Statutory rate collected
1985	32.5	11.3	34.8	50	31.5	63.1
1986	34.5	11.5	33.3	50	30.9	61.9
1987	34.5	11.2	32.4	50	25.1	50.1
1988	30.7	10.9	35.6	50	23.4	46.7
Average	33.1	11.2	34.0	50	27.7	55.5

Source: author's computation using data from Arende, *et al.* (2000)

Tables 1.2a and 1.2b show that between 1980 and 1988, tax collections were a relatively small fraction of the proxy tax base as shown by the implicit tax rates for the various taxes. The implicit tax rate is calculated as the ratio of the actual revenue collected from a given tax source to the size of the tax base for that tax instrument. In the case of the PIT, the proxy tax base for this period is Current Income obtained from the South African Reserved Bank National Accounts with search code 6244K.

The Net Operating Surplus net of interest payments by companies is used as a proxy tax base for CIT. The percentage of statutory tax rates collected, defined as the ratio of implicit tax to statutory tax, gives an indication of the extent of the wedge between the statutory tax rate and the realised average tax rate. A portion of the ratio below 100% be accounted for by tax breaks or exemptions, tax avoidance or tax evasion.[4] The low (i.e. less than 30% from 1980 to 1984 and 35% between 1985 and 1988) percentage of the PIT implicit tax rate relative to the statutory tax rate as

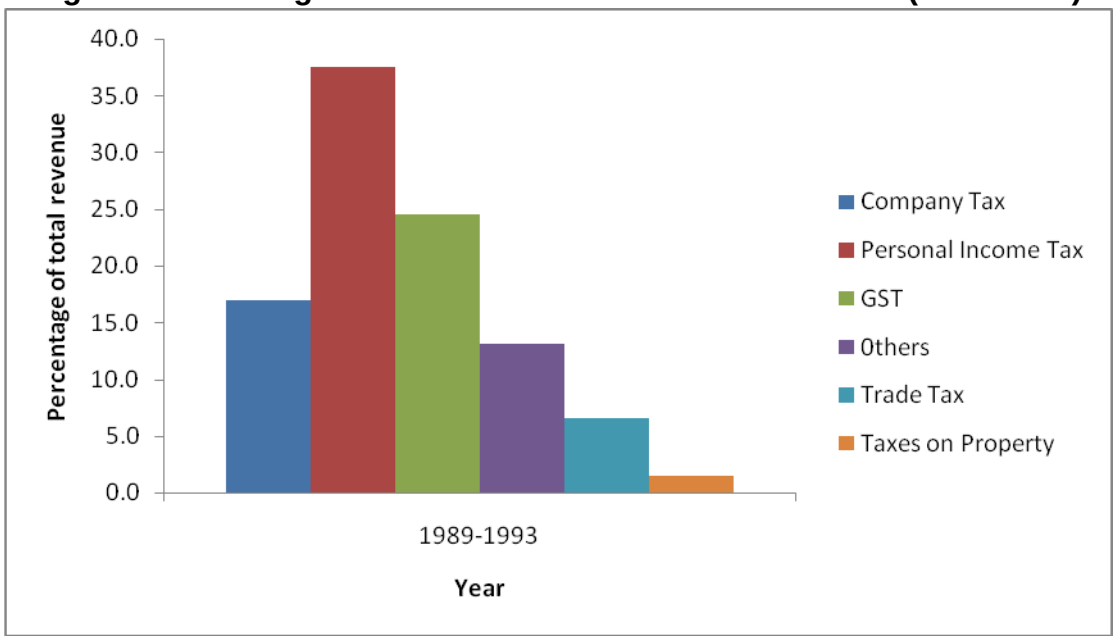
[4] The study recognises that for all the major taxes, entities must usually be over a certain threshold before becoming liable for taxation.

shown in Tables 1.2a and 1.2b could therefore be an indication of tax evasion or tax exemption. Although about 65% of the CIT statutory tax rate was collected between 1980 and 1984, it declined to 55.5% between 1985 and 1988. The difference between the two rates is large enough to raise a concern for the protection of the revenue base.

1.3.1.3 Trends in the tax structure and revenue collection in South Africa (1989-1993)

The contribution of the different tax sources to total revenue collection between 1989 and 1993 is shown in Figure 1.2, whilst Table 1.3 shows the tax structure during this period. Table 1.4 again compares the implicit tax rates to the statutory rates to assess the wedge between the two rates during this period.

Figure 1.2: Average share of tax sources to total revenue (1989-1993)



Source: ratios calculated using data from www.reservebank.co.za.

Figure 1.2 indicates that between 1989 and 1993, the country's tax system continued to rely more on direct taxation as it contributed an average 54.4% of total domestic

revenue during this period. Individually, the highest contribution of revenue within this period was generated from personal income tax (37.5%), followed by GST/VAT (24.5%), company tax (16.9%), fuel levy (7.0%), international trade tax (6.5%) with the smallest contribution from property taxes (1.5%).

Table 1.3: Trends in the Personal Income Tax structure (1989-1993)

Year	Maximum marginal tax rate	Minimum marginal tax rate	Number of tax brackets
1989	45	14	19
1990	44	15	14
1991	43	14	12
1992	43	17	9
1993	43	17	9

Source: Arendse, *et al.* (2000)

Table 1.3 indicates that between 1989 and 1993 the Personal Income Tax system was simplified with the number of Personal Income Tax brackets reduced to only 9 brackets from 19 prior to this period. The maximum PIT rate also showed a declining trend. The minimum rate declined to 14.0% at the initial period between 1989 and 1993 but then increased again to 17.0% prior to the political change in 1994. The CIT statutory rate was held at 50.0% within this period, but slightly declined to 48% immediately prior to 1994 (Table 1.4).

Table 1.4: Implicit and Statutory Tax rate (1989-1993)

Year	PIT			CIT			VAT		
	Statutory rate	Implicit rate	% of statutory rate collected	Statutory rate	Implicit rate	% of statutory rate collected	Statutory rate[5]	Effective rate	% of Statutory rate collected
1989	30.5	12.4	40.7	50	22.0	43.9	N/A	N/A	N/A
1990	30.5	12.8	42.1	50	25.9	51.9	N/A	N/A	N/A
1991	32.5	13.4	41.3	50	18.9	37.3	NA	NA	NA
1992	30.7	14.0	45.7	48	12.9	26.9	14	7.1	50.7
1993	28.5	13.4	47.1	48	12.3	25.5	14	8.3	59.3
Average	30.5	13.2	43.4	49.2	18.4	37.1	14	7.7	55.0

Source: author's computation using data from Arende, *et al.* (2000)

[5] VAT was introduced in 1991. Before that period, the General Sales Tax was implemented for which data on the rate is not available.

Table 1.4 indicates that between 1989 and 1993 there was some increase in the implicit PIT rate. With a further reduction in the average statutory rate to 30.5% the implicit rate increased to 12.4% in 1989 and to 13.2% between 1989 and 1993 from the average of 11.2% between 1985 and 1988. On the other hand, the CIT legal tax rate increased to 49.2% on average, leading to a drop in the implicit tax rate to 18.4% from an average of 27.7% in the previous period.

With regards to VAT, the sum of consumption by households and consumption by general government net of employees' compensations is used as a proxy tax base. In addition, whilst the implicit rate for Personal and Corporate Income Tax is calculated as a percentage of income the effective rate for VAT is used and it is calculated as a levy on top of consumption.[6] Since the implementation of VAT in 1991 the statutory tax rate has been constant at 14%. Between 1992 and 1993 the average effective VAT rate was 7.7% given an average collection rate of 55.0%. Like in the other two main tax sources, the wedge between the VAT statutory rates and the realised average tax rates is a concern for the protection of the revenue base.

1.3.1.4 Trends in tax revenue collection in South Africa (1994-2010)

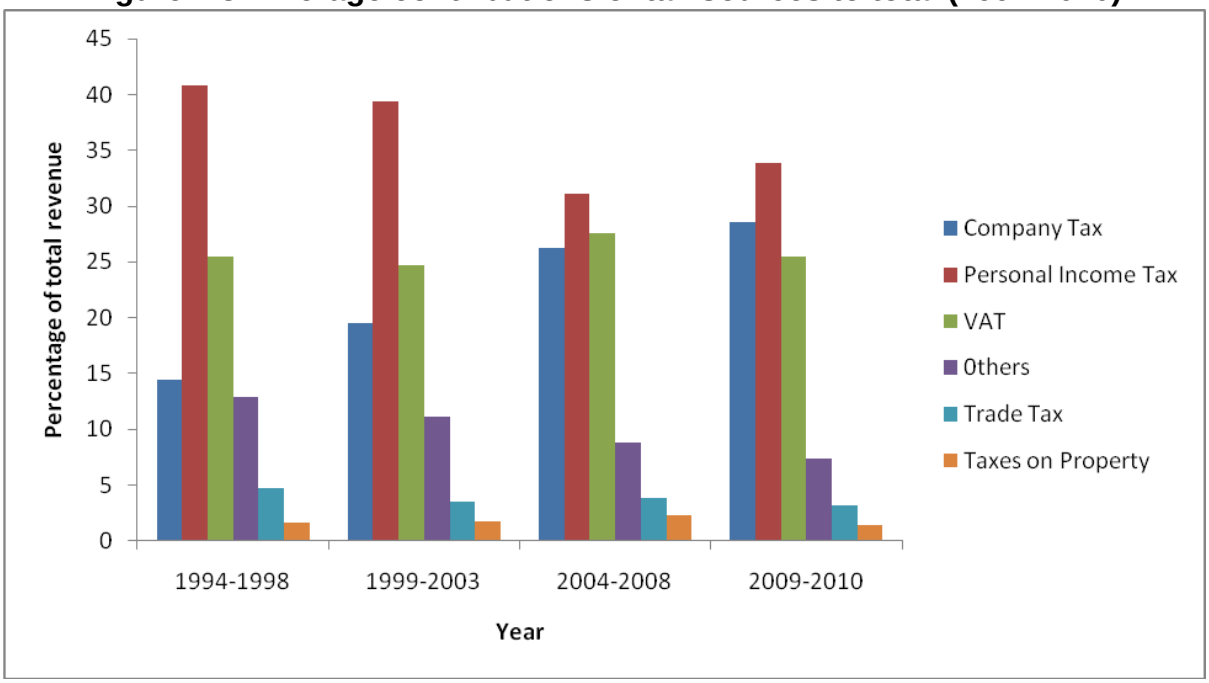
In taking over the reins of fiscal administration, the 1994 Government embarked upon a strong adjustment programme in the fiscal landscape, which resulted in a hike in the tax burden in the earlier part of this period (1994-1999) but eventually provided some fiscal space for the government to embark on strong expenditure growth and continued tax relief in the face of adverse global conditions in the later

[6] The effective tax rate, y, for VAT is calculated using the equation: $\frac{1}{y} = \frac{1}{\beta} - 1$ where β is the implicit rate.

part of the period (2000-2010). The contribution of the different tax sources to total revenue collected between 1994 and 2010 is shown in Figure 1.3, whilst Table 1.5 shows movements in the tax structure and Table 1.6 assesses tax compliance over this period. Tax share data for the different revenue sources for South Africa can be found in the South African Reserve Bank (SARB) database.

Figure 1.3 indicates that from 1994 to 2010, individuals continued to shoulder an increasingly dominant share of the direct tax burden in comparison with companies. In the earlier part of this period, whilst individual taxes on average contributed 40.8% to total revenue between 1994 and 1998, company taxes' contribution was only 14.4% in the same period. Similarly, between 1999 and 2003 individuals on average contributed 39.4% whilst company taxes' contribution slightly increased to 19.5% from 14.4 in the previous period. During the period 2004 to 2010, however, the gap between the average tax burden on individuals and companies seems to have narrowed. Whilst the contribution of individual taxes to total revenue declined to 31.1% between 2004 and 2008, company taxes' contribution increased to an average of 26.3% during the same period. Between 2009 and 2010 both PIT and company taxes' contributions to total revenue increased to 33.9% and 28.6% respectively.

Figure 1.3: Average contributions of tax sources to total (1994-2010)



Source: ratios calculated using data from **www.reservebank.co.za**.

Table 1.5 shows that during the earlier period between 1994 and 1999, the maximum marginal PIT rate increased to an average of 45% but thereafter declined and has been maintained at 40% since then. The PIT minimum rate also slightly increased but as from 2000 it declined again to 18% and was maintained at that level onto 2010. The number of tax brackets was reduced and is currently maintained at 6 brackets. This trend in the PIT rate was to a large extent influenced by the Katz Commission, which placed greater emphasis on equity in the tax system and the need to use taxes as an instrument to redistribute wealth. The Commission was concerned about the widespread poverty and income inequality prevailing in the country (First Interim Report, 1994:3).

The government's policy on company taxes was informed by the Growth, Employment and Redistribution Strategy (GEAR) which sought to achieve sustainable economic growth and employment creation through increasing exports

and private sector investment. The lowering of company taxes was a central part of the strategy to encourage private sector investment. In his 1999/2000 budget speech, the Minister of Finance argued that the reduction in company taxes would boost economic growth and job creation in two main ways. Firstly, it would make South Africa a significantly more attractive destination for both domestic and foreign investors and secondly, lower company taxes would translate into cash flow benefits for small and medium enterprises, thereby enhancing their ability to play a leading role in job creation and economic development (Department of Finance, 1999b).

Table 1.6a shows that, during the initial years of democratic South Africa, the average statutory PIT rate slightly increased to 30.9% between 1994 and 1998 from 30.5% between 1989 and 1993. In computing the implicit tax rate for PIT beyond 1993 the Gross Balance of Primary Income was used as a proxy tax base since no data series exist for Current Income as used in the previous analysis beyond this period. Gross balance of primary income data for South Africa can be found in the production, distribution and accumulation accounts in the South African Reserve Bank Quarterly Bulletin. This series represents compensation of employees, property income received less property income paid (series codes: 6835J).

Table 1.5: Trends in the Personal Income Tax structure (1994-2010)

Year	Maximum marginal tax rate	Minimum marginal tax rate	Number of tax brackets
1994	43	17	9
1995	45	17	10
1996	45	17	8
1997	45	19	6
1998	45	19	6
1999	45	19	6
2000	42	18	6
2001	42	18	6
2002	40	18	6
2003	40	18	6
2004	40	18	6
2005	40	18	6
2006	40	18	6
2007	40	18	6
2008	40	18	6
2009	40	18	6
2010	40	18	6

Source: Arendse, *et al.* (2000); Divaris and Stein (2010)

Table 1.6a further indicates that although there was some improvement in actual PIT collection between 1994 and 1998 compared to the previous period analysed, the share of the PIT implicit tax to the legal tax was still below 50.0%, which is low enough to raise a concern for the protection of the revenue base. The CIT average statutory rate was reduced to 36.0% from 49.2% prior to this period. Despite this reduction, the realised average tax rate relative to the statutory rate only increased slightly to 37.4% from 37.1% mostly as a result of lower profit but probably also because of lower levels of compliance prior to and during the period of transformation. In the case of VAT the difference between statutory rates and implicit rates remained fairly constant except for a substantial deviation in 1997.

During the period 1999 to 2010, however, some substantial declines can be observed in statutory taxes both in the case of PIT and CIT (Tables 1.6b, 1.6c and

1.6d). The statutory PIT rate was reduced and stabilised at an average of 31.0% whilst the CIT basic rate was continuously reduced to stabilise at 28.0% by the end of the period. However, despite a reduction in the PIT statutory rate, the share of the potential revenue collected was still below 50%. Again it should be mentioned that the implicit rate is largely affected by many other factors not related to the marginal tax rate, it might be an indication of underperformance in terms of compliance. In the case of CIT, an analysis of the relevant tax rates show some conflicting trends.

Whilst the statutory rates have decreased continuously the implicit rates show a substantial increase (especially during the period 2004-2008) mostly due to a corresponding increase in profits but it was also a period featured by incentives from the government to improve on tax compliance. The proportionally high levels of compliance up to 96.9% in 2008 should be treated with care though.[7] Similarly, the VAT collection effort showed improvement reaching 80.6% in 2007 but thereafter this number started declining again to reach 71.1% between 2009 and 2010.

Generally, the trend shows that direct taxes continue to account for a larger share of government revenue in South Africa. Between 1994 and 2010 individuals continued to shoulder a dominant share of the direct tax burden compared to companies. Furthermore, it seems as if when the statutory tax rates are relatively high, the share of revenue collected relative to its proxy base is lower.

The analysis in this section also shows that prior to 1994, there was much volatility in the tax rate regime and the tax structure was more complex as reflected in the

[7] In general however it seems as if the lowering of the statutory rates may have contributed to an increase in tax compliance by the corporate sector.

number of tax brackets. However, during the later era this has changed with a reduction of marginal tax rates as well minimising the complexity in the tax administration by reducing the number of tax brackets. Despite such effort, the wedge between the statutory rates and the realised average tax rates for the three main taxes could be an indication of a possible revenue leakage which is a concern regarding the protection of the revenue base. In Chapter 4 this issue is further investigated with an analysis of the impact of “shadow” economic activities on the revenue base.

Table 1.6a: Implicit and Statutory Tax rate (1994-1998)

Year	PIT			CIT			VAT		
	Statutory rate	Implicit rate	% of statutory rate collected	Statutory rate	Implicit rate	% of statutory rate collected	Statutory rate	effective rate	% of Statutory rate collected
1994	28.5	12.6	44.3	40	12.2	30.5	14	9.0	64.0
1995	28.5	13.0	45.4	35	10.4	29.6	14	8.9	63.5
1996	28.5	13.4	46.9	35	13.5	38.6	14	8.7	62.0
1997	32.5	13.6	41.9	35	13.9	39.6	14	7.1	50.7
1998	36.3	13.9	38.3	35	17.0	48.6	14	9.1	64.8
Average	30.9	13.3	43.4	36.0	13.4	37.4	14	8.5	61.0

Source: computed using data from Arendse *et al.* (2000); Divaris and Stein (2010)

Table 1.6b: Implicit and Statutory Tax rate (1999-2004)

Year	PIT			CIT			VAT		
	Statutory rate	Implicit rate	% of statutory rate collected	Statutory rate	Implicit rate	% of statutory rate collected	Statutory rate	effective rate	% of statutory rate collected.
1999	36.7	12.8	34.9	35	15.8	45.2	14.0	9.2	65.8
2000	35.5	11.9	33.4	35	13.8	39.4	14.0	8.9	63.3
2001	32.5	11.2	34.3	30	20.5	68.4	14.0	9.0	64.1
2002	32.5	10.5	32.4	30	20	66.5	14.0	9.2	65.6
2003	31.0	10.0	32.2	30	18.7	62.4	14.0	9.4	66.9
Average	33.6	11.3	33.5	32	17.8	56.4	14.0	9.1	65.1

Source: author's computation using data from Arende, *et al*.(2000); Divaris and Stein (2010)

Table 1.6c: Implicit and Statutory Tax rate (2004-2008)

Year	PIT			CIT			VAT		
	Statutory rate	Implicit rate	% of statutory rate collected	Statutory rate	Implicit rate	% of statutory rate collected	Statutory rate	Implicit rate	% of the statutory rate collected
2004	31	10.7	34.6	30	18.0	60.0	14.0	10.2	72.5
2005	31	9.9	32.0	30	21.0	70.1	14.0	10.8	77.0
2006	31	10.1	32.4	29	24.7	85.2	14.0	11.4	81.1
2007	31	9.7	31.4	29	26.3	90.8	14.0	11.3	80.6
2008	31	10.6	34.2	28	27.1	96.9	14.0	10.6	75.8
Average	31	10.2	32.9	29.2	23.4	80.6	14.0	10.9	77.4

Source: author's computation using data from Divaris and Stein (2010)

Table 1.6d: Implicit and Statutory Tax rate (2009-2010)

Year	PIT			CIT			VAT		
	Statutory rate	Implicit rate	% of statutory rate collected	Statutory rate	Implicit rate	% of statutory rate collected	Statutory rate	Implicit rate	% of statutory collected
2009	31	11.9	38.3	28	25.2	89.9	14.0	9.6	68.9
2010	31	11.8	38.0	28	17.2	61.3	14.0	10.3	73.3
Average	31	11.9	38.2	28	21.2	75.6	14.0	10.0	71.1

Source: author's computation using data from Divaris and Stein (2010)

1.3.1.5 The South African tax system compared to that of other economies

This section examines the South African tax system's competiveness, tax structure, revenue performance, tax administration organisation and efficiency based on a series of quantitative and qualitative indicators (see Appendix 1 for the meaning and calculation of each indicator). South Africa is compared to other countries in Sub-Saharan Africa, upper – middle - income economies and the rest of the world. It should be noted that comparison between South Africa and Sub-Sahara Africa is more complex than the one in this study given that per capita income in South Africa is higher than the rest of Sub-Saharan Africa.

The Section is relevant as it provides some insight into the extent to which tax policy over the years has been successful in making South African's tax policy and administration more competitive[8] as desired in the GEAR strategy and fiscal policy in general as stated in the 1999/2000 Budget Speech of the Minister of Finance. *A priori*, making the tax system more competitive has implications for fiscal sustainability since it encourages growth in both domestic and private investment thereby enhancing growth and securing future revenue for the government.

A comprehensive database containing comparative data for nearly 150 countries can be found at www.collectingtaxes.net. The analysis, however, is limited to the major taxes in 2009 and 2010, namely PIT, CIT and VAT which in total contribute about 80% of the countries' revenue.

[8] A "competitive" tax system is one that imposes the minimum possible burden on its taxpayers. Note that there are many factors that affect overall country competitiveness that have little to do with taxes, such as governance conditions, adequacy of infrastructure, and quality of the labor force.

1.3.1.6 Tax structure

The main indicators used to compare the tax structures of different countries are: PIT maximum rate (PITMAXR); PIT minimum rate (PITMINR); PIT minimum income level (PITMINL); PIT maximum income level (PITMAXL); CIT rate (CITR); VAT rate (VATR); and the VAT threshold.

Table 1.7 shows a comparison of South Africa's tax structure. The general CIT rate, set at 28% in 2009/10 for corporate taxable profits, is lower when compared to the un- weighted average of Sub-Saharan Africa (31.9%), but higher than the rest of the world's average of 27.1%. Compared with other upper-middle-income countries, however, South Africa's company tax rate compares less favourably as the rate is about 4% points higher. The country compares no better either when the PIT rate is considered. Individual income is taxed at progressive rates from 18% to 40%, compared to a band 11.1% to 34.7% in Sub-Saharan Africa,12.8% to 26.5% in upper middle income countries and 12.0% to 29.7% around the world. The PITMINL of 1.1 indicates that only residents earning 1.1 times more than South Africa's per capita GDP have to pay tax whilst the PITMAXL of 9.3 indicates that those whose earnings exceed 9.3% times per capita income pay tax at the top marginal rate. The latter compares unfavourably with the rest of the world with a top marginal tax rate levied on those earnings only exceeding 10.6% times per capita income.

Unlike the CIT and PIT rates, South Africa's VAT compares favourably. At 14%, its VAT rate is 1.8% points below the worldwide average and 2% points below upper middle income and Sub-Saharan African countries' averages, respectively. In dollar terms, the VAT threshold in South Africa is almost twice that of the upper-middle-

income and more than three times the worldwide averages. It should be noted that a low or no VAT threshold could result into an undue tax compliance burden on smaller businesses without sophisticated recordkeeping as well as a unnecessary administrative burden on tax administration.

Table 1.7 Tax structure indicators of South Africa compared to other economies

Category	PITMINR	PITMAXR	CITR	VATR	PITMAXL	PITMINL	VAT threshold US$
South Africa	18	40	28	14	9.3	1.1	142,857
Sub-Saharan Africa	11.1	34.7	31.9	16	13.5	1.2	41,656
Upper middle-income countries	12.8	26.5	24.4	16	4.5	0.72	88,281
World	12	29.7	27.1	15.8	10.6	1.1	38,067

Source: www.collectingtaxes.net database 2009/2010

1.3.1.7 Revenue performance and productivity

This Section considers both reference and performance indicators to compare South Africa to other economies. Table 1.8 shows quantitative indicators that provide a sense of how effectively the tax system produces revenue. These quantitative indicators are: PIT productivity (PITPROD); CIT productivity (CITPROD); VAT productivity (VATPROD); and VAT Gross Compliance Ratio (VATGCR). Table 1.9 on the other hand presents reference indicators. Reference indicators do not indicate performance or quality of the tax system, rather they provide information about the amount of revenue the three major taxes produce and allow for international reference comparisons.[9] The reference indicators discussed in this Section include:

[9] See www.collectingtaxes.net: Introduction, data notes and references.

PIT to GDP ratio (PITY); CIT to GDP ratio (CITY); and VAT as a share of GDP (VATY). The revenue performance of the PIT, at 0.27, is substantially higher than that of upper middle income (0.14), regional (0.08) and worldwide (0.12) averages. Table 1.9 shows that the revenue from PIT, at 8.4% of GDP in FY2009/2010, more than doubled that of the world average (3.6%) and the upper middle income countries' average of 3.4%. A similar picture can also been seen with regard to reference indicators in the case of CIT. Revenues from CIT, at 5.5% of GDP, double the regional average (2.7%) and are more than 60% higher than the upper middle (3.4%) and worldwide (3.5%) averages. In terms of revenue performance, South Africa's CIT ratio is at par with other upper middle income countries but more than twice the regional average (0.09) and more than two-fifth higher than the worldwide average of 0.13.

Collections of VAT, at 6.1% of GDP, are slightly lower than both the worldwide average of 6.3% and the upper middle income average (6.8%) but far higher than the average for the sub-region (4.3%). The average VAT Gross Compliance (GCR) in South Africa is 73.3%, which is higher than the average for countries with a similar level of income (70.8%) and the worldwide average of 65.5%; but substantially higher than that of Sub-Saharan average (42.3%). The VAT productivity ratio of 0.44 is slightly lower than the average for countries with a similar income level (0.45) but slightly higher than that of the worldwide average (0.41) and nearly two-thirds of the regional average (0.28).

Table 1.8: Revenue performance indicators

Category	PITPROD	CITPROD	VATPROD	VATGCR
South Africa	0.27	0.20	0.44	73.3
Sub-Saharan Africa	0.08	0.09	0.28	42.3
Upper Middle-Income countries	0.14	0.15	0.45	70.8
World	0.12	0.13	0.41	65.5

Table 1.9: Reference indicators

Category	PITY	CITY	VATY
South Africa	8.4	5.5	6.1
Sub-Saharan Africa	2.6	2.7	4.3
Upper Middle-Income countries	3.4	3.4	6.8
World	3.6	3.5	6.3

Source: www.collectingtaxes.net database 2009/2010

1.3.1.8 Tax administration organisation and efficiency

Tax administrative efficiency is discussed along the tax organisation structure, cost of administration and personnel to active taxpayer ratios.

Table1.10: Tax administration efficiency indicators

Category	Cost of administration	Tax staff per 1000 population	Tax staff to active taxpayers
South Africa	1.20	0.28	503
Sub-Saharan Africa	2.93	0.32	257
Upper Middle-Income countries	1.04	0.48	417
World	1.42	0.76	520

Source: www.collectingtaxes.net database 2009/2010

In South Africa, all taxes and some levies are administered by the South African Revenue Service (SARS), one of nearly 30 semi-autonomous revenue authorities in Sub-Saharan Africa. Table 1.10 shows that SARS staffing at about 15,000 employees is quite low given the size of the country's population compared to the averages of other categories considered in this analysis. There are about 0.28 tax

administration personnel per 1000 of the country's population, compared to the worldwide average of 0.76 and the upper middle income average of 0.48 and the Sub-Saharan African average of 0.32.

With respect to the number of active taxpayers per tax administration staff, perhaps a more appropriate measure of the workload on tax administrators, there are 503 taxpayers for every SARS employee, high when compared to the averages of Sub-Saharan African (257) and the upper middle income economies (417) but slightly lower when compared to the worldwide average of 520 taxpayers per staff member.

Another indicator of tax administration efficiency is the overall cost of collections measure. As at 2009/2010, SARS' cost-to collections ratio was 1.20% (i.e. R1.20 for every R100 of revenue collected)[10], which was lower than the worldwide average (1.42%), and far lower than the regional average (2.93%), but higher than the middle income economies average of 1.04%. It is important to note that, whilst it is desirable to have a lower cost of administration, it is equally important that the revenue administrations are adequately resourced to be able to deliver on their mandates of generating adequate revenue for the government and better services to their customers.

The review in this Section depicts that, overall, South Africa's tax structure compares less favourably to other economies. Even though fiscal authorities have reduced the CIT rate from a high 50% to 28%, this rate is still higher when compared to other upper middle economies and the rest of the world's average. The country compares

[10] See SARS 2009/2010 Tax Statistics Report.

no better when the PIT rate is considered, but its VAT rate compares favourably to other economies. The revenue performance of these major taxes and the country's tax administrative efficiency, however, are relatively strong when compared to the rest of the world's average.

1.3.2 Review of public spending in South Africa

This Section reviews the main compositions of spending in South Africa. It is divided into three parts. Part 1.3.2.1 focuses on the functional distribution of government expenditure pre-1994; Part 1.3.2.2 deals with the functional distribution of government expenditure after-1994; and Part 1.3.2.3 compares South Africa's expenditure allocations with other middle income economies, Sub-Saharan Africa and the rest of the world. The functional distribution of government expenditure data series for South Africa can be found in the South African Reserve Bank (SARB) database. The annual data series exists from 1983.

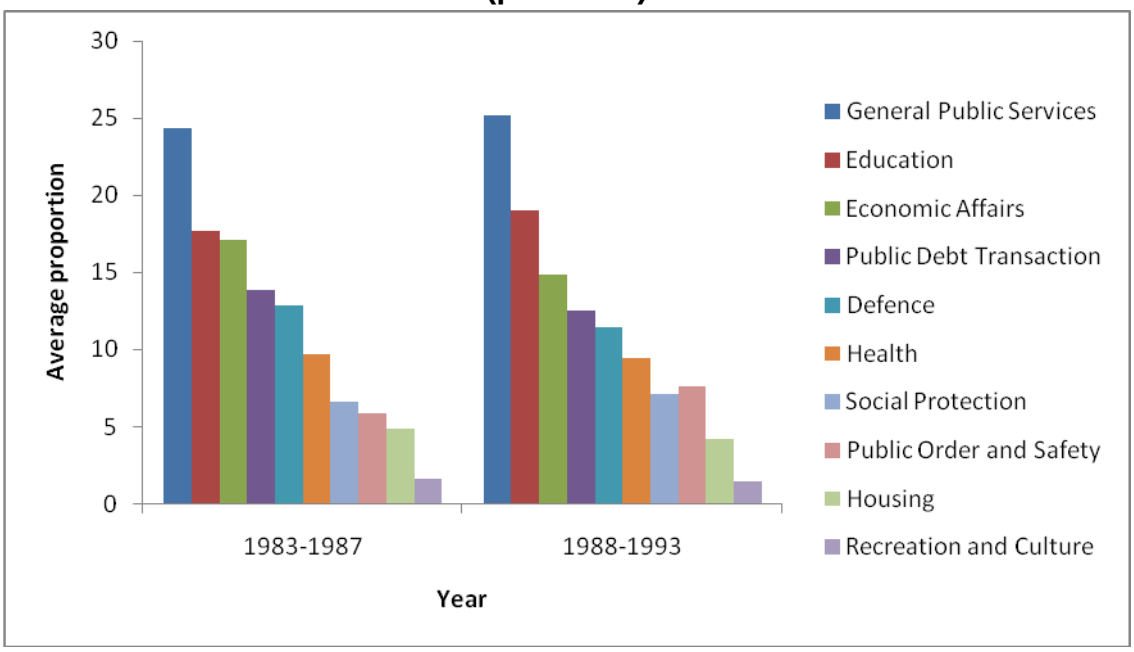
1.3.2.1 Functional distribution of government expenditure: Pre-1994

Whilst government revenue is concentrated at the national government level, public expenditure is consolidated to include all levels of government. The average distribution of government consumption expenditure by function between 1983 and 1993 is shown in Figure 1.4.

Figure 1.4 indicates that between 1983 and 1987, the majority of government expenditures (24.3%) were allocated to general services, of which interest payments on public debt accounted for 13.8% of total government outlay. Another major

allocation went to Education, accounting for an average of 17.7% of total expenditure between 1983 and 1987, followed by Economic Affairs (17.1%), Defence (12.8%), Health (9.7%), Public Order and Safety (5.8%), Housing and Community Services(4.8%), with the least on Recreation and Culture (1.6%). A similar allocation pattern was followed between 1988 and 1993. During the period 1983 and 1993, the government's support for groups such as Unita in Rwanda and its own internal conflict saw a substantial expenditure allocation on Defence. At an average of 12.8% of the total between 1983 and 1987 and 11.4% between 1988 and 1993, Defence expenditure was higher than expenditures in some social sectors, such as Health, Housing and Community. Another concern is the significant allocation to interest payments on public debt.

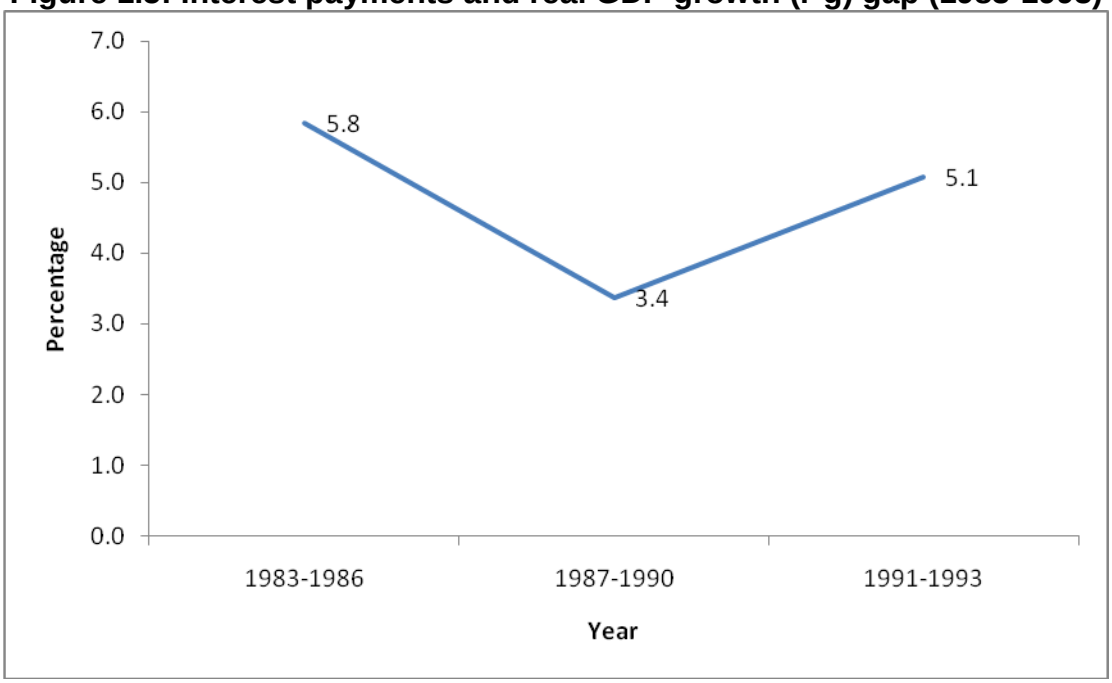
Figure 1.4: Average proportional allocation of government expenditure (pre- 1994)



Source: ratios calculated using data from www.reservebank.co.za

Figure 1.5 shows that between 1983 and 1993 real effective interest payments on public debt[11], exceeded the real growth rate of the economy, hence the gap between interest payment (r) and real GDP growth (g) widened. *A priori,* with such a trend, the country required increasingly larger primary surpluses to avoid an exploding debt to GDP ratio.

Figure 1.5: Interest payments and real GDP growth (r-g) gap (1983-1993)



Source: author's computation using data from www.imf.org

1.3.2.2 Functional distribution of government expenditure: *Post* -1994

Since 1994, the structure and organisation of South Africa's public expenditures have undergone several major reforms (National Treasury 2010), including but not limited to:

- The introduction of a three-year medium-term expenditure framework (MTEF) which brought greater transparency and certainty to the budget process and

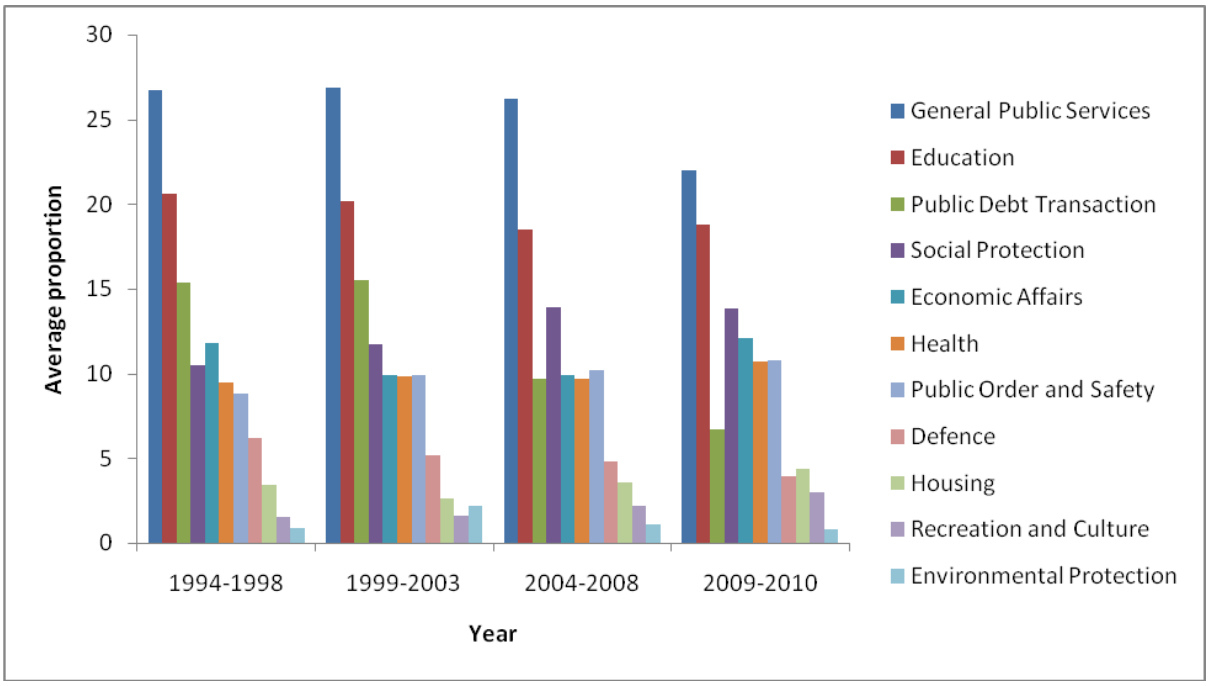
[11] This series was computed as: interest expenditure to debt deflated by the GDP deflator.

strengthened the links between policy priorities and the government's longer-term spending plans;

- The establishment of a statutory Budget Council and several technical committees to oversee budgetary and financial co-operation between national, provincial and local government; and
- The establishment of the Financial and Fiscal Commission that reviews and advises on intergovernmental financial relations.

The functional distribution of government expenditure between 1994 and 2010 is shown in Figure 1.6.

Figure 1.6: Average proportional allocation of government expenditure (1994-2010)



Source: ratios calculated using data from www.reservebank.co.za

Figure 1.6 shows that between 1994 and 1998, expenditure on public services remained the larger portion (26.7%) of total government outlay, of which interest payments on public debt increased from 13.8% in the pre-period to 15.4% in the period under review.

Expenditure on Education (20.6%) more than doubled that on Health (9.6%) in the early years of democratic South Africa (1994-1998). There was also an increase in Social Protection expenditure from an average of 7.1% immediately prior to 1994 to 10.5% between 1994 and 1998 whilst expenditure on Defence reduced significantly from 11.4% before 1994 to 6.2% within the period under review. Expenditure on General Services continued to have the highest allocation (26.9%) between 1999 and 2003. Expenditure on interest payments on public debt continued at about 15.5% of total outlay between 1999 and 2003.

Collectively, expenditure on the social sector averaged about 46.5%; specifically, there was a slight reduction in the proportional allocation to Education from a high of 20.6% between 1994 and 1998, to an average of 20.2% between 1999 and 2003 and further to an average of 18.8% between 2009 and 2010. On the contrary, allocations to Social Protection increased from 11.7% between 1994 and 1998 to an average of 13.9% between 1999 and 2003 and 13.8% of total outlay between 2009 and 2010 due to an increase in social grants. Health expenditure continued to stagnate at slightly below 10% from 1994 to 2008 but increased to 10.7% between 2009 and 2010. Defence expenditure declined to 3.9% and Public Order and Safety increased from 8.8% between 1994 and 1998 to 10.8% between 2009 and 2010 as the need to combat crime intensified in the country.

To summarise, this Section reveals that General Services[12] continue to account for a greater share of government expenditure. Collectively, post 1994 expenditure on the social sector accounts for slightly below half of government consumption expenditure; specifically, there was a reduction in the proportional allocation to Education whilst at the same time allocations to Social Protection, Public Order and Safety and Social Grants increased. Defence expenditure was relatively high pre-1994 and immediately after the first democratic election, but has declined since then.

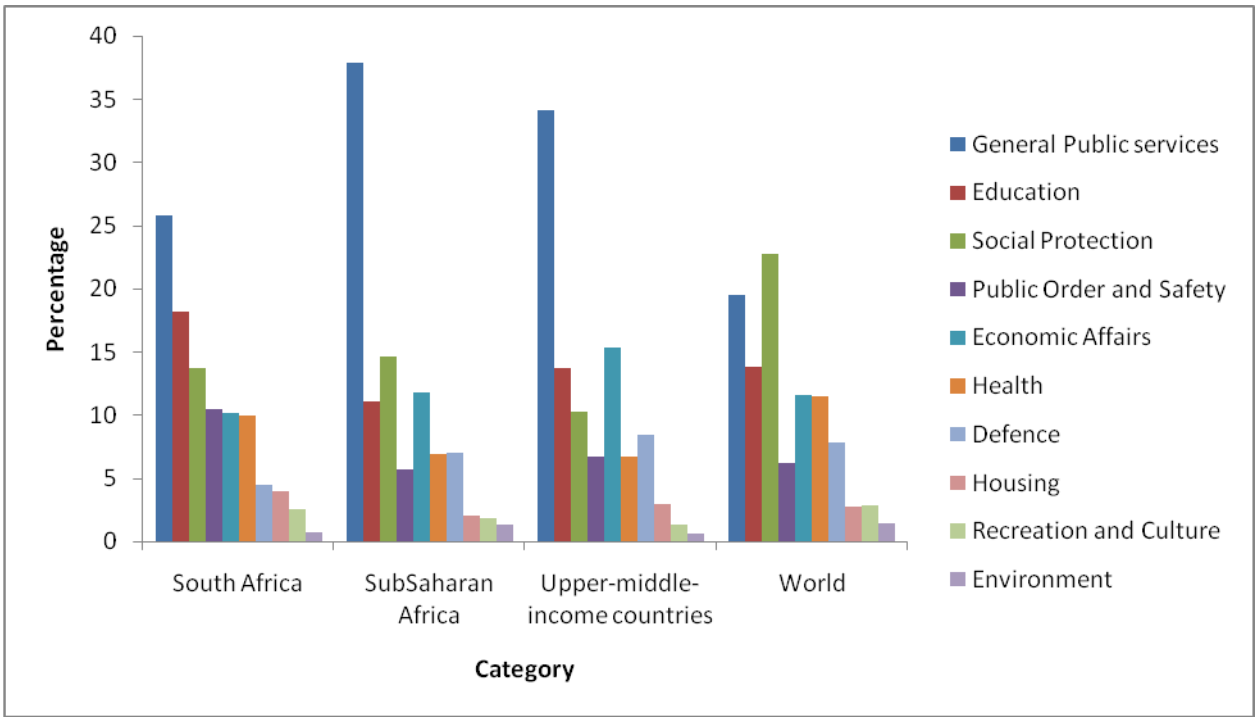
1.3.2.3 South African expenditure distribution compared to other Economies

Figure 1.7 compares the functional distribution of South Africa's expenditure to other high middle income countries, Sub-Saharan Africa and the rest of the world between 2006 and 2010 for which data is available.

As shown in Figure 1.7, South Africa's budget allocation to General Public Services (26.0%) is higher when compared to the world's average of 19.0%, but lower when compared to the averages of other upper middle income countries (34.0%) and the sub region (38.0%) between 2006 and 2010.

[12] Note South African Reserve Bank Quarterly Bulletin, series code KBP4331.

Figure 1.7: Average % budget allocation: South Africa compared to other economies (2006-2010)



Source: calculated from IMF Government Finance Statistics

With regards to Defence expenditure, the South African government's budget allocation to this category is lower (5.0%) when compared to the world's average of about 8.0% during the same period. Allocations to Public Order and Safety (10.0%) are higher in South Africa compared to the world's average (6.0%), Sub-Saharan African (6.0%) and other upper middle income countries (7.0%), respectively. Even though the allocation to Education in South Africa declined to an average of about 18% during the period 2006 to 2010, it exceeded the upper middle income and world average of 14%. In a similar vein, South Africa's Health expenditures (10.0%) are below the world's average of about 14% between 2006 and 2010 but higher than the averages of the sub region and other upper middle income countries for the same periods.

The trend therefore depicted in this Section is that the expenditure composition in South Africa compares favourably with the rest of the world averages, even though the proportional allocation to, *a priori,* growth enhancing sectors like Education seems to be declining. It should be noted though that in a country with relatively higher levels of unemployment and low skills levels such a trend could work against fiscal sustainability.

1.3.3 Review of South Africa's public debt and fiscal balance

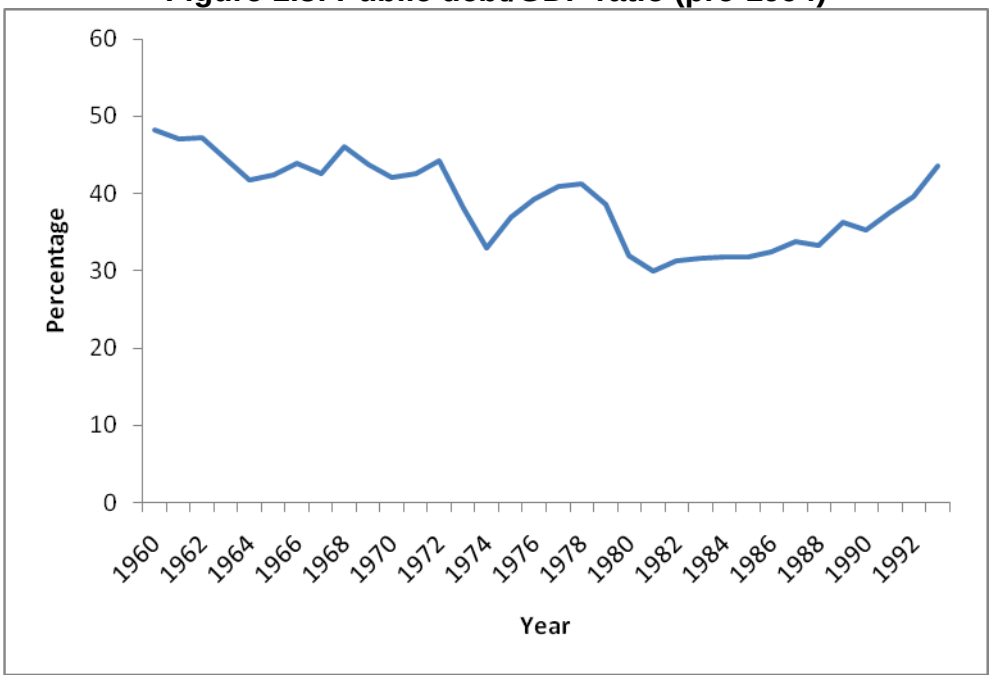
This section reviews the public debt and fiscal balance of South Africa. The section is divided in three parts. Part 1.3.5.1 reviews South Africa's public debt and fiscal balance pre-1994. Part 1.3.5.2 focuses on the country's debt and fiscal balance after 1994. Part 1.3.5.3 compares South Africa's debt and fiscal balance to other economies.

1.3.3.1 Review of South Africa's public debt and fiscal balance pre-1994

The public debt of South Africa is defined as the sum of the domestic debt (i.e. marketable and non-marketable) and foreign debt owed by the national government. Figure 1.8 indicates that between 1960 and 1993, South Africa's ratio of public debt to GDP remained below 50%. In 1960 the ratio was 48.2% but it declined to an average of 31.3% between 1980 and 1984 before increasing immediately prior to the first democratic election to 43.5% in 1993. In a similar vein, the political tension, combined with domestic and international recession meant that the government could not introduce expenditure cuts within these periods (Burger, *et al*. 2012:209-27). This was reflected in the large fiscal deficit during these periods (Figure 1.9),

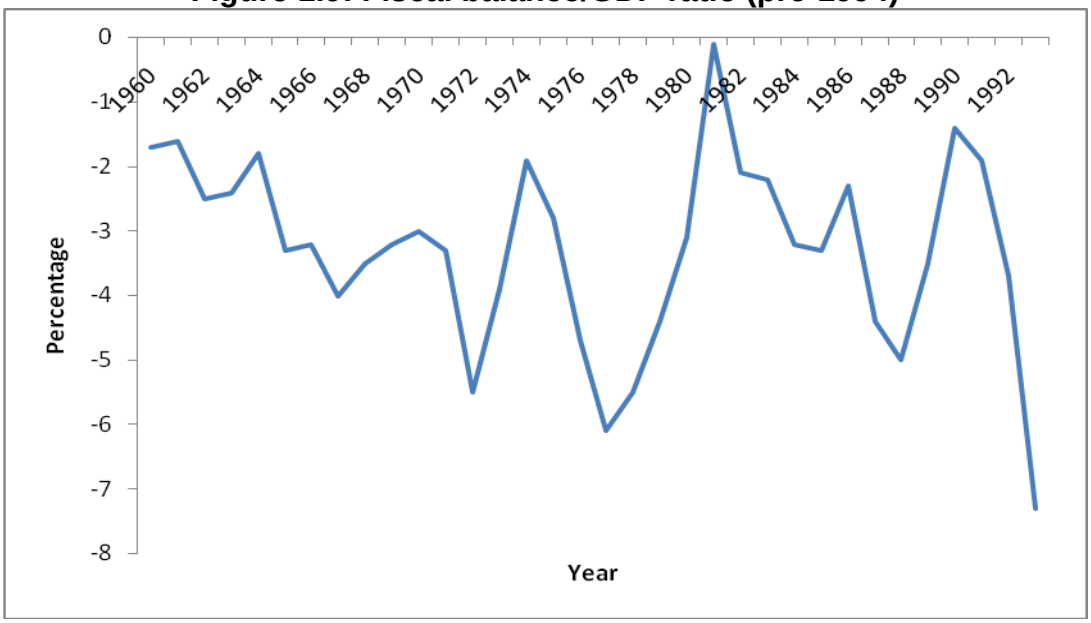
averaging about 3.6% of GDP between 1990 and 1993, with the largest deficits recorded in 1993 (7.3%).

Figure 1.8: Public debt/GDP ratio (pre-1994)



Source: author's computation using data from www.reservebank.co.za

Figure 1.9: Fiscal balance/GDP ratio (pre-1994)

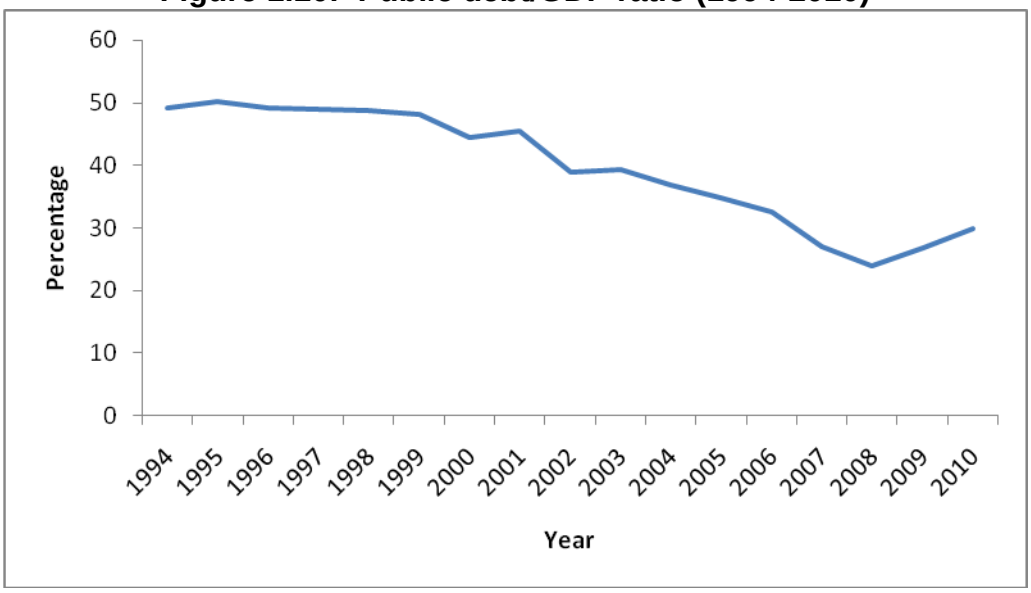


Source: www.reservebank.co.za\

1.3.3.2 Review of South Africa's public debt and fiscal balance (*Post*-1994)

The trend in the public debt to GDP ratio over the period 1994 to 2010 is shown in Figure 1.10.

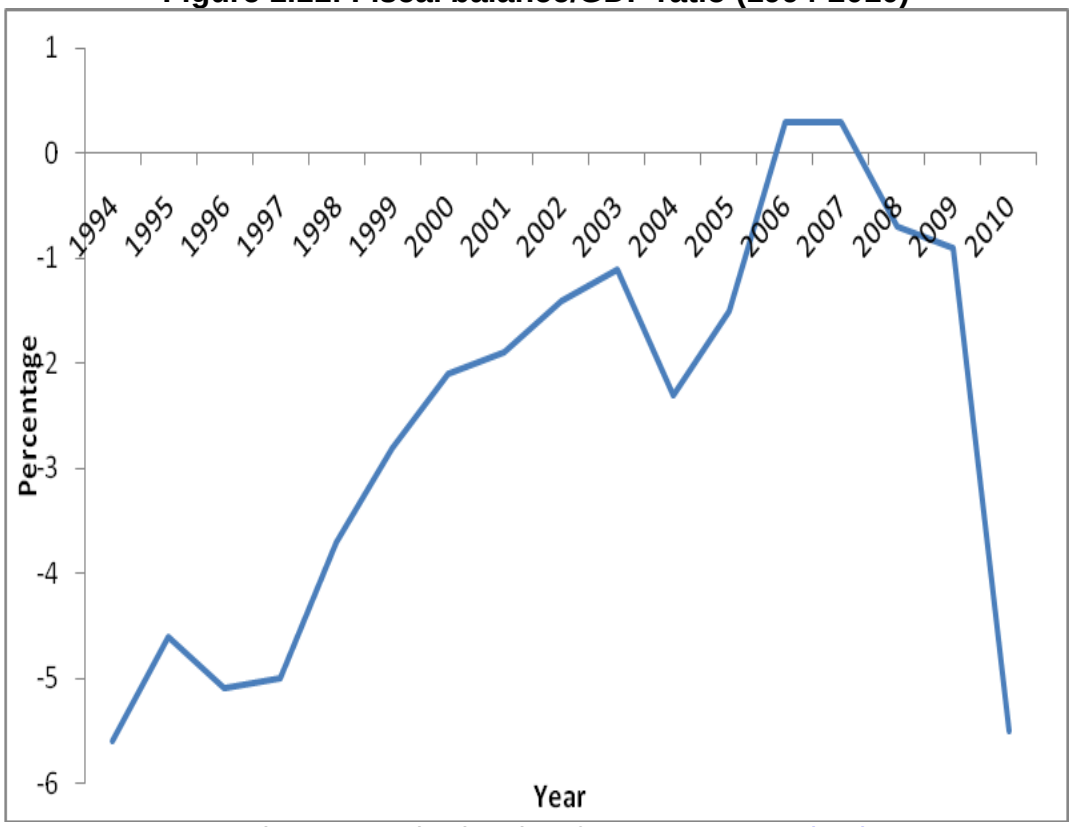
Figure 1.10: Public debt/GDP ratio (1994-2010)



Source: author's calculation using data from www.reservbank.co.za

As shown in Figure 1.10, the gross debt to GDP ratio reached the 50% mark in 1995 but it decreased continuously to a low of 23.9% in 2008. Thereafter the debt ratio started rising again reaching about 30.0% by 2010 as government ran larger fiscal deficits (5.5%) during this period (Figure 1.11) partly because of countercyclical fiscal stimulus to combat the 2008/09 recession. In 2006 and 2007, however, government recorded a small budget surplus of 0.3% and 0.7% of GDP, respectively.

Figure 1.11: Fiscal balance/GDP ratio (1994-2010)

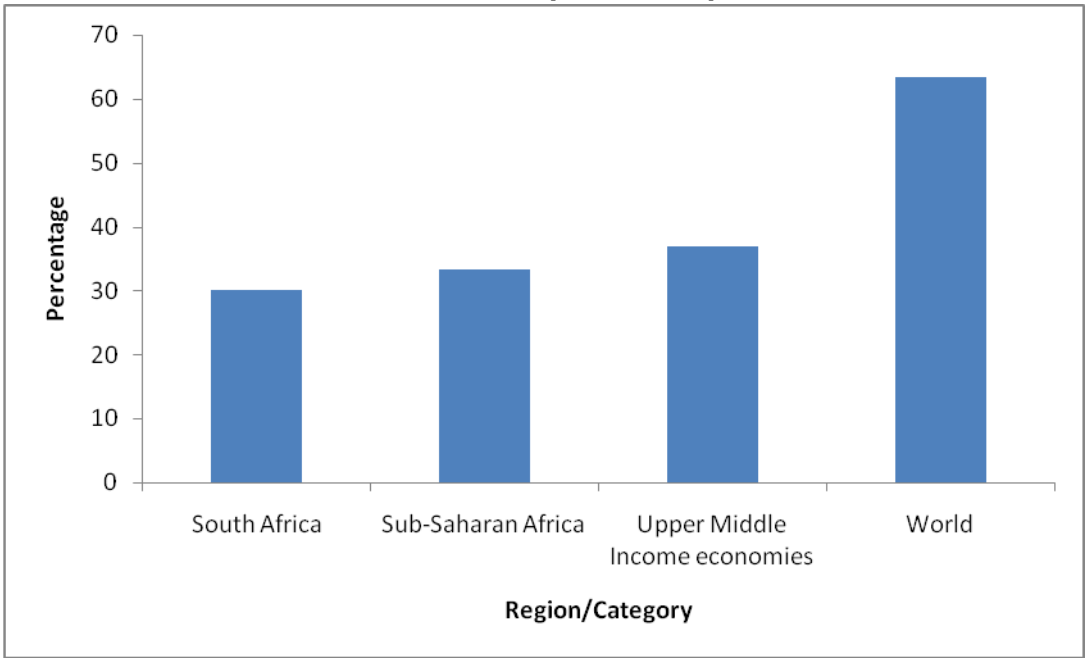


Source: ratio computed using data from www.reservebank.co.za

1.3.3.3 South Africa's debt and fiscal balance compared to other economies

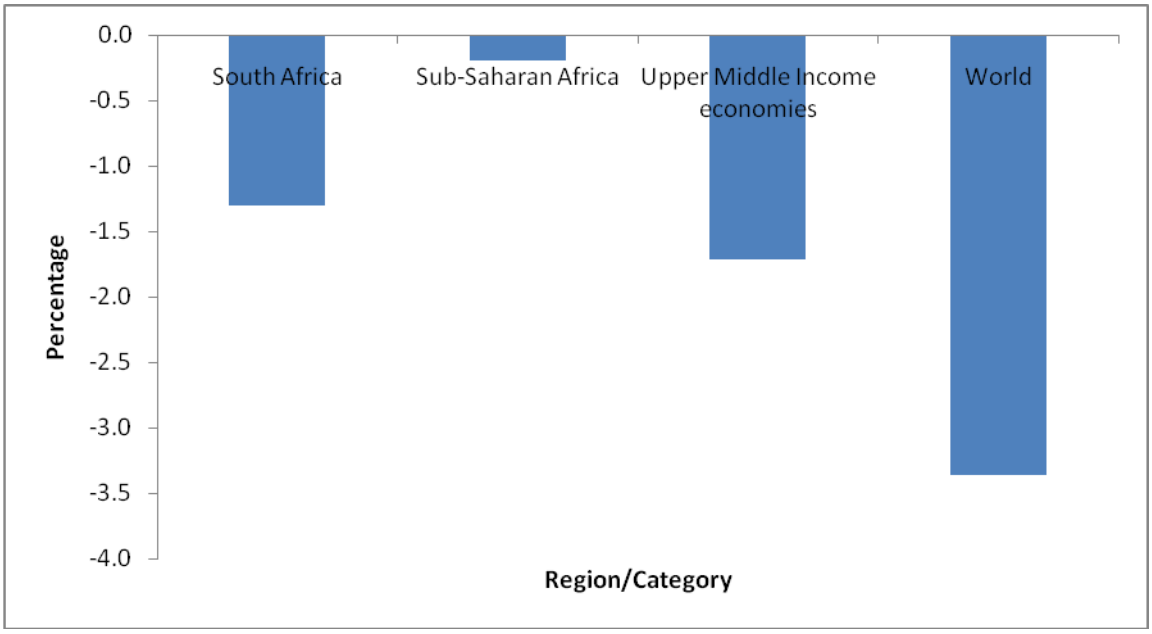
Figure 1.12 shows that South Africa's average debt to GDP ratio of 30.0% between 2006 and 2010 compares favourably to Sub-Saharan countries' average (33.2%), the average ratio for emerging countries (36.8%) and it was less than half the worldwide average of 63.3%. Benchmarking with the Maastricht Treaty of 1992, it can be inferred that the debt burden of South Africa does not *per se* show any serious threat to debt sustainability since it is far below the critical level of 60% of GDP.

Figure 1.12: Average public debt/GDP ratio: South Africa compared to other economies (2006-2010)



Source: ratios computed using data from www.imf.org

Figure1.13: Average fiscal balance/GDP ratio: South Africa compared to other economies



Source: ratios computed using data from www.imf.org

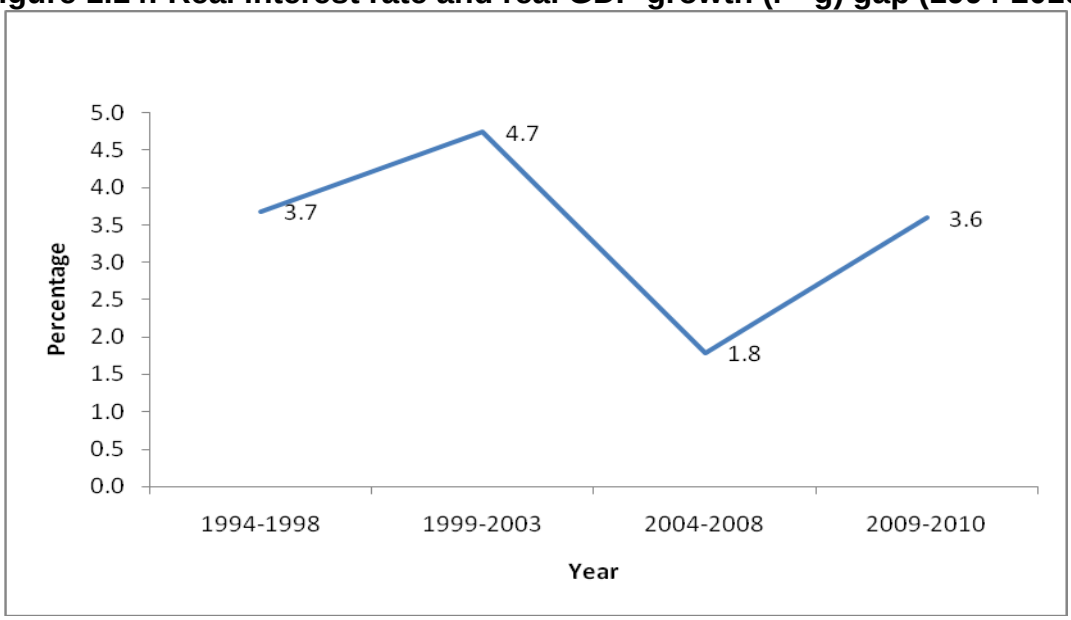
Figure 1.13 indicates that the average fiscal deficit to GDP ratio of about 1.3% for South Africa between 2006 and 2010 compares favourably to the average deficit

ratio for upper middle income countries (1.7%) and the world wide average of 3.4%; but worse than that of the Sub-Saharan average (0.2%). In general, South Africa's public debt and fiscal deficits compare favourably with other economies.

1.3.4 South Africa's cost of debt and the real growth rate

Figure 1.14 shows that between 1994 and 2003 the South African economy was characterised by high real interest rates (i.e. above 4%) and low real GDP growth. The reasons given for the large (r-g) gap within this period include, among others, the risk premium required by foreign and local investors due to political and emerging market risk and the monetarist inspired policies of the South African Reserve Bank (Burger, 2003:19). Beyond 2003, however, the policy of fiscal prudence resulted in a substantial decline in real debt cost and the real growth rate of the economy increased considerably, thereby reducing the (r-g) gap. Nevertheless, the decline in the growth of the economy after 2008 in part due to the slowdown in the world economy has caused the (r-g) gap to increase again.

Figure 1.14: Real interest rate and real GDP growth (r - g) gap (1994-2010)



Source: computed using data from www.imf.org

1.3.5 Key macroeconomic, fiscal and demographic outlook

This section reviews the main macroeconomic, fiscal and demographic outlooks for South Africa. It is relevant since demographic and fiscal structural changes provide an indication of the long-term challenges to fiscal sustainability in the country.

1.3.5.1 Key macroeconomic and fiscal outlook

Risks to fiscal sustainability may emanate from activities in the economy which are not included in the current government budget, but which might eventually impose fiscal liabilities in the future. This may arise due to changes in the economic and demographic structures of the country which pose challenges from a fiscal perspective. As shown in Table 1.11 National Treasury estimated that the growth rate of the South African economy would slow to 2.7% in 2012 before accelerating to 3.6% in 2013, 4.2% in 2014 and 4.3% in 2015. As stated in the 2012 Budget Review, this growth is expected from recovery of the world's economy and stronger domestic consumption and investment support mainly through expansion (ZAR 3.2 trillion)[13] in the infrastructure capacity over the next nine years (Budget review 2012).

The higher infrastructure spending projected is based on the assumption that such expenditure will boost growth in the coming years thereby providing fiscal space to finance future expenditure. However, the issue of capacity constraints mainly amongst municipalities to implement government's spending plans is in part responsible for the improved deficit outcomes relative to projections (Budget 2012). It should be noted that it is outside the scope of this study to assess the validity of the

[13] ZAR 845 billion has been budgeted over the next three years

National Treasury's macroeconomic forecasts but since these are the only official forecast which is published it is included in this analysis.

Table 1.11 also shows that whilst export growth will accelerate over the medium term, imports are projected to grow more quickly in response to robust domestic demand. This will contribute to the current account deficit widening from an estimated 3.3% of GDP in 2011 to 4.4% in 2014.

With moderate GDP growth in the medium-term, the budget deficit is projected to narrow to 3.0% of GDP by 2015 in part due to an increase in both direct and indirect taxes. The direct taxes targeted include: increase in the effective maximum tax rate from capital gains to 13.3% from 10% and a higher dividends tax replacing the secondary tax on companies to 15% from 10%. In addition, revenue is expected to be raised from "sin taxes", levies and improved tax compliance (Budget Review 2012). Whilst a revenue increase is expected, government expenditure as a percentage of GDP is expected to decline to 31.0% by 2015 in part because of the intention of government to cap public sector wage increases (Budget Review 2012).

The cost of debt is projected to rise to 2.8% of GDP in 2014 before declining marginally to 2.7% by 2015; but the government's net loan debt is projected to increase from 36% of GDP to 38.5% by 2015. This increase, however, is marginal, which projects favourably on the country's sovereign debt rating and tempers the fears of a probable crowding out of the private sector in the local debt market. However, such increases pose a risk in that the country might be vulnerable to any

deterioration in the performance of the global economy, which is a potential threat to the long term fiscal balance.

Table 1.11: Key macroeconomic and fiscal data projections at National Treasury (Consolidated government)

Variable	2011 Estimate	2012 Forecast	2013 Forecast	2014 Forecast	2015 Forecast
Real GDP growth	3.1	2.7	3.6	4.2	4.3
Current account balance	-3.3	-4.3	-4.5	-4.4	N/A
Revenue-GDP	27.2	27.7	27.4	27.8	28
Expenditure-GDP	32.7	32.5	32.1	31.7	31.0
Budget balance-GDP	-5.5	-4.8	-4.6	-4.0	-3.0
Net loan debt-GDP	32.2	33.3	36	37.8	38.5
State debt cost-GDP	2.9	2.6	2.7	2.8	2.7

Source: National Treasury

In conclusion, the proposed improvement in the fiscal balance in the medium term to 3% of GDP is envisaged to be made possible by capping public sector wages as well as tax increases. However, the highly unionised nature of the workforce may pose much difficulty in implementing a public sector wage cap. This may result in compromising other spending categories like capital expansion. Furthermore, the increased tax burden may inhibit both future consumption expenditure and savings, which *a priori* will negatively affect growth, more so if capital-spending objectives are not achieved, thereby posing a risk to long term fiscal sustainability.

1.3.5.2 Demographic and social outlook

The long-term demographic forecasts are a source of concern for both economic growth and public finances. In part, concerns often raised about population ageing are those related to a society's social security systems and patterns of resource distribution. These concerns include intergenerational support systems, workplace pension funds, retirement policies, social welfare assistance, health insurance and health-care provision. This Section reviews the demographic outlook and the possible fiscal implications for the South African economy. Table 1.12 provides key demographic indicators for the South African population between 2010 and 2040.

The 2001 population census found that 7.3% of the total population was 60 years or older. This proportion can be perceived to be lower when compared to the 2000 proportions of some developed countries such as Italy (24.1%), Greece (23.4%), but higher when compared to the average proportions of 5.1% for the African continent in 2000.[14] Moving forward, Table 1.12 shows that despite the demographic impact of HIV/AIDs, the proportion of people aged 65 and above is projected to increase over the next two decades; and the population growth in the older cohorts will be considerably more rapid than in the cohorts younger than 65 years. Beyond 2025, however, whilst the proportion of people aged 65 and above is projected to increase those in the economically active group (15-64) will be declining. The old-age dependency ratio is projected to follow an increasing trend. The increase in the proportion of this group suggests an increase in the demand for long-term health care, chronic care, and end of life care (Joubert, and Bradshaw 2005:206). The age dependency ratio is projected to decline in the next decade (2010-2020), beyond

[14] See Chapter 15, page 206 of Chronic Diseases of Lifestyle in South Africa since 1995-2005, by Joubert and Bradshaw.

which it will show an increasing trend. The declining trend in the age dependency in the medium-term implies that there is not much threat to domestic savings owing to demographic structure, however in a much longer period, the rise in the dependency ratio might have the potential to undermine the economy's capacity to undertake the investment in physical and human capital which may be needed to achieve long term growth and labour productivity.

Furthermore, the workforce is projected to rise within the same period accounting for almost two-thirds of the South African population, but again will decline in the longer term. With the workforce projected to increase, it is most likely that the medium-term growth forecast will be achieved and the threat to fiscal sustainability be tempered. However the challenges involved will determine the longer-term growth and fiscal sustainability of the country.

Table1.12: Main demographic indicators for South Africa (2010-2040)

Indicator	2010	2015	2020	2025	2030	2035	2040
Population size (Million)	50.8	52.0	52.9	53.6	53.8	53.7	53.3
Annual population growth (%)	0.60	0.39	0.29	0.17	0.07	-0.03	-0.15
Total fertility rate	2.38	2.31	2.23	2.15	2.15	2.07	1.98
Crude mortality rate	15.1	16.1	16.4	16.7	17.1	17.4	17.7
Age composition % < 15	29.1	27.7	26.6	25.6	24.7	23.7	22.8
% 15-64	65.2	65.8	65.8	65.3	64.8	64.7	64.8
%65+	5.7	6.5	7.6	9.1	10.5	11.6	12.4
Age dependency ratio	53.3	51.9	52.1	53.2	54.3	54.5	54.3
Old-age dependency ratio	8.6	9.8	11.6	13.9	16.3	17.9	19.2

Source: Institute for Futures Research, 2010

1.3.5.3 Fiscal challenges of National Health Insurance

One of the most significant long-term fiscal risks in South Africa, with key questions regarding affordability, is the proposed National Health Insurance initiative. As spelt out in the Budget Review document 2012, an additional ZAR 6 billion will be needed in fiscal year 2014/15, increasing as the system is phased in over a 14-year period. Whilst this study has not been able to quantify the fiscal impact of such a plan owing to lack of comprehensive data on the revenue-raising options to fund the plan, it seeks to highlight that such a plan could pose a potential threat to the long-term fiscal sustainability of the country if the funding arrangement is not well designed.

1.4 Summary

Section 1.3 reviews the South African fiscal structure between 1960 and 2010. On the revenue front, the section shows that income, profit and wealth taxes continued to account for a larger share of government revenue. However, immediately prior to the first democratic South Africa, there was a substantial shift from company taxes to personal taxes; a trend that has continued onto 2010. The statutory rates of the main taxes of South Africa (especially PIT) do not compare favourably to that of other emerging economies, the sub-region and worldwide averages. But the revenue performance and productivity of these taxes do compare favourably with the rest of the world. In a similar vein, the efficiency of revenue administration and the organisation of the tax system of South Africa compares favourably to that of other economies. Despite these favourable outcomes, the wedge between the statutory rates and the realised average tax rates for the three main taxes is a concern for the protection of the revenue base.

With regards to budget allocations, it is shown that a greater share of government expenditure is allocated to General Services. Defence expenditure was relatively high pre-1994 and immediately after the first democratic election, but declined in the later years of democratic South Africa. There was, however, a slight reduction in the proportional allocation to Education whilst at the same time increasing proportional allocations to Social Protection and Public Order and Safety. The policy of fiscal prudence after 1994 resulted in a substantial decline in debt service cost, whilst the real growth rate of the economy increased considerably. Nevertheless, the former still exceeded the latter.

The Section also highlights the main economic, fiscal and demographic outlooks and the possible implications of such projections to fiscal sustainability. It is noted that government's proposed improvement in the fiscal balance in the medium-term to 3% of GDP would apparently be made possible by capping public sector wages as well as tax increases. Demographic changes do not seem to pose a major threat to the fiscal position in the medium-term but might become an increasing risk to the fiscal position of the country in the longer-term. Another possible risk to long-term fiscal sustainability identified is the proposed introduction of the National Health Insurance Scheme. Whilst this study has not been able to quantify the fiscal impact, it cautions that such a plan could be a potential threat to the long-term fiscal sustainability of the country if funding arrangements are not well designed.

In subsequent Chapters the implications of especially three of the issues identified thus far will be discussed in greater detail. These include the role of taxes, revenue leakages and fiscal policy in addressing imbalances. In each case the impact on the revenue base and fiscal sustainability in general is analysed.[15]

1.5 Research Statement

The issues discussed in the previous section can be summarised in four broad research questions, namely: (i) was the fiscal stance taken in the past, sufficient to attain fiscal sustainability in South Africa? (ii) How did fiscal policy in the past adjust to budget imbalances and to what extent did that affect fiscal sustainability? (iii) Which are the optimal ways to protect the revenue base; and (iv) how does the current fiscal dispensation (i.e. composition of expenditure and tax) affect the economy and inter alia fiscal sustainability?

1.5.1 Uniqueness of this research

In addressing the above four questions, this study contributes to the empirical literature on fiscal sustainability. More importantly, most of the available studies on fiscal sustainability have either tested for linear stationarity in the total government deficit series or tested for linear co-integration between total government spending and total tax revenues (Baharumhah and Lau, 2007; Cunado, Gil-Alana and Perez de Gracia, 2004; Hakkio and Rush 1991). Only a few studies (Cipollini, 2001:643-655); Cipollini, Fattouh, and Mouratidis, 2009:34-35); Arghyrou and Luintel, 2007:

[15] Owing to the lack of comprehensive data, this study has not quantified the fiscal implications of how expected developments in the future will affect current fiscal sustainability. In particular, how demographic changes, development in health costs and pension liabilities will affect the country's fiscal position. As a future study, when data is available, it may be interesting to look at such dynamics.

387-410) have tested the non-linear relationship between government revenue and expenditure.

In South Africa in particular, this is one of a few studies testing whether the error-correction process used in the respective studies is non-linear. Instead, most previous studies have assumed that the adjustment process driving the variables towards equilibrium is linear; i.e. adjustment towards equilibrium is always present and of the same strength under all circumstances.[16]

Secondly, as mentioned in previous sections, in order to bring fiscal balances back on track, most fiscal authorities have either resorted to increases in the tax rate or have relied heavily on some categories of tax, like in the case of South Africa, whilst at the same time reversed some of the increases in expenditures as a percentage of GDP. Increasing the tax burden may trigger a response in the shadow economy which many studies have assumed symmetric. As noted before, a large shadow economy may lead to an erosion of the tax base, a decrease in tax receipts and thus to a further increase in the budget deficit and fiscal instability.

Finally, whilst a consensus view has been reached on the effects of monetary policy shocks, the literature on fiscal policy so far has not provided any robust stylised facts on the effects of fiscal policy shocks and therefore remains an object of empirical research. Most empirical studies thus far have investigated fiscal policy effects on growth in the United States of America (USA) and Europe and the results have been

[16] Burger, P, Stuart, I, Jooste,C and Cuevas, A. (2012:209-27) estimated fiscal reaction functions for South Africa using State-Space and Threshold Autoregressive (TAR) modelling. This study however used a Smooth Transition Error Correction Model (STECM) instead of a TAR model (Chapter 3 discusses the advantages of STECM over TAR.

mixed. In South Africa, the debate on the efficacy of fiscal policy in stimulating growth seems to have received little attention and the few studies conducted have not considered the structure of fiscal policy; rather they have used aggregated fiscal data for a short time series.

This study is unique in several respects. Firstly, it seeks to apply an extension of the linear inter-temporal budget constraint rule of fiscal sustainability, which is widely used in the literature, to a regime-switching framework, where the transition from one regime to the other occurs in a smooth way.

This feature of the smooth transition model allows for testing the ability of high against low budget deficits or surpluses to best describe the non-linear dynamics of fiscal policy in South Africa. Secondly, this study estimates the tax burden at which the propensity to evade or avoid taxes begins to accelerate. In the existing empirical literature, this is one of only a few studies testing the asymmetric relationship between the shadow economy and the tax burden using data from South Africa. The possibility of asymmetric response of the shadow economy to changes in effective tax rates is of considerable interest as it will assist in evaluating the extent to which the revenue base can be protected by means of fiscal changes as opposed to tax administrative changes (Giles and Caragata, 1999:1857-1867).

Finally, this study also analyses the short and long run effects of changes in a number of fiscal instruments that are aimed at achieving fiscal consolidation. Along the lines of actions taken by fiscal authorities in South Africa over the years, the instruments considered in this part of the study are: the aggregate indirect and direct

tax burden on the revenue side and aggregate expenditure, consumption expenditure and private investment on the expenditure side. An attempt is also made to indicate the usefulness of the fiscal policy instruments that could contribute towards fiscal consolidation, both in terms of its short-run and long-run effects on economic activity and the implications for fiscal sustainability.

1.5.2 Specific objectives of the study

The broad objective of this study is to investigate how to enhance fiscal sustainability in South Africa. The specific objectives include:

1. To determine whether South African fiscal policy has been sustainable over the period, 1960-2010.
2. To determine how the South African government has in the past reacted to a variation in fiscal imbalances, and the implications of such reactions for fiscal sustainability.
3. To estimate the size of shadow economic activities and the amount of tax evaded.
4. To estimate the tax burden at which the propensity to evade or avoid taxes begins to accelerate.
5. To estimate the net effects of the current fiscal policy structure on the South African economy.

1.5.3 Hypotheses of the study

The mutual consideration of the South African fiscal policy framework as discussed in Section 1.3 and recent scholarly work on fiscal sustainability as presented in the theoretical literature (see Chapter 2) have guided the formulation of the research

hypotheses in this study. These are divided into three major theoretical approaches namely:

(1) Government Inter-temporal Budget Constraint Framework.

Here fiscal sustainability is assessed in terms of whether the economy is able to maintain a budgetary position over time that satisfies its inter-temporal budget constraint. The research hypotheses tested from this theoretical framework include:

(i) South Africa's fiscal policy is sustainable.

(ii) The adjustment process driving the fiscal variables towards equilibrium is always present and of the same strength under all circumstances.

(2) Economics of crime framework

Theory assumes that taxpayer behaviour is influenced by factors such as the tax rate, which determines the benefits of evasion; and the probability of detection and penalties for fraud which determines the costs. The hypotheses tested under this framework are:

(i) A tax band of inertia[17] exists.

(ii) The response of the shadow economy to increases in the tax burden is symmetric with the corresponding response to decreases in taxes.

(iii) The size of South Africa's shadow economy and thus the level of tax evasion exceeds the budget deficit (both as ratios of GDP).

(3) Endogenous growth model

In this approach the fiscal structure is defined as the composition of government expenditure and taxation. The overall size of government has a substantial influence

[17] The tax bracket or range beyond which, the response of shadow economy to tax rate changes is insignificant.

on economic growth and by extension fiscal sustainability. The following hypotheses can be formulated from this framework:

(i) Government expenditure and its composition negatively affect aggregate economic activities.

(ii) The tax burden and its composition have distortionary effects on aggregate economic activities.

1.6 Outline of the dissertation

The rest of the dissertation is structured as follows: Chapter 2 discusses the theoretical and empirical literature that relates to fiscal sustainability; Chapter 3 estimates and discusses the fiscal reaction and the sustainability of fiscal imbalance in South Africa using a smooth transition error-correction approach; and Chapter 4 discusses the empirical results of the response of the shadow economy to tax changes. Chapter 5 reports the empirical results of the effects of fiscal policy instruments on economic activities in South Africa whilst Chapter 6 concludes with some policy recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This Chapter reviews both the theoretical and empirical literature with the aim to reveal the theoretical underpinning of fiscal sustainability as a brief synopsis of the scope of studies on this topic. The Chapter has three main sections. Section 2.2 focuses on the theoretical and empirical literature that explains the concept of fiscal sustainability. Section 2.3 also discusses both the theoretical and empirical literature available on the tax burden and shadow economy. Section 2.4 theoretically and empirically reviews fiscal sustainability and its effects on economic activities. Section 2.5 summarises and concludes.

2.2 Theoretical literature review of the fiscal sustainability concept

This Section reviews the two main theories that have been proposed to explain fiscal sustainability. The first is the Domar (1944) view on fiscal sustainability; and the second is the modern, mainstream view.

2.2.1 The Domar theory of fiscal sustainability

Literature on the impact of public debt dates back to the pre-Keynesian era (i.e. before the 1940s), even though the first empirical analysis on this issue was pioneered by Domar (1944).[18] Domar is, therefore, regarded as the father of the mathematical treatment of fiscal sustainability that is still in use today (Burger, 2003). Domar's objective was to contrast the opinion that deficit spending leads to an ever growing public debt, the servicing of which inevitably leads to an increasing tax burden on the economy.

[18] See Burger 2003, Sustainable Fiscal Policy and Economic stability.

Domar (1944:803) is of the opinion that a higher deficit generates higher economic growth which in turn generates sufficient tax revenue to annually service the debt. If the tax revenue generated through the higher deficit expenditures is not sufficient the problem 'does not lie with the deficit financing as such, but in its failure to raise national income' (Domar, 1944:806). Thus, Domar's view is that the government can contribute to increasing the economy's growth rate by converting into productive expenditures that part of private income that it absorbs through taxation. He views expenditures as public investment, as opposed to current expenditures which he regards as unproductive. According to Domar (1944:820), if healthier people are more productive, expenditures on public health satisfy these requirements. The same holds true for expenditures on education, research, flood control, resource development and so on.

2.2.2 The modern, mainstream view of fiscal sustainability

In the 1990s Blanchard, Chouraqui, Hagemann and Sartor (1990:7-36) offer what they call 'new answers' to the problem of fiscal sustainability. The approach followed by Blanchard and others represents the current standard approach in the mainstream literature on the topic of fiscal sustainability (Sardoni, 2008). After the developments of the 1940s, less attention was paid to the theory of fiscal sustainability for over three decades (Burger, 2003). The lack of attention was probably due to strong economic performance during those decades with the real interest rate being lower than the real growth rate (Eltis, 1998). The strong economic performance in the form of high economic growth was translated into a low debt to GDP ratio for many of these OECD countries (Masson and Mussa, 1995:4b). Unfortunately, there was a reversal in the gains achieved during these decades

resulting into large budget deficits and increasing ratios of government debt to GNP for many OECD countries in the early years of the 1980s (Blanchard, *et al.* 1990). This prompted concern that fiscal policies which led to such outcomes were not only unwise, but also unsustainable. Consequently, attention was again focussed on the sustainability of fiscal policy, evident in the stream of studies on the topic (Bohn 1998; Blanchard 1993, Burger 2003, Bravo and Silvestre, 2002). This modern theory displayed marked changes from that of the 1940s.

In the Domar model, it is normal for the real interest rate to be lower than real economic growth whilst modern theorists are of the view that dynamic efficiency requires that the real growth rate should not only be greater than the interest rate but that the difference should diminish as the economy matures. This comes from the Keynes-Ramsey rule that in an efficient dynamic setting consumption would grow at a constant rate equal to the difference between the real rate of interest on riskless debt and the pure rate of time preference (Blanchard, Chouraqui and Sarton, 1990; Barro and Sala-I-Martin, 1992). With industrial maturity and increased welfare, the rate of time preference tends to fall and the difference in the real rate of interest and the growth rate should narrow (Blanchard, 1993).

Mainstream economists have developed a theoretical framework that considers government similarly to a household that faces budget constraints throughout its lifetime.[19] Government is considered to be subjected to a budget constraint in the

[19] Taking the utility maximization problem into consideration, in some periods the household is expected to consume and spend more than it earns or has saved. During these periods the household is borrowing. In other periods the same household is expected to spend less than it earns thus being able to repay the previous borrowed amounts. Financial institutions will not, however, be in a position to continue lending to such household indefinitely. Therefore it is typical to assume that

long-run, which the fiscal policy literature refers to as the economy's inter-temporal budget constraint. Generally, it is assumed that unlimited borrowing is not possible and thus governments are obliged to repay borrowed funds. An economy's ability to fulfil its debt obligations is only possible when sustaining the budgetary position in such a way that government spending net of interest payments in present value terms together with the initial stock of the debt are not exceeding the discounted value public revenue over the existing path of the economy (Romer and Romer 2010).

What constitutes a sustainable fiscal policy according to mainstream theory depends on the level of savings that maximise the (inter-temporal) utility of individuals. With given production and investment functions, low levels of savings mean that $r > g$, whereas high levels of saving mean that $r < g$. An explosion in debt and thus, unsustainable fiscal policy is possible only if $r > g$. Thus the relationship between r and g determines whether government needs to run a primary surplus or is able to run a primary deficit (Burger, 2003). Unsustainable fiscal policy defined as a continuously increasing public debt to GDP ratio, crowds out investment because it absorbs an ever-increasing portion of savings (Burger, 2003).

Empirically, the most straightforward way to assess the fiscal sustainability position is to start from a government's inter-temporal budget constraint. The budget constraint looks at the long-run relationship between government revenue and expenditure (that covers total government spending on goods and services, transfer payments and interest on debts). For simplicity, assume that budget deficits are

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any household is subjected to its budget constraint in present value terms in the long run as it is expected to earn at least as much as it spends throughout lifetime (Hamilton and Flavin, 1986).

financed using bonds with a maturity of one period. This implies that the government faces a budget constraint as shown in equation one:

$$G_t + (1+r_1)B_{t-1} = R_t + B_t \tag{2.1}$$

Where G is government expenditure, r is the one-period real rate of interest, R is government revenue and B is the stock of debt. Iterating equation (2.1) forward yields the government's inter-temporal budget constraint:

$$B_t = \sum_{s=0}^{\infty} \prod_{i=1}^{s} (1+r_t)^{-1} (R_{t+s} - G_{t+s}) + \lim_{s\to\infty} \prod_{i=1}^{\infty} (1+r_{t-1})^{-1} B_{t+s} \tag{2.2}$$

Assuming that the real interest rate is stationary with unconditional mean given by r and also that the growth rate of the real supply of bonds, on average, is equal to or lower than the average rate of interest (Hamilton and Flavin, 1986:808) the following expression holds:

$$\lim_{s\to\infty} (1+r)^{-s} B_{t+s} = 0 \tag{2.3}$$

The above equation (2.3) states that the debt stock, when measured in present value terms, vanishes in the limit and is also called the transversality condition. By definition, it excludes Ponzi financing; that is, the government is not 'bubble'-financing its expenditure by issuing new debt to finance the deficit. This is equivalent to saying that the deficit is sustainable if and only if the stock of debt held by the public is expected to grow no faster than the mean real rate of interest, which is viewed as a proxy for the growth rate of the economy (Baharumshah and Lau, 2007:878-889).

Following equation (2.3), the inter-temporal budget constraint, equation (2.2), can be re-written as:

$$G_t - R_t = \sum_{s=1}^{\infty}(1+r)^{-s+1}(\Delta R_{t+s} - \Delta G_{t+s} + r\Delta B_{t+s-1}) \tag{2.4}$$

The inter-temporal budget constraint, under the no-Ponzi scheme rule, imposes restrictions on the time series properties of government expenditure and revenue given by the right hand side of equation (2.4). It will be stationary, as long as government expenditure, revenue and the stock of debt are all stationary in first differences. Specifically, if G_t and R_t are I(1) process, they will be cointegrated, implying that there exists an error-correction mechanism pushing government finances towards the levels required by the inter-temporal budget constraint (Baharumshah and Lau, 2007:878-889). According to them conclusions on sustainability are made by evaluating the properties of the cointegration vector as well as evaluating the order of integration of debt time series.

Assuming that the transversality condition for the budget constraint holds and the limit term in equation (2.3) is zero, the co-integrating relationship is shown in equation (2.5).

$$R_t = \alpha + \beta G_t + \varepsilon_t \tag{2.5}$$

Following Martin (2000:83-105), the deficit is ‘strongly’ sustainable (strong solvency) if and only if the I(1) process of R and G are co-integrated and β=1. The deficit is only ‘weakly’ sustainable if R and G are co-integrated and 0<β<1 (Trehan and Walsh,1991:207-211; Quintos,1995:411). In general, there are two classical methodological approaches to the Inter-temporal Budget Constraint (IBC): the unit root test (Hamilton and Flavin, 1986; Trehan and Walsh, 1988; Uctum and Wickens, 2000) and cointegration tests (Hakkio and Rush,1991; Afonso, 2005:19-44; Baharumshah and Lau, 2007:878-89).

Bohn (2007:1837-47) however casts some doubt on the relevance of classical empirical tests. He demonstrates that the assessment of fiscal sustainability is ensured by the fiscal reaction function (FRF) that describes the primary surplus-to-GDP ratio as a positive function of the public debt-to-GDP ratio. If governments were able to generate primary surpluses in the past, and fiscal policy was flexible enough to respond to increasing public debt, then future higher surpluses assessed as meeting the constraints imposed by the IBC in the long-run will not create difficulties and fiscal sustainability will be easier to achieve (Stolan, 2010:501-518).

Bohn (1998) argues that if the primary surplus responds positively to an increase in debt, then the government's fiscal reaction function can be viewed as sustainable. Mendoza and Ostry (2008:1081-1093) describe two benefits and a number of possible limitations of the FRF model. First, since asset pricing applies to all kinds of financial assets, the test does not require particular assumptions about debt management, or the composition of debt in terms of maturity or denomination structures; and secondly, the FRF test does not require knowledge of the specific set of government policies on debt, taxes and expenditures. One limitation of the FRF as highlighted by Mendoza and Ostry is that it provides limited information when severe and fully unanticipated shocks occur, such as an unexpected shut down in the credit market or surprisingly large negative shocks to the primary balance. Another caveat is that a time-invariant conditional response of the primary balance to the debt level alone is a sufficient but not a necessary condition. A non-linear and time varying response can also generate fiscal solvency as long as the response is strictly positive above a certain debt-to-GDP threshold. It could have a response that kicks in at some higher, not yet reached debt level or specific set of government policies

that would likely improve the primary surplus in future. Few studies have applied regime-switching models to the empirical testing of the government's inter-temporal budget constraint (Cipollini, 2001:643-655; Arghyrou and Luintel, 2007:387-410; Cipollini, Fattouh & Mouratidis, 2009:34-54; Burger, *et al.* 2012:209-27).

2.2.3 Empirical literature on fiscal sustainability-measurement and results

There has been a substantial volume of empirical studies focusing on the sustainability of the government's fiscal policy in the United States of America (Cipollini Fattouh and Mouratidis, 2009: 34-54; Sarno, 2001:119-25; Hakkio and Rush, 1991; Quintos, 1995; Wilcox 1989; and Hamilton and Flavin 1986). Cipollini, *et al.* (2009) analysed the fiscal adjustment process in the United States using a multivariate threshold vector error regression model and find evidence that fiscal authorities intervene to reduce real per capita deficit only when it reaches a certain threshold and that fiscal adjustment takes place primarily by cutting government expenditures. Sarno (2001) provides evidence of nonlinear mean reversion in the U.S. debt-to-gross domestic product (GDP) ratio.

Hamilton and Flavin (1986) in a seminal article demonstrate that the federal government cannot run a permanent deficit exclusive of interest payments on debt, but may have a constant deficit when interest payments are included. The main conclusion from this work is that the real rate of interest at which the government borrows must be greater than the growth rate of real debt so that the discounted present value of future government debt moves to zero. In addition, they claim that if the government budget is to be balanced in present value terms, the surplus (deficit)

inclusive of interest payments should be stationary. Hamilton and Flavin present evidence that this condition is satisfied using annual data from 1960 to 1984.

Like Hamilton and Flavin, Trehan and Walsh (1988) fail to reject the inter-temporal budget balance of the United States through the sample period. Trehan and Walsh generalise the Hamilton and Flavin result to show that government expenditures, inclusive of interest payments and revenues should be cointegrated with a cointegration vector equal to [1,-1]. The authors suggest that a stationary stochastic process in the total deficit time series might be verified by applying cointegration techniques.

Hakkio and Rush (1991) extend the work of Trehan and Walsh (1988) which is based on the cointegrating relationship between public revenue and spending. Hakkio and Rush derive a model under the assumption that the real interest rate follows any stationary stochastic process. They point out that the restriction that the cointegrating vector between government expenditures, inclusive of interest payments and revenues equal $[1 \; -b]'$ such that b = 1, is a sufficient condition for inter-temporal budget balance but not, strictly speaking, a necessary condition. Hakkio and Rush (1991: 437) further conduct an analysis to see if the results are sensitive to the sample period. Using a sample that spans from the first quarter of 1952 to the fourth quarter 1988 they find that the inter-temporal budget is balanced in the sub-sample up until 1976, but that for the sub-sample 1976:1 to 1988:4 the constraint is violated.

Quintos (1995) extends the work of Hakkio and Rush by introducing the concept of 'strong' and 'weak' sustainability. She defines the necessary and sufficient conditions for deficit sustainability as $0 \leq b \leq 1$. Quintos (1995) notes that $0 < b < 1$ is sufficient for the deficit to be sustainable, but it is inconsistent with the government's ability to market its debt in the long run.[20] In support of Hakkio and Rush, Quintos stated that $b = 1$ is probably necessary for the government to remain solvent.

Wilcox (1989) also finds evidence of a change in the stance of U.S fiscal policy in that the market value of government debt appears to be greater than the sum of expected future surpluses. Wilcox cites 1974 as the year in which the disequilibrium is first observed which is somewhat earlier than the period suggested by Hakkio and Rush. The implications as stated by Wilcox are that 'these results suggested that the structure of fiscal policy must eventually change' (Wilcox 1989: 292).

Several empirical studies focussing on fiscal sustainability in the European countries are also available in the literature. For instance, Stolan (2010: 501-518) uses a fiscal reaction function proposed by Bohn (2007) and concludes that for Bulgaria, Czech Republic, Estonia, Hungary and Lithuania governments have the ability to run a primary surplus in the short term whilst for Poland, Romania and Slovakia, sustainable fiscal policy will be more difficult to attain given the opposite response of governments to public debt shocks. Afonso and Rault (2008) conduct the first panel analysis of fiscal sustainability encompassing the enlarged set of 27 EU countries using data spanning the period 1960-2006 and reach the conclusion that fiscal policy is not sustainable within the EU-27 panel.

[20] She referred to this as weak sustainability.

Polito and Wickens (2005) propose an index of the fiscal stance that is convenient for practical use. It is based on a finite time other than an infinite time horizon like most tests. The authors show how it is possible to analyse a change in policy within a VAR framework. They use this methodology to examine the effect on fiscal sustainability of a change in policy, and then conduct an empirical examination of the fiscal stances of the US, the UK and Germany over the last 25 or more years. Polito and Wickens also carry out a counter-factual analysis of the likely consequences for fiscal sustainability over this period. Among their findings are that the fiscal stances of all three countries are not sustainable.

Empirical investigations on the government's inter-temporal fiscal constraints in the Asian region are also available in the literature (for example, Wu 1998; Chung, 2002; Cashin, *et al.* 2003; Baharumshah and Lau, 2007). These series of studies were undertaken following concerns on budget deficits and the associated build-up of debts observed in the post-Asian financial crisis period of 1997. Using time series analysis, both Wu, (1998) and Chung (2002) find sustainable fiscal policies for Taiwan and Korea whilst Pakistan is on the unsustainable path. Similarly, based on time series analysis and quarterly data over three decades, Baharumshah and Lau (2007) apply the methods derived by Hakkio and Rush (1991) and Quintos (1995) seeking for a cointegration relationship between revenue and total spending for some East Asian countries. They find evidence of sustainable fiscal finances in Thailand and South Korea, whilst the Philippines and Malaysia demonstrate only 'weak sustainability'.

Baharumshah and Lau (2007) show that in Singapore, revenue is growing at a faster rate than government spending. Their conclusions on sustainability are made by evaluating the properties of the cointegration vector as well as the evaluating order of integration of the debt series.

In the earlier and mid-1990s several researchers argue that fiscal policy is unsustainable in South Africa (Roux 1993; Van der Merwe 1994; Schoeman 1994; Cronje 1995). Roux (1993) argues that the South African government would be able to finance higher social expenditure only if economic growth improved; otherwise, debt-financed increases in social expenditure would cause an increase in the public debt/GDP ratio. Van der Merwe (1994) argues that fiscal policy in South Africa is unsustainable due to the large gap between real interest rates and real economic growth as well as the relatively large size of the deficit. Schoeman (1994) also warns that as long as government runs a large deficit in the face of a real interest rate that exceeds real economic growth, the public debt/GDP ratio would tend to explode. Burger, *et al.* (2012:209-27) estimate fiscal reaction functions using various methods (OLS, VAR, TAR, GMM, State-Space modelling and VECM) and find that since 1946 the South African government has implemented sustainable fiscal policies by reducing the primary deficit or increasing the surplus in response to rising debt.

From the empirical literature reviewed, it is observed that most of the empirical studies on fiscal sustainability focus on the unit root and cointegration tests to investigate whether the behaviour of these series is consistent with the inter-temporal budget balance. Several more have used the fiscal reaction model since Bohn (2007). Few studies, mostly in the U.S and a small body of research

investigating the issue of fiscal sustainability in South Africa, have applied regime-switching models. Instead, in almost all the studies reviewed the researchers have assumed that the adjustment of fiscal variables towards equilibrium is always present and of the same strength under all circumstances. This study attempts to illustrate that there are situations in which the validity of this assumption might be questioned. Furthermore, the empirical results of these studies vary depending on the sample period and the methodology used.

2.3 Literature on fiscal policy changes, the shadow economy and fiscal sustainability

Erosion of the tax base has detrimental fiscal effects and is therefore a cause for concern. Among other factors and important to this study, revenue losses from non-compliance are particularly critical in the context of substantial budget deficits (Fjeldstad and Schulz-Herzenberg, 2012; Tanzi, 2000a). Furthermore, tax evasion may have harmful effects on economic efficiency in general (Fjeldstad, and Schulz-Herzenberg, 2012; Chand and Moene 1999:1129-1140; and Tanzi 2000b), and income distribution in particular because the effective tax rates faced by individuals and firms may differ due to different opportunities to evade (Fjeldstad, and Schulz-Herzenberg, 2012).

Models and theories of taxpayer behaviour, including the decision whether or not to pay taxes, tend to reflect one of five 'schools of thought' namely: fiscal exchange; social influences; comparative treatment; political accountability; and economics of crime framework.[21]The fiscal exchange theory suggests that the presence of government expenditures may motivate compliance. This proposition is well rooted

[21] See Fjeldstad and Schul-Herzenberg, 2012 for a detailed discussion of these theories.

in economics and political science (Prichard, 2010; Feld and Frey, 2007:102-120; Moore, 2004:297-319; Slemrod, 1992).

The social influence theory assumes that human behavior in the area of taxation is influenced by social interactions and therefore compliance behaviour and attitudes towards the tax system may be affected by the behaviour of an individual's reference groups (Fjeldstad, 2007). Banerjee (1992:797-817) in his research on herd behavior indicates that social influences may affect compliance, in particular by affecting the perceived probability of detection. The Comparative Treatment theory suggests that individuals are more likely to comply with rules if they perceive the system that determines those rules to be impartial (Mckerchar and Evans, 2009:171-201). With regards to political legitimacy, the literature emphasises that higher legitimacy for political institutions leads to higher tax compliance (Torgler and Schneider, 2007:443-470).

Unlike the four models highlighted, nearly all economic approaches to tax evasion are based on the economics of crime framework (Fjeldstad 2012) and this study is no exception. The economics of crime model assumes that taxpayer behaviour is influenced by factors such as the tax rate, which determines the benefits of evasion; and the probability of detection and penalties for fraud which represent the cost of evasion. This theory is based on a wide range of assumptions, which have been criticized as generally been unrealistic (Andreoni, 1998:818-860).[22]

[22] For example the model assumes that all people respond to a change in one variable in an identical and predictable manner; and that taxpayers have full knowledge of the probability of being audited.

In line with the economics of crime model, several theoretical models have been suggested to support the relationship between taxes and the amount of tax evasion, or the size of the shadow economy: e.g., Schneider, Buehn, and Montenegro (2010: 443-46); Neck, Schneider and Wachter (2010); Schneider and Enste (2000:77-114); and Trandel and Snow (1999:217-222). The intuitive reason for this is that taxes form a wedge between gross and net incomes, revenues or prices. The higher this wedge is, the more attractive it is to avoid the tax payments because there is more to gain by the substitution effect.

Following Trandel and Snow (1999:217-222) the relationship between the tax burden and the shadow income can be shown as follows: assume individuals maximise expected utility given a constant marginal tax $\tau > 0$ imposed on declared income above a threshold, c > 0. Let the probability of detecting undeclared income x equals ρ; the penalty m > 0, for under declaration of income is a multiple of the amount of tax evaded; and income earned in the shadow economy equals Y_s, whilst Y_n is the income earned in official economy. The objective of the tax evaded is to choose a level of undeclared income to optimise:

$$\rho U(y_s(1-\tau)+\pi c - mx\tau)+(1-\rho)U(y_s(1-\tau)+\pi c+\pi x \qquad (2.6)$$

Where U(.) is a risk-averse von Neuman-Morgestern utility function; and an interior solution assumed. Denoting α as the proportion of workers in the shadow economy, and y_i (α) the wage earned in sector i, with $y_s'(\alpha)<0$ and $y_n'(\alpha)>0$ (primes denotes derivatives); and agents choose where to work, the sectors must offer equal expected utilities in equilibrium:

$$U(y_n(\alpha^*)(1-\tau)+\pi c)=\rho U(y_s(\alpha^*)(1-\tau)+\pi c - mx^*\tau)+(1-\rho)U(y_s(\alpha^*)(1-\tau)+\pi c+\pi x^* \qquad (2.7)$$

Where α* is the equilibrium proportion of workers in the shadow economy, and x* the equilibrium undeclared income. Equation (2.7) can be rewritten as:

$$U(\phi)-(1-\rho)U(\varphi)-\rho U(\gamma)=0 \tag{2.8}$$

where:

$\phi = y_n(\alpha^*)(1-\tau)+\pi c$; $\varphi = y_s(\alpha^*)(1-\tau)+\pi c+\pi x^*$ and $\gamma = y_s(\alpha^*)(1-\tau)+\pi c-mx^*\tau$

If one sector becomes relatively attractive, then workers move into that sector until pre-tax wages adjust to re-establish equation (2.8). Applying the implicit function theorem to equation (2.8) and using the first-order condition for x*, gives:

$$\frac{\partial\alpha^*}{\partial\tau}=\frac{U'(\phi)(y_n-c)-[(1-\rho)U'(\varphi)+\rho U'(\gamma)](y_s-c)}{(1-\tau)[U'(\phi)y_n'-((1-\rho)U'(\varphi)+\rho U'(\gamma))y_s'}\equiv\frac{A}{\Delta}>0 \tag{2.9}$$

Where Δ > 0. Equation (2.9) states that when a fixed, non-degenerated range of income is untaxed and preferences exhibit decreasing absolute and non-decreasing relative risk aversion, a rise in the tax rate increases the proportion of the work force in the evadable sector. Trandel and Snow (1999:217-222) assert that the ultimate effect of an increased tax rate on tax revenue depends, in part, on the number of workers who must shift between sectors in order to re-equate the sectors' expected utilities. Given a constant attitude to risk, if wages are highly responsible to changes in the distribution of workers, then labour market equilibrium is re-established with only a small movement of workers into the shadow economy. But if wages are relatively inelastic then the shadow economy expands to a greater extent and marginal welfare cost becomes larger. If the wage elasticity is sufficiently low, and the number of workers shifting into the shadow economy is sufficiently large, then a rise in the tax rate causes tax revenue to fall.

The associated empirical literature on the effect of the tax burden on the shadow economy is more limited, partly due to the difficulty of obtaining reliable time-series data on the size of the underground economy. However, empirical results of the influence of the tax burden on the shadow economy are provided in the studies of Neck, *et al.* (2010); Schneider, *et.al.* (2010: 443-461); Thiessen (2003:295-318); Giles and Tedds (2002); Giles and Caragata (2001:1857-67); and Giles and Johnson (2002) who all found strong evidence for the general influence of taxation on the shadow economy.

Neck, *et al.* (2010) investigate how different tax systems and structures affect the extent of the shadow economy. The authors formulate a theoretical microeconomic model of household behavior, where the household can participate in the official and in the shadow economy. Using comparative statics, they show that the complexity of the tax system affects participation in the shadow economy negatively, i.e., a more complex tax system implies, *ceteris paribus*, a smaller labour supply in the shadow economy. The tax burden is also shown to have a positive effect on shadow economic activities.

Schneider, *et al.* (2010:443-461) apply a Multiple Indicator Multiple Causes (MIMIC) model and conclude that the increased burden of taxation combined with regulations and the quality of public services as well as the state of the official economy seem to have been the driving forces of the shadow economy in 162 countries, including developing, Eastern European, Central Asian, and high income OECD countries from 1999 to 2006/2007.

Thiessen (2003:295-318) uses the Currency Demand model and also finds that the direct tax burden and the complexity of the tax system are important causes of shadow economic activities in Ukraine.

Giles and Johnson (2002) and Giles and Tedds (2002) use a non-parametric regression to estimate the relationship between taxes and the shadow economy from New Zealand and Canadian data. Their results indicate a positive response in the shadow economy ratio to an increase in the effective tax rate. Giles and Tedds (2002) undertook a similar non-parametric analysis for Canada, with taxes broken down into personal, corporate, indirect and "other" components so as to analyse the effects of changes in the "tax-mix". In the case of the New Zealand shadow economy, Caragata and Giles (2000) also consider tax-mix issues, but use a (parametric) logistic model for the shadow economy and tax rates relationship. The elasticities that are computed suggest that the New Zealand shadow economy is much less responsive to changes in the effective tax rate than is the case of Canada.

Schoeman and Caner (2006) identify three measurable tax related causes of the development of the shadow economy in South Africa since the early 1980s, as represented in terms of unrecorded employment.[23] The causes they identify include the marginal effective personal income tax rates, the differential between labour costs and labour productivity and the differential between corporate and personal income tax rates. They argue that it is the marginal effective tax rates and not average tax rates that are crucial in the growth of the unrecorded economy. Personal

[23] Given the inherent differences between the characteristics of the unrecorded economy of South Africa compared to that of the countries mentioned in other studies they attempt to define that part of the unrecorded economy that could be regarded as "shadow" in which case either legislation and/or regulations impacts on the size thereof.

income taxes affect the labour supply decision of individuals whether to work in the formal sector or in the unrecorded sector of the economy or not work at all. Saunders (2005) using the currency demand model estimates the shadow economy of South African and finds a positive relationship between the total tax burden and such shadow economic activities.

From the literature reviewed, it is observed that various tax variables i.e. the average direct tax rate, average total tax rate (indirect and direct tax rates) and marginal tax rates are the main causes for the increase in the shadow economy. Intuitively, these studies have shown that the level of the tax rate is linked to the security of the tax base. The higher taxes, the greater the risk to the revenue base or at worst the smaller the base is. Most of these studies reviewed, however, have assumed that the relationship between the tax burden and shadow income is symmetric and that there is no tax band of inertia. Building on the literature reviewed above, Chapter four of this study explores the possibility of an asymmetric relationship between the tax burden and shadow income.

2.4 Literature on fiscal policy changes, economic growth and fiscal sustainability

Growth theory describes when it is justified for government in terms of Pareto optimality theory, to run a primary deficit. It also depends on whether the (r- g) gap is positive or negative. If the gap is positive (i.e. r > g), a primary deficit reduces inter-temporal utility and drives the economy away from the “golden rule” of capital accumulation (Burger, 2003). On the other hand, if negative (i.e. r < g), a deficit improves inter-temporal utility and drives the economy closer to the optimum level of capital accumulation. Thus, the justification to run a primary deficit coincides with the

ability of government to manage such a policy when the (r - g) gap is negative. Therefore, (r - g) represents the nexus between growth theory, which describes the justification to run a primary deficit, and fiscal sustainability theory that describes the ability to run primary deficits (Burger, 2003). Mainstream analysts of fiscal sustainability do not concern themselves with the problem of the effects of government spending and borrowing on the economy's output (Sardoni, 2008). In these models, the level and composition of public expenditure as well as public debt are totally independent of the growth rate. The growth models of Ghosh and Gregorious (2008: 485-516); Gupta, Clements, Baldacci and Mulas-Granados (2005:441-63); Ghosh and Roy (2004:742-56); Devarajan, Swaroop, Zou (1996:313-44); and Barro (1990:103-126), consider the growth rate as endogenous. In these models, resources spent on the creation of human capital (e.g. Education expenditure) affect the growth rate.

Ghosh and Gregoriou (2008) investigate the effect of expenditure compositions on growth but from an optimal fiscal policy perspective. Within a decentralised economy set-up, the authors analytically derive the welfare maximising fiscal policy chosen by a benevolent government and the effects of this on the long-run growth rate. From an optimal fiscal policy perspective, their empirical results demonstrate that developing countries which have correctly perceived current expenditure as being the more productive have increased the share of spending on this category of public goods and this has led to higher growth.

In an empirical study with a sample of 39 low income countries (all with IMF-supported programmes) during the period 1990 – 2000, Gupta *et al.* (2005:411-63)

show that fiscal consolidations achieved through the cutting of selected current expenditures tend to raise growth rates, whilst protecting capital expenditures has a similar effect. Also in an endogenous growth framework, Ghosh and Roy (2004:742-56) introduce both public capital and public services as inputs in the production of a final good and demonstrate that optimal fiscal policy in an economy depends not only on the tax rate but also on the apportionment of tax revenues between the accumulation of public capital and the provision of public services.

In the endogenous growth model of Barro (1990), the fiscal structure defined as the composition of government expenditure, the structure of taxation and the overall size of government have a substantial influence on economic growth. Barro (1990:103-126) demonstrates that certain forms of government expenditure can in theory improve economic growth, whereas, if lump-sum taxation is ruled out, financing such expenditure will typically have negative impacts on economic growth. Devarajann, *et al*. (1996:313-344) theoretically derive the conditions under which a change in the composition of public expenditure could enhance the steady-state growth rate of the economy. They conclude that the generally assumed productive expenditures could become unproductive if the amount allocated to it is excessive.

The methodology outlined by Kneller, *et al.* (1999) and adopted by Bose, Haque and Osborn (2007) explains the importance of the government budget constraint in the context of the growth effects of fiscal policy for developed countries. Following this framework, for n producers each producing output (y) the production function can be specified as:

$$y = Ak^{1-\alpha}g^{\alpha} \qquad 0 < \alpha < 1 \qquad (2.10)$$

Where k denotes private capital, g is publicly provided private input, which is rival and excludable; 'A' is a measure of factor productivity. It is also assumed that the government balances its budget in each period by raising a proportional tax on output at the rate $\tau = \frac{g}{y}$ on the quantity of output, y, and a lump-sum tax L. Given this assumption, the budget constraints will be:

$$ng + C = L + \tau ny \qquad (2.11)$$

Where C represents government consumption goods that enters consumers' utility functions but do not enter the production function in equation (2.10) and therefore are deemed unproductive. The lump-sum tax is non-distortionary and therefore would not affect private sector incentives to invest in input goods, whilst taxes on output do affect such incentives (Barro, 1990).

From equation (2.10), the marginal product of capital can be expressed as:

$$\partial y / \partial k = (1-\alpha)A^{1/(1-\alpha)}(g/y)^{\alpha/(1-\alpha)} \qquad (2.12)$$

Where $\partial y / \partial k$ is computed for a given value of g. The private rate of return on investment is found by multiplying the marginal product of capital by $(1-\tau)/\mu$, where τ is the marginal tax rate on output (and hence, on the income from capital) and μ is the cost of a unit of capital. Using an isoelastic utility function[24], Barro and Sala-I Martin (1992) express the long-run growth rate, ϕ as:

$$\phi = \lambda(1-\tau)(1-\alpha)A^{1/1(1-\alpha)}\left(g/y\right)^{\alpha/(1-\alpha)} - \mu \qquad (2.13)$$

[24] See Barro and Sala-I-Martin (1992) for the derivation of the isoelastic utility function.

Where λ is a constant parameter in the utility function. From equation (2.13) it can be observed that the growth rate (ϕ) is decreasing at the rate of distortionary tax (τ), but is an increasing function of productive government spending (g), and is unaffected by non-distortionary taxes (L) or non-productive expenditure (C).

In the event the budget is not balanced in every period, a more practical situation, equation (2.11) can be reformulated by including a budget deficit/surplus, (d) term as shown in the identity (2.14) below.

$$ng + c + d = L + \tau ny \qquad (2.14)$$

Where d is the budget deficit or surplus. *A priori*, g > 0; $\tau > 0$; C and L = 0; d = 0 provided that the Ricardian equivalence holds and that the composition of expenditure and tax remains unchanged.

Let X_{jt} be the fiscal variable j at time t and Y_{it} the non-fiscal variable, i, at time t. The set of fiscal variables include government expenditure, government revenue and budget balance items. If there are m such distinct elements, then the government budget constraint imply the identity:

$$\sum_{j=1}^{m} Y_{jt} = 0 \qquad (2.15)$$

Allowing each element to have an impact on growth leads to a generalisation of the growth equation (Bose, *et al.* 2007) as:

$$\phi_t = \alpha_t + \sum_{i}^{k} \beta_i Y_{it} + \sum_{j=1}^{m} \gamma_j X_{jt} + U_t \qquad (2.16)$$

Most fiscal variables are strongly correlated with each other so there might be a problem with multicollinearity if equation (2.16) is estimated. In this case there may

be perfect collinearity between the m elements X_{jt} arising from the identity of the budget constraint. Thus, (at least) one element X_{jt} must be omitted. If for, simplicity, we assume X_{mt} is the single omitted element, the model to be estimated then becomes:

$$\phi_t = \alpha_t + \sum_{i=1}^{k} \beta_i Y_{it} + \sum_{j=1}^{m-1} (\gamma_j - \gamma_m) X_{jt} + u_t \tag{2.17}$$

The standard hypothesis test of a zero coefficient of X_{jt} is in fact testing the null hypothesis that $(\gamma_j - \gamma_m) = 0$ rather than $\gamma_j = 0$. Equation (2.17) depicts that the coefficient on each of the fiscal policy variables is best interpreted as the effect of a unit change in the related variable offset by a unit change in the element omitted from the regression or some mix of the omitted elements, if more than one, which is the implicit financing element (Kneller, *et al.* 1999:171-190; Bose, *et al*. 2007:533-556). If, however, the excluded X_{mt} has a coefficient $\gamma_m = 0$, then $\gamma_j = \gamma_m$ and the coefficient of each included fiscal variable in (2.17) retains the same interpretation as in (2.16).

The theoretical growth model has been reinforced by empirical research distinguishing the types of government expenditure and taxation and explicitly incorporating the government budget constraint. Kneller, *et al.* (1999) and Bleaney, *et al.* (2001) affirm that the composition of fiscal policy has a substantial influence on economic growth. Chamorro-Narvaez (2012), however, suggests that neither capital nor current expenditure has any impact on the per capita economic growth rate. The author attributes this insignificant relation between expenditure and growth to inefficiency due to poor governance and corruption. It seems as if there is no consensus in the literature about which public expenditure is productive or

unproductive.[25] Public expenditures on infrastructure such as transport networks, water and sewer systems, education and defense are quoted as typical examples of possibly growth-enhancing publicly provided inputs (Nijkamp and Poot, 2004:101). It is also argued that improvements in health care raise a labour force's productivity by reducing absenteeism and illness and by enhancing the capacity to work over the life cycle (Gerson, 1998: 10). As a result, government expenditure for health care may boost economic growth. Overall, there is a whole range of government expenditures that may be growth enhancing. This supports the assertion that the composition of government outlays may be more relevant than the level (Nijkamp and Poot, 2004:107).

Government expenditures, however, must be funded in some way. In endogenous growth models, taxes and social contributions can hamper growth by distorting the decisions of a representative household that maximises utility over time with respect to income such as savings-investment decisions or decisions concerning the trade-off between leisure and labour (Podrecca, 1993, 412). From these models it can be inferred that income taxes and social contributions, if income-related, have a negative growth effect, whereas consumption taxes have an effect on the level rather than on the growth rate of output (Tanzi and Zee, 1997: 185-86). Consequently, tax systems that are more consumption-based should be more favourable to growth. However, so far the empirical evidence regarding the negative effect of taxation on growth has been rather weak (e.g. Nijkamp and Poot, 2004).

[25] Productive expenditure is assumed to be positively correlated with economic growth whilst the reverse is the case for unproductive expenditure.

In general, the empirical evidence on the effect of fiscal policy on growth again affirms that there is no consensus amongst researchers on this issue. Afonso and Sousa (2012: 4439-4454) investigate the macroeconomic effects of fiscal policy using a Bayesian Structural Vector Autoregression (BSVAR) approach and find that government spending shocks in general have a small effect on Gross Domestic Product (GDP); result into important crowding-out effects; have a varied impact on housing prices and generate a quick fall in stock prices. Blanchard and Perotti (2002:1329-68) use information about the elasticity of fiscal variables in the US to identify the automatic response of fiscal policy and find that expansionary fiscal shocks increase output, have a positive effect on private consumption and a negative impact on private investment. In other countries, Australia, Canada, West Germany and the UK, Perotti (2004) find a relatively large positive effect on private consumption and no response on private investment.

Fatás and Mihov (2001) and Favero (2002) use a Cholesky ordering to identify fiscal shocks and show that increases in government expenditure are expansionary and lead to an increase in private investment that more than compensates for the fall in private consumption. In a similar vein, Mountford and Uhlig (2009) using the agnostic identification procedure based on sign and near-zero restrictions on impulse responses find that government spending shocks crowd out both residential and non-residential investment, but do not reduce consumption.

Gali, Lopez-Salido, and Vales (2007:227-70) explore the conditions under which a dynamic general equilibrium model with nominal rigidities and rule-of-thumb consumers can account for the positive co-movement of consumption and

government purchases that arises, in nominal terms, in response to exogenous variations in the latter variable. They show how the interaction between rule-of-thumb households (whose consumption equals their labour income) and sticky prices makes it possible to generate an increase in private consumption in response to a persistent expansion in government spending. Giordano, Momigliano, Neri and Perotti (2007) show that in Italy, government expenditure has positive and persistent effects on output and on private consumption.

The non-Keynesian effects of large fiscal consolidation programmes are exemplified by the work of Giavazzi and Pagano (1990). In particular, Perotti (1999) finds evidence of a negative co-movement of consumption and government expenditure during episodes of fiscal consolidation (and hence large spending cuts) in circumstances of 'fiscal stress' (defined by unusually high debt/GDP ratios), but the opposite effect is realised in normal periods. Castro and Cos (2008) find that whilst there is a positive relationship between government expenditure and output in the short-term, in the medium and long-term, expansionary spending shocks only lead to higher inflation and lower output. Afonso and Sousa (2012: 4451) also find that the effects of a shock in government spending for Germany on GDP are negative reflecting the fall in both private consumption and private investment and providing evidence of a 'Non-Keynesian' effect. Nevertheless, the magnitude of the impact is small.

Stahler and Thomas (2012) using a dynamic stochastic general equilibrium (DSGE) model of a two-country monetary union find that using cuts in public investment is probably the less desirable way of performing fiscal consolidation, in terms of both its

short-run and long- run effects on economic activity. The authors also find that the effects of public consumption cuts depend on which specific measure is taken: whereas cuts in public purchases tend to be relatively harmful in the short-run due to its effects on aggregate demand, reductions in public sector wages or employment have positive spill-over effects on the private sector, lower labour cost and improve international competitiveness. They also show that a shift of direct to indirect tax-financing of government expenditures can improve Spain's competitiveness whilst its effect on the rest of the European Monetary Union is positive but small.

In conclusion, the literature reviewed in this section so far has not provided any robust stylised facts on the effect of fiscal policy and GDP growth. Several empirical investigations are therefore seen as a way of making progress on this issue. Hence this study adds to the on-going debate on the impact of fiscal policy on growth using data from an emerging economy.

2.5 Summary and conclusion

The theoretical literature on the concept of fiscal sustainability falls into two main schools of thought. According to the first school, it is normal for the real interest rate to be lower than the real economic growth rate and that government could grow the economy out of the burden of public debt by relying on the income multiplier. The other school requires the real growth rate to be higher than the real interest rate to maintain dynamic efficiency.

Several of the empirical articles on fiscal sustainability focus on the time series behaviour of tax revenues and expenditures, as well as debt series, to investigate whether the behaviour of these series is consistent with the inter-temporal budget balance. These studies assume the adjustment towards equilibrium is always present and of the same strength under all circumstances. The empirical results of these studies vary depending on the sample period and the methodology used.

The literature on tax evasion highlights the decision of a taxpayer to evade taxes and can be explained by five main theories namely, fiscal exchange; social influences; comparative treatment; political accountability; and economics of crime. With regards the economics of crime framework, various tax variables i.e. the average direct tax rate, average total tax rate and marginal tax rates are the main causes for the increase in the shadow economy. Intuitively, these studies have shown that the level of the tax rate is linked to the security of the tax base. The higher tax rates are the greater the risk to the base or at worst the smaller are the base. Most of these studies reviewed, however, assume that the relationship between the tax burden and the shadow income is symmetric.

Finally, the literature so far has not provided any robust stylised facts on the effect of fiscal policy on GDP growth. However, the theoretical and empirical findings seem to indicate that the structure of fiscal policy has important implications for fiscal sustainability. The empirical articles reviewed have identified the variables and methods that are fundamental in the estimation of models on fiscal sustainability. In subsequent chapters an attempt is made to add value to the literature discussed by explaining how fiscal sustainability can be enhanced in South Africa.

CHAPTER THREE: FISCAL REACTION AND THE SUSTAINABILITY OF FISCAL IMBALANCE IN SOUTH AFRICA

3.1 Introduction

In the aftermath of the recent financial crisis, fiscal policy is playing a bigger role in smoothing the business cycle and getting the crisis affected countries back on their growth paths. Thus, there has been a resurgence of interest in fiscal sustainability study among academia and researchers alike. This study, therefore, contributes to the empirical literature on fiscal sustainability by testing the asymmetric relationship between fiscal revenue and expenditure, estimating the threshold at which fiscal authorities are likely to react quicker in enhancing fiscal solvency. The analyst uses quarterly data for South Africa.

The findings of this study suggest that fiscal policy over the sample period has been sustainable and that fiscal authorities in South Africa are more likely to react quicker when the budget deficit exceeds 4.02% of GDP, but the stabilisation measures used by these authorities are fairly neutral below this estimated threshold; that is, at deficit levels of 4.02% of GDP and below. The fiscal reaction of the government i.e., increasing the tax burden to bring the large deficit level to a band of tolerable values indicate that fiscal authorities in South Africa are more concerned about a solvency constraint. Thus on the basis of this historical fiscal stance it can be expected that fiscal policy will remain sustainable in the medium-term and that the government's projection to reduce the fiscal deficit from a high 5.3% of GDP in 2010 to 3.0% in 2015 is plausible. In South Africa the main fiscal challenge, therefore, is to find ways through which the recent gains in fiscal solvency do not hinder GDP growth and shrinks the future tax base thereby undermining long-term fiscal stability.

The Chapter comprises five Sections: following the introduction, Section 3.2 discusses the background and motivation to the study. Section 3.3 provides the estimation procedures, with both linear and non-linear specifications; Section 3.4 presents the results from the estimations and the last Section summarises and concludes.

3.2 Background

In South Africa, issues of fiscal sustainability received greater attention in the late 1980s and earlier 1990s following a growing fiscal deficit and public debt/GDP ratios (see Sections 1.3 and 2.3). However, the debate on fiscal sustainability has now been renewed following the global financial and economic crisis. Having reduced its debt burden over the past decade and a half, the South African government again finds itself facing a rising debt as the fiscal deficit increases. The government has however outlined in its 2011/2012 medium-term budget document that by 2014/15 the budget deficit will decline from a high 5.3% of GDP in 2009/2010 to 3.0%. This is to be attained by increasing the tax-to-GDP ratio from about 25.0% in 2010/2011 to 28% mainly from increasing the tax burden on wealth and income and some indirect taxes (Section 1.3). The said budget document makes provision for some marginal cuts in government expenditure such as wage expenditure. This Chapter therefore addresses the following questions: was the fiscal stance taken in the past sufficient to attain fiscal sustainable in South Africa? How has the fiscal authorities reacted to budget imbalances and what are the implications of such reactions to fiscal sustainability?

As stated earlier in Section 2.3, several of the empirical studies on fiscal sustainability focus on the time series behaviour of tax revenues and expenditures, as well as debt series, to investigate whether the behaviour of these series is consistent with the inter-temporal budget balance. In many of these studies, the authors have only applied the methodology proposed by Bohn (1998), with possible extensions, focusing on the fiscal reaction function {e.g. Stolan and Campeanu (2010: 501-518); Kirchgaessner and Prohl (2006); Greiner, Koeller and Semmier (2006); and Ballabriga and Martinez-Mongay (2005)} some others {Baharumshah and Lau (2007:878-89); Martin (2000:83-105); and Cunado, Gil-Alana, and Perez-de Gracia (2004:501-526)} have applied only methods derived by Hakkio and Rush (1991) and Quintos (1995) seeking for a cointegration relationship between revenue and total expenditure. Conclusions on sustainability are derived at by evaluating the properties of the cointegration vector as well as evaluating the order of integration of the debt series.

In the work of Gurbuz, Jobert and Tuncer (2007), the authors combined the two methods to investigate the Turkish public debt development. Few studies (Cipollini, 2001:643-655; Cipollini, *et al*. 2009:34-54; Luintel, 2007:387-410) and mostly in the U.S. have extended the linear inter-temporal budget constraint rule of fiscal sustainability to a regime-switching framework. The empirical results of these studies in the literature vary depending on the sample period and the methodology used (see Section 2.3).

In South Africa in particular Burger, *et al.* (2012:209-27) estimated fiscal reaction functions using various methods (OLS, VAR, TAR, GMM, State-Space modelling

and VECM). Unlike Burger, *et.al.* (2012) that apply, among others, the Threshold Autoregressive model (TAR), this study applies the Smooth Transition Error Correction Model (STECM) of Granger and Teräsvirta (1993); Teräsvirta (1994); Teräsvirta, (1998) adopted by Cipollini (2001); and Cipollini, *et al.* (2009) that allows for smooth transition between regimes of behaviour and thus generalise the threshold autoregressive model (TAR). The other strength of the smooth transition model is that it is theoretically more appealing than the simple TAR models that impose an abrupt switch in parameter values. An abrupt switch only happens if all agents act simultaneously. Additionally, the STR model allows different types of market behaviour depending on the nature of the transition function. In particular, the logistics function allows differing behaviour depending on whether deviations from equilibrium are positive or negative, whilst the exponential function allows differing behaviour to occur for large and small deviations regardless of sign (McMillan, 2004:1663-6786).

In this Chapter, switching between regimes is controlled by the state of the fiscal balance. This feature of the smooth transition model is suitable for testing the ability of high against low budget deficits or surpluses to best describe the non-linear dynamics of fiscal policy in South Africa.

3.3 Specification and estimation techniques

In this Chapter the empirical estimation follows the mainstream approach discussed in Section 2.3 and involves the following steps: (i) testing for stationarity of the variables; (ii) testing for cointegration and estimation of the cointegrating relation; (iii)

testing for non-linearity of the adjustment process; and (iv) estimating and evaluating the smooth transition error correction model.

3.3.1 Linear estimation techniques

Following Cipollini (2001:643-655) and having established weak exogeneity (Table 3.6) in government expenditure-to-GDP in line with the 'expenditure dominance hypothesis',[26] the linear model estimated after eliminating insignificant lags, is specified as:

$$\Delta rev_t = \alpha_0 + \alpha_1 \Delta rev_{t-1} + \alpha_2 \Delta rev_{t-4} + \alpha_3 \Delta rev_{t-5} + \alpha_4 \Delta rev_{t-8} + \alpha_5 \Delta \exp d_t + \alpha_6 \Delta \exp d_{t-2} + \alpha_7 \Delta \exp d_{t-4} + \alpha_8 \Delta \exp d_{t-5} + \alpha_9 ecm_{t-1} \quad (3.1)$$

Where 'Δrev'$_t$ and 'Δexpd'$_t$ are the differenced revenue-to-GDP and expenditure-to-GDP variables in the current period, respectively. *A priori*, there is a positive and significant relationship between government expenditure-to-GDP and its revenue-to-GDP ratios. To choose the lag lengths, this study follows the suggestions of Tarasvirta (1994) by considering a number of test statistics on the error correction model (VECM) specifications; and Cipollini (2001) by using the likelihood ratio sequential tests on the residuals. Using the information criteria, the Schwarz Information Criterion and the Hannan-Quinn Information Criterion (HQ) suggest a lag length of 3, whilst the Akaike Information Criterion (AIC) and the Final Prediction Error (FPE) suggest a lag length of 5. However, a lag length 8 is chosen as the optimal lag length since this lag order gives evidence of homoscedastic and serially independent residuals.[27]

[26] The expenditure dominance hypothesis asserts that budgetary developments are determined by government spending (Cipollini, 2001)
[27] The stationarity test is done on the change in level of the data.

Three different tests for the order of integration were carried out, which are: the Augmented Dickey-Fuller (1981), the Kwiatowski, Phillips, Schmidst and Shin (1992) and the Phillips-Perron (1988) tests. The Dickey-Fuller and Phillips-Perron tests have as their null hypothesis that the dynamics of the respective series are characterised by a unit root. The Kwiatowski, Phillips, Schmidst and Shin test, on the other hand, is based on the null of stationarity. The use of three tests is justified since Philips-Perron (1988) and Zivot and Andrews (1992) have demonstrated that the Augmented Dickey-Fuller test has low power in the presence of a structural break.

Furthermore, those cointegration tests that are most popular among researchers were considered: the Residual-based test suggested by Engle and Granger (1987) and the Likelihood Ratio test introduced by Johansen (1991). Given a bi-variate case with no deterministic regressors, the Residual-based test for co-integration is performed via the two-step procedure of Engle and Granger (1987). That includes firstly the estimation of the cointegration regression as specified in equation (3.2) using the ordinary least square (OLS) method and secondly, testing for the presence of unit root in the regression residuals. The use of the Engle-Granger residual-based test in a bi-variate case can be justified as there can only be one cointegration relationship. In a multivariate framework, the use of the Engle-Granger residual-based test is prone to the risk of considering only one cointegrating relationship when there may be more than one. In a multivariate framework, therefore, the use of the Johansen (1991) test is most appropriate. However, to test the robustness of the Engle-Granger test, this study also uses the Johansen test.

$$y_t = -\beta x_t + u_t \tag{3.2}$$

Where y_t is government revenue, x_t is government expenditure and β is the slope coefficient in the co-integrating regression which is equal to unity. Johansen (1991) advocates a test for co-integration by testing the rank r of π by applying likelihood ratio tests to test the significance of the squared partial canonical correlations between Δy_t and y_{t-1} denoted $\hat{\lambda}_1$ and $\hat{\lambda}_2$ which can be obtained by solving a generalised eigenvalue problem. The author uses trace tests to test H_0: $r = r_0$ against the alternative hypothesis:

$$\mathrm{H}_1 : r \geq r_{0+1} \text{ for } r_0 = 0,1$$

This study considers both non-parametric and parametric tests for linearity. The non-parametric test follows Brock-Dechert-Scheinkman (1987). It tests the null hypothesis of independence and identically distributed variables against an unspecified alternative. The Brock-Dechert-Scheinkman (1987) test cannot test chaos directly, but only non-linearity, provided that any linear dependence has been removed from the data (e.g. using traditional ARIMA-type models or using first differences). The Brock-Dechert-Scheinkman (1987) statistics are, therefore, different from other non-parametric test statistics since the focus of the former is mainly on either the second - or third-order properties of X_t. The basic idea of the BDS test is to make use of a 'correlation integral' popular in chaotic time series analysis. Given a k-dimensional time series and observations $(x_t)_{t=1}^{T_k}$, the correlation integral is defined as:[28]

$$C_k(\delta) = \lim_{T_k \to \infty} \frac{2}{T_k(T_k - 1)} \sum_{i<j} I_\delta(X_i X_j) \qquad (3.3a)$$

Where $I_\delta(u,v)$ is an indicator variable that equals one if ||u-v||<δ, and zero otherwise and where ||·|| is sup norm. The null hypothesis of the BDS test is that the series is

[28] See Tsay (2005). Analysis of Financial Times Series, Second edition, page 210.

linear and the alternative hypothesis is that the time series is non-linear after removing any linear dependence from the data, either by using ARIMA-type models or taking the first difference of the series. This test statistic has a standard normal limiting distribution. The parametric test for linearity follows Teräsvirta (1994) who suggests a method of approximating the transition function by a Taylor expansion about the null of linearity $\gamma = 0$. The linearity test involves estimating an auxiliary regression by OLS:

$$\Delta y_t = \phi' w_t + \phi_1' \hat{w}_t z_{t-d}^2 + \phi_2' \hat{w}_t z_{t-d}^2 + \phi_3' \hat{w}_t z_{t-d}^3 + \varepsilon_t \qquad (3.3b)$$

where:

$$w_t = (1, \Delta y_{t-1}, \Delta y_{t-p}, \Delta x_{t-p}, z_{t-d})'$$

$$\hat{w}_t (\Delta y_{t-1}, \Delta y_{t-d}, \Delta x_{t-1} \ldots\ldots\ldots \Delta x_{t-p}, z_{t-d})$$

The original null hypothesis of linearity $\mathrm{H}_0 : \gamma = 0$ is equivalent to the hypothesis that all coefficients of the auxiliary regressors $\hat{w}_t z_{t-d}^j$, $j = 1,2,3$ are zero implying that $H_0' : \phi_1 = \phi_2 = \phi_3 = 0$. For details on the LM-type test for this hypothesis see, Van Dijk and Franses (1997). To select the most appropriate lag of z_t to use as transition variable, the test should be carried out for a number of different values of the reaction delay variable (d)[29] say, d = 1 ...D. If the linearity is rejected for several values of d, the one with the smallest p-value is selected as the transition variable; see Van Dijk and Franses (2000).

3.3.2 Non-linear estimation technique

If the linearity hypothesis is rejected, a non-linear model can be estimated using non-linear least squares (NLS). In this Chapter, the smooth-transition threshold models of

[29] The reaction delay variable determines how long it takes for government to react when the transition variable, in this case, the fiscal balance is above or below a certain estimated threshold in order to bring the dynamics of this variable under control (Cipollini, 2001).

Granger and Teräsvirta (1993); Teräsvirta (1994); Teräsvirta (1998) adopted by Cippollini (2001), Mcmillan (2004); and Cipollini, *et al*. (2009) is applied. Following McMillan (2004:1463-6786) the STR model is given by equation (3.4) below:

$$\Delta x_t = \delta_0 + \sum_{i=1}^{p} \Delta x_{t-i} + \rho_1 u_{t-1} + (\theta_i + \sum_{i=1}^{p} \theta_i \Delta x_{t-i} + \rho_2 u_{t-1}) F(u_{t-1}) + \varepsilon_t \qquad (3.4)$$

Where $F(u_{t-d})$ is the transition function and u_{t-d} the transition variable. The logistic function is given as follows, with the full model thus referred to as a logistic STR (or LSTR) model:

$$F(u_{t-1}) = \{1 + \exp[-\gamma(u_{t-1} - \tau)]\}^{-1} \qquad \gamma > 0 \qquad (3.5)$$

Which allows a smooth transition between the differing dynamics of positive and negative deviations, where γ is the smoothing parameter and τ the transition parameter. This function allows the parameters to change monotonically with u_{t-1}. As $\gamma \to \infty$, $F(u_{t-1})$ becomes a Heaviside function, $F(u_{t-1}) = 0, (u_{t-1}) \leq \tau, F(u_{t-1}) = 1, (u_{t-1}) \geq \tau$ and equation (3.4) reduces to a TAR model. As $\gamma \to 0$, equation (3.4) becomes a linear model of order *p.*

The second type of asymmetry, which distinguishes between small and large equilibrium errors, is obtained when $F(u_{t-d})$ is taken to be the exponential, with the resulting model referred to as the exponential STR (or ESTR) model and ESTECM for a bivariate model:

$$F(u_{t-1}) = 1 - \exp[-\gamma(u_{t-1} - \tau)^2] \qquad (3.6)$$

Equation (3.4) results in gradual changing strength of adjustment for larger (both positive and negative) deviations from equilibrium. It implies that the dynamics of the middle ground differ from those of the larger deviations. This model is therefore only

able to capture non-linear symmetric adjustment. A possible drawback of this choice for the transition function is that both if $\gamma \rightarrow 0$ or $\gamma \rightarrow \infty$, the model becomes linear. This can be avoided by using the 'quadratic logistic function' as proposed by Jansen and Teräsvirta (1994:2008-218).

$$F(u_{t-1}) = (1 + \exp\{-\gamma(u_{t-1} - \tau_1)(u_{t-1} - \tau_2)\})^{-1} \tag{3.7}$$

In this case, if $\gamma \rightarrow 0$, the model becomes linear, whilst if $\gamma \rightarrow \infty$, the function F(.) is equal to 1 for $u_{t-1} < c_1$ and $u_{t-1} > c_2$. The STR model is estimated using non-linear least squares; however in the LSTR model, a large γ results in a steep slope of the transition function at τ, thus a large number of observations are required to estimate γ accurately. Furthermore, convergence of γ may be slow with relatively large changes in γ having only a minor effect upon the shape of the transition function. To get around this problem, Granger and Teräsvirta (1993) and Teräsvirta (1994) proffer scaling the smoothing parameter γ by the standard deviation of the transition variable and by the variance of the transition variable in the case of ESTR (McMillan, 2004).

3.4 Data discussion

The data used to estimate the model suggested in this Chapter consists of the South African national government receipts and expenditures, expressed as ratios of GDP. The data, obtained from the Quarterly Bulletin published by the South African Reserve Bank are quarterly and seasonally adjusted from 1960:1 to 2010:4 as shown in Figures 3.1 and 3.2. All variables have been expressed as a percentage of GDP and converted into their natural logarithmic form. The revenue and expenditure ratios to GDP are used since government authorities are mainly concerned with the dynamics of the different budget items relative to the overall size of the economy

(Hakkio and Rush, 1991; Cipollini, 2001). The cointegrating relationship between the two variables using the Engle and Granger approach is also shown in Figure 3.3. Note, since Figure 3.3 shows mean-reverting residuals to the equilibrium, which is zero; the estimated co-integrating relations are appropriate.

Figure 3.1: Expenditure/GDP ratios, seasonally adjusted (1960-2010)

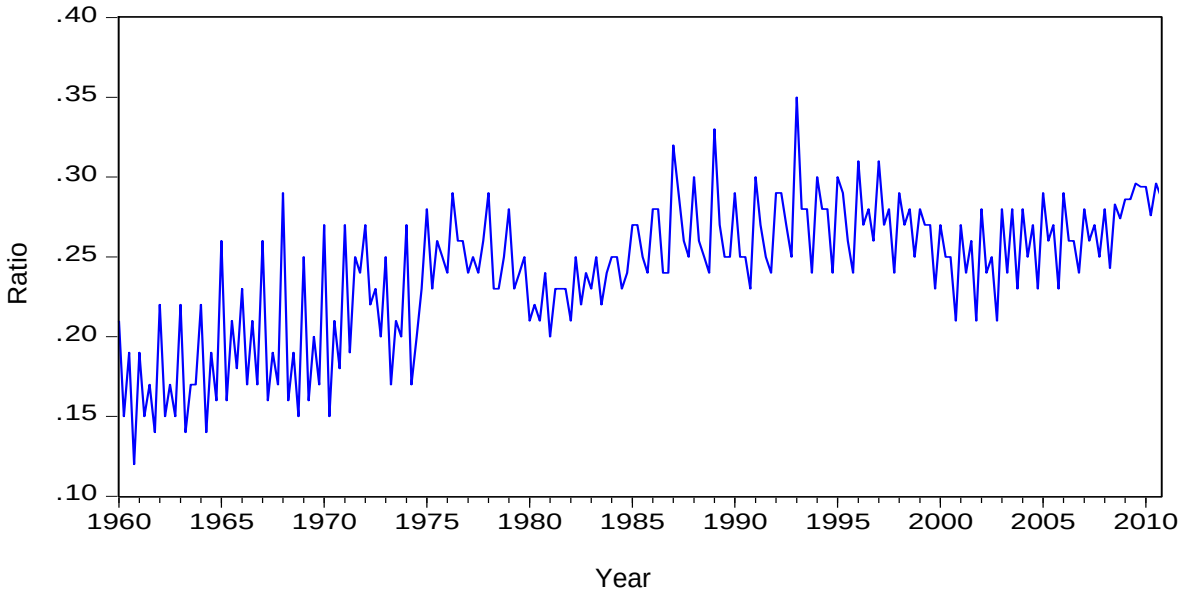


Figure 3.2: Revenue/GDP ratios seasonally adjusted (1960-2010)

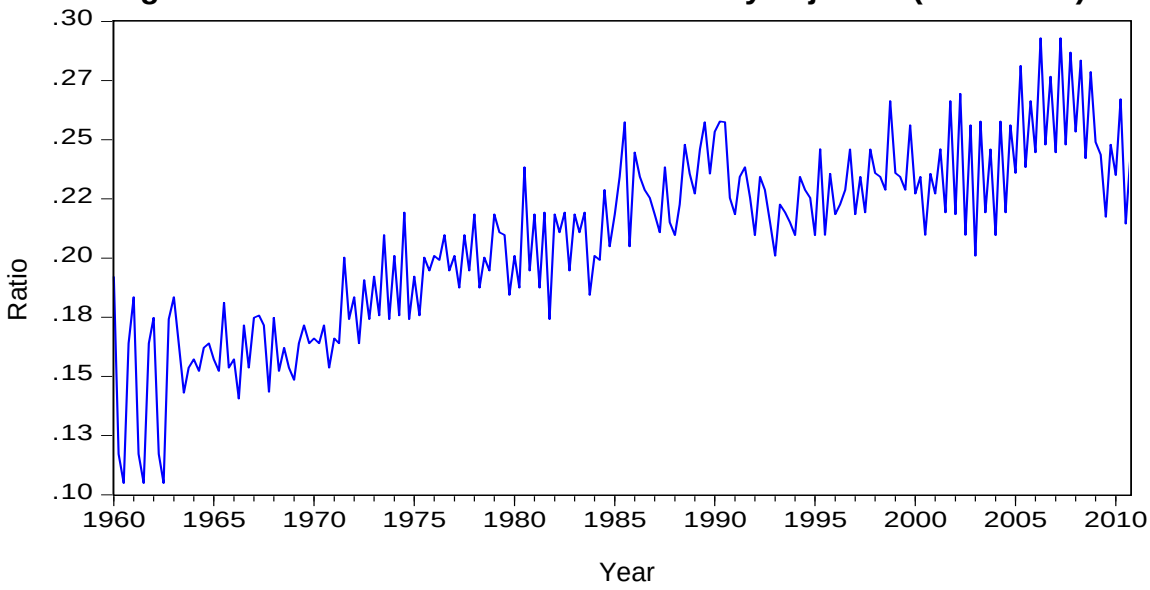
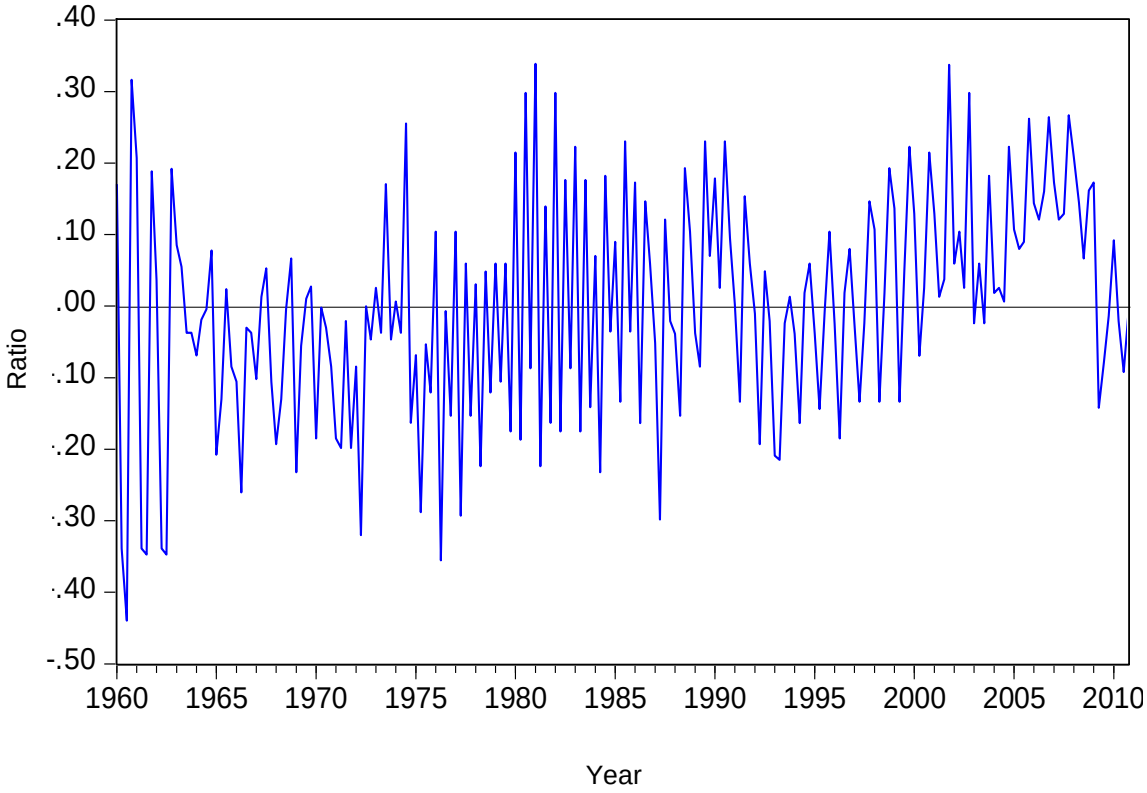


Figure 3.3: Cointegrating relationship between series



3.5 Empirical results

Table 3.1: Unit Root Tests

Panel A: in Levels	ADF	PP	KPSS
Revenue-GDP	1.62 [0.975]	-0.598 [0.493]	1.599***
Expenditure-GDP	0.83[0.889]	-0.300 [0.576]	1.307***
Panel B: first difference			
∆Revenue-GDP	-9.665***[0.00]	-9.998**[0.001]	0.095
∆Expenditure-GDP	-10.132***[0.00]	-7.528***[0.001]	0.092

Note *(**)(***) denotes significance at 10, 5, and 1% levels respectively. [ ] are probability values.

Table 3.2: Granger Causality Test (lag 4)

Panel A : Δ(REVGDP) as dependent variable

Excluded	Chi-sq	DF	Prob.
Δ(EXPGDP)	10.446	4	0.043
ALL	10.446	4	0.043

Panel B: Δ(EXPGDP) as dependent variable

Excluded	Chi-sq	DF	Prob.
Δ(REVGDP)	7.307	4	0.121
ALL	7.307	4	0.121

The Augmented Dickey-Fuller (1981) and Phillips-Perron (1988) unit root tests as well as the Kwiatkowski-Phillips-Schmidt-Shin (1992) stationarity tests for both series are reported in Table 3.1. The null of a unit root cannot be rejected on the basis of Augmented Dickey-Fuller (1981) and Phillips-Perron (1988) for both series. This result is supported by the Kwiatkowski-Phillips-Schmidt-Shin (1992) test as this test rejects the null of stationarity for both series. There is no ambiguity in the order of integration; therefore the first differences of the series are used in this study.

In Table 3.2 Panels A and B report results of the Block Causality Test in a cointegrated system. Panel A shows that the null hypothesis that expenditure-to-GDP does not Granger cause revenue-to-GDP is rejected at 5% level of significance. This implies that the lagged difference of expenditure-to-GDP cannot be excluded in the differenced revenue-to-GDP equation. The results in panel B reveal that the hypothesis that revenue-to-GDP Granger causes Expenditure-to-GDP cannot be rejected. This means that the lagged difference of revenue-to-GDP can be excluded in the differenced expenditure-to-GDP equation.

This result was verified using the weak exogeneity test (Table 3.5). The Table shows that the null hypothesis of weak exogeneity for the revenue-to-GDP variable is rejected but the null hypothesis of weak exogeneity for the expenditure-to-GDP variable cannot be rejected. This result supports the expenditure dominance hypothesis, implying that in South Africa, budget developments are mainly determined by government spending. The evidence of weak exogeneity in government expenditure-to-GDP implies that a conditional (single-equation) error correction model, where a change (first-order difference) of revenue-to-GDP is the dependent variable can be estimated.

Table 3.3 Unrestricted Cointegration Rank (Trace) Test

Hypothesised No. of CE(s)	Eigenvalue	Trace Statistics	critical value	Probability value
None*	0.323	79.236	12.321	0.000
At most 1	0.004	0.832	4.130	0.417

*Rejection of null hypothesis: Trace test indicates one cointegration equation at the 5% level.

Table 3.4: Binding Restrictions

B(1,1)=1, B(1,2) =-1

Hypothesied no. of Cointegration	Restricted Likelihood	LR Statistics	Degree of freedom	Probability value
1	452.0105	0.219771	1	0.639215

Table 3.5: Exogeneity Test

Variable	Restriction	Restricted Log likelihood	LR statistic	Degree of Freedom	Probability	Conclusion
Ln_rev	$\alpha_{11} = 0$	330.178	10.454	1	0.005	Endogenous
Ln_expd	$\alpha_{21} = 0$	341.219	2.809	1	0.125	Exogenous

The Johansen (1991) cointegration test determines the number of cointegrating vectors. The result is reported in Table 3.3. The Trace test, which is also supported

by the Maximum-Eigen value test, show that there is one stationary relation at the 5% level of significance (Table 3.3). This finding confirms the result of the residual-based test of cointegration as suggested by Engle and Granger (1987).

The hypothesis that the cointegrating vector is (1, -1) is also tested. Since the ρ-value is not significant at the conventional levels the null hypothesis that the restrictions are binding cannot be rejected (see Table 3.4), implying that during the sample period, fiscal policy in South Africa, consistent with the inter-temporal condition of sustainability, was sustainable.

The unrestricted Vector Error Correction (VECM) is reported in Table 3.6. In the error-correction panel of Table 3.6 containing the long-run component *a minus in* front of the parameter indicates *a positive relationship* between the variable to which the parameter applies and the variable on which the vector is normalised (Burger, *et al.* 2012:209-27). The long-run relationship shows that for every 1% increase in government expenditure, revenue will increase by 0.96%. Testing whether the cointegration coefficient $\beta = 1$[30](i.e. strong form of sustainability condition) it was found that the null hypothesis of $\beta = 1$ cannot be rejected. This result provides evidence satisfying the solvency of the government's inter-temporal budget constraint (strong form of sustainability) for South Africa. The test further shows that the transversality condition holds implying that the undiscounted value of the public debt goes to zero. The error-correction term for the revenue-to-GDP equation shows a fiscal response to deviations from the long-run relationship equal to -0.409

[30] The t-statistics was compared to t- critical at a 5% levels of significance to test the hypothesis: $H_0 : \beta = 1$ against $H_1 : \beta \neq 1$. T-statistics is computed as: $t = \frac{\hat{\beta} - \beta}{Se(\hat{\beta})}$

indicating that slightly over two-fifths of the deviation is corrected in the first period after the deviation occurs. Both the AIC and SC indicate that the revenue-to-GDP equation is the most preferred.

The fitted linear conditional error-correction model for revenue-to-GDP using the Ordinary Least Square (OLS) method is shown in Table 3.9, column 1.The linear model seems quite satisfactory, with the post-estimation residual tests indicating normality but with evidence of heteroscedasticity. The LM-test at lag 4 rejects the null of no serial correlation. It may be that these significant test values are caused by neglected non-linearity (Van Dijk, 2001).

Table 3.6: VECM results

Cointegration Equations:		
$(Lrev)_{t-1}$	1	
$(Lexpd)_{t-1}$	-0.958	
	(0.0754)	
C	0.021	
Error Correction Equations:	Δ(rev)	Δ(exp)
Cointegration Equation 1	-0.409	-0.443
	(0.091)	(0.102)
$\Delta(rev)_{t-1}$	-0.485	-0.051
	(0.095)	(0.107)
$\Delta(rev)_{t-2}$	0.110	0.258
	(0.069)	(0.077)
$\Delta(expd)_{t-1}$	0.623	-0.594
	(0.078)	(0.088)
$\Delta(expd)_{t-2}$	-0.362	-0.123
	(0.062)	(0.070)
C	0.002	0.001
	(0.008)	(0.002)
Adjusted R-squared	0.71	0.61
Akaike AIC	-4.52	-4.28
Schwarz SC	-4.42	-4.18

Values in ( ) represent standard errors.

3.5.1 Linearity testing and model selection

Table 3.7: BDS Test

ε/σ	Embedding Dimensions(m)	BDS Statistics
2	2	0.014***(0.0045)
2	3	0.024***(0.0071)
2	4	0.040***(0.0085)
2	5	0.046***(0.0087)
2	6	0.046***(0.0085)

Note: *(**)(***) denotes significance at 10, 5 and 1% respectively

Table 3.8: LM-Type for non-linearity and model selection

Transition Variable	LM	H_{01}	H_{02}	H_{03}
U_{t-1}	0.018	0.018	0.043	0.025
U_{t-2}	0.706	0.706	0.240	0.558
U_{t-3}	0.448	0.448	0.140	0.680
U_{t-4}	0.113	0.113	0.205	0.446
U_{t-5}	0.144	0.144	0.068	0.090
U_{t-6}	0.000	0.000	0.001	0.0012
U_{t-7}	0.421	0.421	0.507	0.957
U_{t-8}	0.001	0.0011	0.0010	0.124

Note: ρ-values of F variants of the LM-type tests used in the specification procedure of Escribano and Jorda (2001).

The Brock-Dechert-Scheinkman (1987) test is carried out on a series of estimated residuals to check whether the residuals are independent and identically distributed; i.e. whether the residuals from the linear model have any non-linear dependence in the series after the linear model has been fitted. Table 3.7 indicates that all the test statistics are significantly greater than the critical values. Thus, the null hypothesis of independent and identically distributed series/variables is rejected. The results strongly suggest that the time series in the model are non-linearly dependent, which is one of the indications of chaotic behavior.

A parametric test was also considered i.e. the Escribano and Jorda (EJ hereafter) (2001) linearity LM test. The null hypothesis in this test, $H_{0,}$ is that the series follows

a stationary linear process. The computation of the test is carried out using the F-version, which is an asymptotic Wald test. All variables in the linear error correction model are regarded as potential transition variables but computing the LM-type test statistics and setting the lagged variable (delay variable (d)) equal to 1 through 8, it is seen that linearity is rejected for the transition variable (fiscal balance, U_{t-d}) at d = 1, 2, 6 and 8 at the 5% level of significance. But given that d = 6 has the smallest ρ-value, it was selected as the delay variable (Table 3.8). The delay variable gives an indication of how long it takes for fiscal authorities to respond in bringing the dynamics of the fiscal variable under control (Cipollini, 2001:643-655). The result shows that in South Africa it takes 6 quarters or one and a half years for fiscal policy changes to be effective. This is not uncommon as fiscal policy issues require legislature procedures which do take time.

Deciding between the transition functions can be done by a short sequence of tests nested within H_0. This testing is motivated by the observation that if a logistics alternative is appropriate, the second-order derivative in the Taylor expansion (3.3b) is zero (Van Dijk and Franses, 2000). The null hypothesis to be tested is as follows:

$$H_{03}:\phi_3=0; H_{02}:\phi_2=0|\phi_3=0; H_{01}:\phi_1=0|\phi_3=\phi_2=0$$

Granger and Teräsvirta (1993) suggest carrying out all three tests, independent of rejection or acceptance of the first or second test and using the outcomes to select the appropriate transition function. The decision rule is to select an exponential STR function only if the p-value corresponding to H_{02} is the smallest and select the logistic function in all other cases. Table 3.8 shows that at d = 6, the logistic representation of the data is most preferred.

Having established a non-linear relationship the parameters of the LSTECM are estimated by using the non-linear least squares (NLS) technique. Two LSTECM models are fitted; one is general and the other is fitted after parameter reduction (see Table 3.9, columns 3 and 4); this is obtained by removing the insignificant coefficients. The model estimated is specified as:

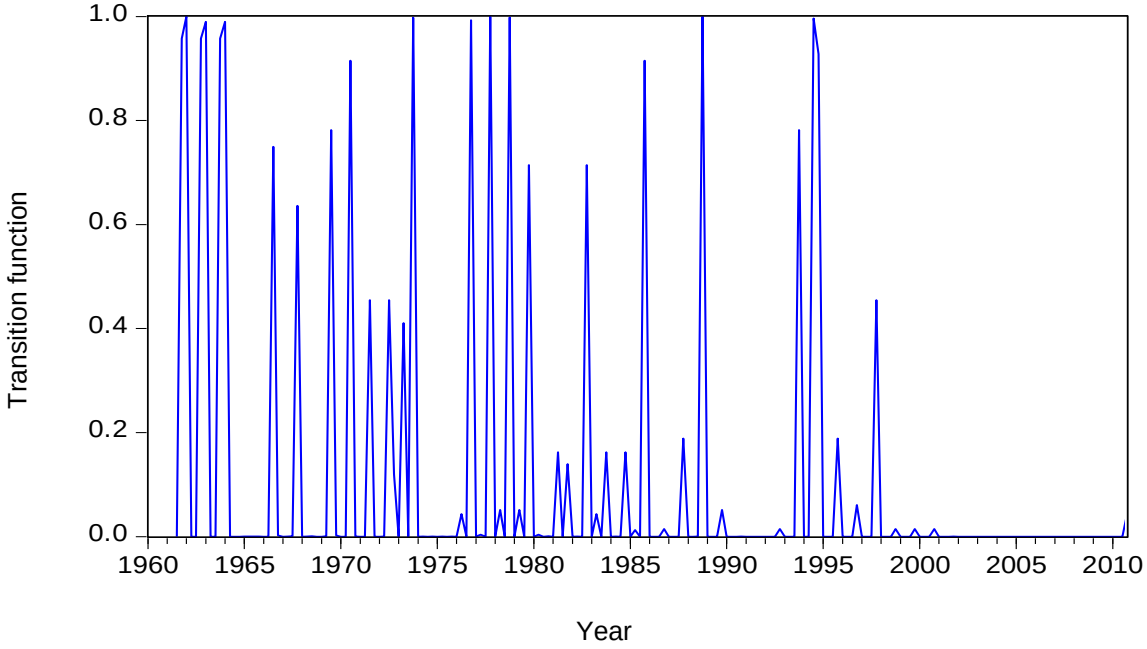
$$\Delta rev_t = \alpha_0 + \alpha_1 \Delta rev_{t-1} + \alpha_2 \Delta rev_{t-4} + \alpha_3 \Delta rev_{t-5} + \alpha_4 \Delta rev_{t-8} + \alpha_5 \Delta \exp d_t + \alpha_6 \Delta \exp d_{t-2} + \alpha_7 \Delta \exp d_{t-4} + \alpha_8 \Delta \exp d_{t-5} + \alpha_9 ecm_{t-1} + (1-\theta)(\beta_0 + \beta_1 \Delta rev_{t-1} + \beta_2 \Delta rev_{t-4} + \beta_3 \Delta rev_{t-5} + \beta_4 \Delta \exp d_{t-8} + \beta_5 \Delta \exp d_t + \beta_6 \Delta \exp d_{t-2} + \beta_7 \Delta \exp d_{t-4} + \beta_8 \Delta \exp d_{t-5} + \beta_9 ecm_{t-1} \quad (3.8)$$

where the weight F is the logistic function and is modelled as:

$$F(u_{t-d}) \equiv \theta(u_{t-d}; \gamma, C) = \{1 + \exp[u_{t-d} - \tau]\}^{-1} \qquad \gamma > 0$$

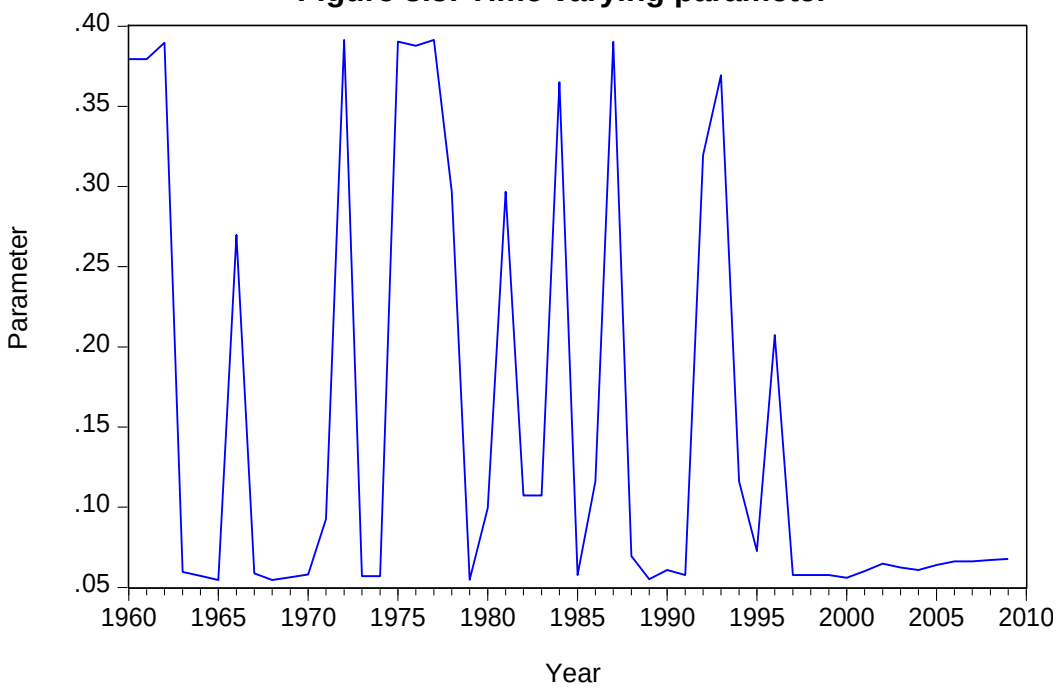
The parameter γ which determines the smoothness of the transition regime is set at 10; and the threshold (C) is estimated to be at 0.0402. The transition variable is denoted by the fiscal balance with a negative value indicating a budget deficit. Exp denotes an exponential function. The delay variable (d) is estimated to be at 6 quarters i.e. one – and - a - half years. This study follows Granger and Teräsvirta (1993) and Teräsvirta (1994) in making γ dimension-free by dividing it by the standard deviation of σU_{t-d}. As the surplus grows larger, i.e. $U_{t-d} \rightarrow \infty$, the transition function equals one ($F \rightarrow 1$); whilst as the budget deficit grows increasingly larger i.e. $U_{t-d} \rightarrow -\infty$, the transition function equals zero ($F \rightarrow 0$). When $F \rightarrow 0$ implying (1- F) = 1, i.e. for a large budget deficit regime, the relevant parameters are a summation over α and β. Figure 3.4 shows that the transition function fluctuates between zero and one during the sample period. Thus, the changes in the dependent variable i.e. the tax revenues-to-GDP are in effect non-linear.

Figure 3.4: Transition Function against Time



The non-linear impact of expenditure-to-GDP on revenue-to-GDP is also illustrated in Figure 3.5. The plot is calculated as: $\rho_t = \theta_t \alpha_t + (1-\theta_t)(\alpha_t + \beta_t)$. Where θ_t is the transition function and α_t and β_t are estimated parameters. It is observed in Figure 3.5 that in periods when the budget deficit exceeds the threshold, ρ increases to almost 0.40 as the parameter on expenditure-GDP switches from α_t to $(\alpha_t + \beta_t)$.

Figure 3.5: Time varying parameter



The results from estimating model equation (3.8) are presented in Table 3.9. In the Table, columns 3 and 4 report the non-linear least square estimates of the models. Tests of the residuals show no residual autocorrelation, no serial correlation, no non-normality of residuals and, finally, no heteroscedasticity. The Akaike information criterion shows that the non-linear model (i.e. model 3) is a better fit than the linear model. The error-correction terms are of the expected signs and statistically significant and show that the adjustment process to equilibrium is faster when the government budget is in deficit than in surplus.

In short, government is likely to react quicker when the budget deficit exceeds 4.02% of GDP, since it will raise concern about the achievement of fiscal sustainability. The one – and – a - half-year reaction delay (i.e. d = 6) combined with a relatively smooth switch from one regime to the other $(\gamma = 10)$) can be explained in terms of the political-institutional processes (Cipollini, 2001). Fiscal laws and regulations are drafted through a budget document and tabled to Parliament for approval before implementation, a process that could be time consuming.

Table 3.9 further shows that an increase in the government budget deficit (i.e. the transition variable) beyond 4.02% implies variation in the transition function that is larger (i.e. a stronger policy maker reaction) than when the deficit is below the estimated threshold, showing that in this phase the South African government becomes more concerned about solvency or fiscal sustainability.

Table 3.9: Model Estimates (1960:Q1- 2010:Q4)

Parameter	Linear model		Non-linear (General)		Non-linear (Specific)	
α_0	0.002	(0.005)	0.009	(0.008)	0.006	(0.008)
α_1	-0.279***	(0.079)	-0.424***	(0.109)	-0.433***	(0.079)
α_2	0.509***	(0.168)	0.507***	(0.188)	0.542***	(0.169)
α_3	0.232***	(0.063)	0.334***	(0.089)	0.297***	(0.067)
α_4	0.194**	(0.061)	0.154**	(0.075)	0.173 ***	(0.059)
α_5	0.153**	(0.059)	0.136*	(0.078)	0.093**	(0.046)
α_6	-0.082**	(0.041)	-0.132**	(0.056)	-0.108**	(0.054)
α_7	-0.086	(0.065)	0.023	(0.075)		
α_8	-0.213***	(0.054)	-0.253***	(0.079)	-0.127*	(0.066)
α_9	-0.214***	(0.061)	-0.165**	(0.077)	-0.135**	(0.068)
β_0			-0.058***	(0.021)	-0.058***	(0.019)
β_1			0.399**	(0.171)	-0.326***	(0.121)
β_2			-0.073	(0.151)		
β_3			-0.111	(0.142)		
β_4			0.126	(0.131)		
β_5			0.103	(0.135)	0.253**	(0.087)
β_6			0.148*	(0.089)	0.138*	(0.078)
β_7			0.018	(0.112)		
β_8			-0.131	(0.144)	-0.269**	(0.125)
β_9			-0.342 **	(0.144)	-0.277**	(0.122)
$\alpha_5+\beta_5$			0.239**	(0.112)	0.346***	(0.127)
$\alpha_9+\beta_9$			-0.507***	(0.147)	-0.412***	(0.111)
τ			-0.0401		-0.0401	
γ			10		10	
Adjusted R^2	0.90		0.90		0.92	
T	195		195		195	
AIC	-2.35		-2.34		-2.37	
ARCH	[0.0066]		[0.52]		[0.30]	
LM (lag 4)	[0.001]		[0.108]		[0.402]	

Note: *(**)(***) denotes significance at 10, 5 and 1% respectively; T is the number of observations, ARCH- Autoregressive conditional heteroscedasticity, AIC-Akaike info criterion are probability values. The Delta method is used to calculate the standard errors of $(\alpha_5+\beta_5)$ and $(\alpha_9+\beta_9)$

3.6 Summary and Conclusion

This Chapter uses the government inter-temporal budget constraint approach to investigate the sustainability of fiscal policy in South Africa. The approach is complemented by the fiscal reaction function which tests the asymmetry relationship

between revenue and expenditure, estimating the threshold at which fiscal authorities are likely to react quicker in enhancing fiscal solvency. It uses quarterly data on South Africa from 1960:q1 to 2010: q4.

The findings of this study suggest that fiscal policy over the sample period has been sustainable and that fiscal authorities in South Africa are more likely to react quicker when the budget exceeds the threshold of 4.02% of GDP. However, the stabilisation measures used by the authorities are fairly neutral at deficit levels below this ratio; that is, at deficit levels of 4.02% of GDP and below. The fiscal reaction of the government (increasing the tax burden to bring the large deficit level to a band of tolerable values) indicates that fiscal authorities in South Africa are more concerned about solvency. Thus, on the basis of this historical fiscal stance it can be expected that fiscal policy will remain sustainable in the medium-term and that the government's projection to reduce the fiscal deficit from a high 5.3% of GDP in 2010 to 3.0% in 2015 (see Section 3.2) is plausible. In South Africa the main fiscal challenge, therefore, is to find ways through which the recent gains in fiscal solvency are not at the expense of the future revenue base. The next Chapter, therefore, investigates how the revenue base could be protected in order to maintain fiscal sustainability. In particular, leakages from the revenue base via "shadow" economic activities are considered.

CHAPTER FOUR: TAX STRUCTURES TO PROTECT THE REVENUE BASE FROM SHADOW LEAKAGES

4.1 Introduction

The discussion in Chapter 1 shows that fiscal sustainability is affected by the revenue side of the budget as well as by expenditure obligations. On the revenue side of the budget, the level of the tax rate is linked to the protection of the tax base i.e. the higher taxes are the greater is the risk to the base or the smaller is the base. Thus, among the issues discussed in this Chapter is the determination of a tax rate at which the propensity to evade or avoid tax begins to accelerate.

Consistent with the "economics of crime framework" this study focuses on testing the relationship between the tax burden and the shadow economy. Given that there is no reliable time series data on the shadow economy in South Africa, it is attempted to generate such a series. This series is also used to test the hypothesis that the response of the shadow economy to increases in the effective tax burden is symmetric with the corresponding response to decreases in taxes.

The findings indicate that on average, the size of the South African shadow economy amounts to about 22% of GDP with estimated tax revenue evaded at about 7% of GDP. Results from the analysis reject the hypothesis that the response of the shadow economy to increases in the tax burden is symmetric with the corresponding response to decreases in taxes and that businesses and individuals are likely to react quicker when the tax burden changes fall outside the band of -3.64% to +2.13% of GDP but remains neutral as long as they are within this band. The implication of this finding is that any attempt by the fiscal authorities to increase the tax burden above the estimated threshold of 2.13% in order to close the budget

deficit will trigger a significant response from the shadow economy thereby reducing the tax base and contribute to a further worsening of the fiscal deficit.

The Chapter is divided into six sections. Following the introduction, Section 4.2 discusses the background to the study. Section 4.3 considers the methodology adopted to estimate the shadow economy. Section 4.4 investigates the specification and estimation procedures adopted for both the shadow economy and its relationship with the effective tax rate. Section 4.5 presents the estimation results and Section 4.6 concludes with a discussion of some policy implications.

4.2 Background

After the recent economic crisis public budgets of most countries have moved into higher deficit levels calling for higher taxes or other public sector revenues to address the resultant debt financing challenges. In this regard the protection and even expansion of the revenue base becomes an issue of paramount importance and the most obvious way to achieve this would be an increase in taxes. However, the analysis in Section 1.3 have shown that the tax burden in South Africa is already high when compared to other countries with a similar level of income and the rest of the world's average. A high tax burden might also lead to a proliferation of shadow economic activities which is a major threat to the revenue base of developing countries like South Africa. Some of the unrecorded activities are however "informal" because of the small scale and temporary nature thereof but some are unrecorded because of illegal activities and dedicated attempts to "stay below the radar" to evade tax obligations. A large shadow economy may lead to an erosion of the tax base, a decrease in tax receipts and thus to a further increase in the budget deficit. Several studies in the literature have explored the effects of the shadow economy. In

these studies the presence of shadow economic activities affects both the level and the cyclicality of fiscal policy (Cicek and Elgin, 2011:725-737); provision of social security, labour force participation behavior (Schneider and Enste, 2000:77-114); magnitude of business cycles (Elgin, 2012); and total factor productivity (D'Erasmo and Moscoso-Boedo, 2012). These growing concerns have led many economists to the challenging task of measuring the size and growth rate of the shadow economy, to trace back the main causes of it and to analyse the interactions of the official and unofficial economies (Neck, *et al*. 2010).

The discussions in Section 1.3 reveal that since the new era, in particular between 2000 and 2010, the fiscal authorities in South Africa focussed on the reduction and stabilisation of the tax burden resulting from major taxes as well as minimising the complexity in tax administration by reducing the number of tax brackets. Despite such efforts the wedge between the statutory rates and the realised average tax rates for the three main taxes is a concern for the protection of the revenue base. The wedge between the statutory rates and the realised average tax rates may emanate from tax exemptions, tax avoidance or tax evasion. This study focuses on the wedge due to tax evasion since tax exemptions often have legislative support and are therefore legal; but more importantly, activities in the shadow economy pose a serious threat to both fiscal and monetary policies and reduce the public support for the philosophy of "voluntary compliance" which is the basis for the stability of the tax system (Giles, 2001:1857-1867).

A good number of theoretical models as well as empirical research (as shown in Section 2.3) confirm the relationship between the tax burden and the amount of tax evasion, or the size of the shadow economy. What has not been investigated in

almost all of these studies, with the exception of a few (Giles, Werkneh and Johnson 2001), is whether this relationship is symmetric. In South Africa, this maybe the first study testing an asymmetric relationship between the shadow economy and the tax burden. The possibility of an asymmetric response of shadow income to changes in the effective tax rate is of considerable interest as it will assist in evaluating the extent to which the revenue base can be protected by means of tax policy or administrative changes (Giles, *et al.* 2001).

This study is not only concerned with the growth of the shadow economy as such, but principally with the broad nature of the linkage between the relative size of the shadow economy and the relative tax burden. This Chapter, therefore, deals with the shadow economy in South Africa and the extent to which its relative size can be affected by the overall 'tax burden', as measured by the aggregate effective tax rate.[31]

4.3 Modelling and estimating the Shadow Economy

4.3.1 Introduction

There is a voluminous literature on estimating the size of the shadow economy and comprehensive surveys in this regard have been undertaken such as those by Schneider and Enste (2000) and Feld and Schneider (2010). Essentially, much of this debate has arisen as a result of quite different definitions of the shadow economy being used by different authors. Some authors define it to relate only to

[31] Defined as the ratio of total tax revenue-to-GDP, consistent with Giles and Caragata (2001:1857-1867); Giles, Werkneh and Johnson (2001:148-159). This study uses an aggregate effective tax rate since a single tax rate measure is required. It is also widely used in the literature for international comparison of the tax burden. It is however acknowledged that this measure has its limitations and it must be recognised that fluctuations in its value reflect more than just changes in tax policy and statutory rates.

legally-based transactions that are covered by, but omitted from GDP (or some other official output measure). For others, the shadow economy can be defined in terms of all transactions (*legally-based or illegally based*) that generate unrecorded income (Schneider & Easte, 2000). In this study the shadow economy is defined as all economic activities which would generally be taxable if they were reported to the tax authorities. The methods most often used to estimate the underground or shadow economy are classified into direct or indirect approaches, each having its own strengths and weaknesses.

4.3.2 Estimating the shadow economy

a) Direct Methods

Direct methods are based on contacts with or observations from persons and/or firms, to elicit direct information about non-declared income. These include auditing of tax returns and questionnaire surveys.

Firstly, the tax audits approach. The idea is that information on the shadow economy can be elicited from the differences between the income submitted for tax purposes and that which is calculated by the tax auditors. Threats of fines and imprisonment compel participants to reveal their hidden income. There are, however, a few difficulties with this method. Firstly, estimates based on this technique do not provide complete information about the size of the informal economy and these results tend to be biased. Further, the data that is used (i.e. tax compliance data) may itself be a biased sample of the population (Greenidge, Holder and Mayers, 2009).

The second direct method involves a sample survey. Useful information about the size and structure of the informal economy can be derived from structured interviews. However, the results obtained from this process depend on the structure of the questionnaire. A questionnaire that is poorly formulated does not induce individuals to reveal their participation in the hidden economy and cooperate with the survey. This unwillingness can lead to unreliable results.

b) Indirect Methods

Indirect methods attempt to determine the size of the shadow economy by measuring the traces it leaves in the official statistics. They are often called indicator approaches and use mainly macroeconomic data (Dell and Schneider, 2003).

The first indirect method requires analysing the discrepancy between national expenditure and income statistics to draw inference about the size of the shadow economy (Schneider and Enste, 2000). The idea is that in the presence of shadow activities, the income measure of national income will not be equal to the expenditure measure and therefore the surplus of expenditure over income is an indicator of the shadow economy.[32] The problem with this method is that the difference between the two aggregates can actually be due to error and omission terms and, as such, would make the estimates unreliable.

Another approach considers labour as an input factor for both the shadow and the legal economies, whereby changes in the labour force indicate the dynamics of the former. The weakness of this accounting method as stated by Schneider and Enste

[32] In published Quarterly Bulletins, such as the South African Reserve Bank Quarterly Bulletin, the two measures are equal because shadow activity is already discounted (provided for) in the relevant accounts.

(2002) is that it does not allow for changes in the labour force that are inherent and independent from the shadow activities sector. Therefore, an ageing population might reflect a lower share of workers to total population without implying a proportional increase of the shadow economy. In addition, illegal migrants and other social groups not working in the legal sector might have a significant impact on the measurements.

The third approach is measuring electricity consumption. The gist of this approach is that because the electricity-to-GDP elasticity has been observed to be close to one the growth rate of the official GDP can be subtracted from the growth rate of electricity consumption (Kaufmann, 1996). The difference in value is attributed to growth of the shadow economy. The criticism by Schneider and Enste (2002) on this model is that it can neither account for exogenous changes in electricity use, nor can it capture the interpersonal unaccounted trade that makes little use of capital. These critics also argue that indexing countries according to the electricity/GDP ratio and using an estimation of the shadow economy in one base country to compute the shadow economies of the other countries in the sample, assumes constant (and possibly important) country and culture specific factors.

The fourth approach, which is model based, is referred to as the MIMIC model. It brings together expected causes and effects (or indicators) of the underground sector. There are two parts to this model: a measurement model, linking the observed indicators to the size of the shadow; and a structural equations model, specifying causal relationships among the observed indicators. The underlying idea is that the measurements of both the causal indicator variables can be used in a time

frame to infer the movements of the intermediate or middle value (the unobserved size of the shadow economy) which is then reported as a percentage of GDP (Dell'Anno and Schneider, 2003). This method, although seemingly more complex is heavily criticized by Breuch (2005a) who argues that it is vague in its specification, sensitive to the units of measurement and hard to reproduce (hence possibly subjective). Breuch (2005a) also argues that the MIMIC model relies too much on the public's interest in large estimations. Moreover, the MIMIC model measures only the change in the size of the shadow economy and not its actual size. This means that estimations from another source are needed for the base year; a weakness which is outlined by Schneider and Enste (2002) as a critique on Tanzi's currency demand model.[33]

Finally, the monetarist approach developed by Feige (1979) and Tanzi (1983) attempts to estimate the size of the US economy from the perspective of payments and transactions. The monetarist approach assumes the aggregate money supply to be a good indicator of the size of the real economy and makes estimations based on the Fisher $MV = PT$ equation. This equation holds that money (M), times velocity (V) equals the price level (P) times the level of transactions (T) in an economy. Tanzi (1983) uses the constructed aggregate money demand of Feige (1979) and compares it to the recorded money supply. He suggests that the overall excess of money supply is unrecorded money used in the shadow economy.

[33] The Tanzi model will be explained in the next paragraph.

In the rest of the Chapter the monetarist approached is followed to estimate the size of shadow economy in South Africa. The reason for following this approach will be explained but mostly relate to the critique on the other models discussed and the absence of official data on "shadow" economic activity in this country. In addition, the quality data on monetary flows available from the South African Reserve Bank rendered the Currency Demand Model to be more attractive for use in the analysis.

4.3.3 Currency Demand Model

4.3.3.1 Introduction

The Currency Demand Model by Tanzi (1983:283-305) adopted by Neck, *et al.* (2010); Greenidge, *et al.* (2009:197-227); Maurin, Sookram and Watson (2006:321-341); Thiessen (2004:295-318); Faal (2003): and Bajada (1999: 369-384) forms the basis for this analysis. The currency demand methodology assumes that there exists an "official" demand for money in the official economy and a "shadow" demand for money in the shadow economy. Tanzi captures unofficial currency demand by introducing income tax variables; hence, his model captures only those underground activities that result from income taxes. Although this method has limitations, like the other models reviewed, it remains one of the foremost tools to measure the growth of the shadow economy (Neck, *et al.* 2010). Ferwerda (2010) argues that it is the intuitive aspect of Tanzi's model that makes it attractive to both academics and the public at large especially as the relationship that the model encapsulates has proven to be resistant to a number of new econometric developments. In addition, three basic empirical propositions might justify the use of this model. First, the per capita amount of coins and notes[34] holding outside banks in South Africa remains high (see

[34] This series can be found in the South African Reserve Bank Quarterly Bulletin, series code 1000M.

Figure 4.1). The second empirical justification is that the lack of willingness to reveal too much information also excludes those involved in shadow activities from access to formal banking institutions. Thus, one can make reasonable inferences about transactions in this sector that are predominantly done through cash. Finally, as indicated before, it is difficult to measure the size of the "shadow" economy in South Africa due to the fact that this sector, which is mostly taxable, should not be mistaken as the whole of the unrecorded or informal sector. Therefore, the choice of model through which the size of this sector can be measured is largely determined by the availability of data and as a result it was decided to use the currency demand model since relevant data on financial flows is available from the South African Reserve Bank.

Tanzi (1983) examines the view of Cagan (1958) who argues that although cash does not pay interest, it is and will be used as a means to avoid paying taxes. As his interest was more on tax evasion, the Tanzi model (1983) reflects the ratio of cash to non-cash money supply as explained by the ratio of personal income tax to total adjusted income, the ratio of legal cash remuneration to total personal income, the interest rate and real income per capita.

Based on this model the long-run demand for currency equation can be written as:

$$LnC = \beta' Z + \theta T \qquad (4.1)$$

Where Z is the vector of all explanatory variables except the tax variable T; β is the associated vector of coefficients on Z and θ is the coefficient on T.

The estimated value of currency from equation 4.1 in year t is therefore:

$$\hat{C}_t = \exp(\hat{\beta} Z_t + \hat{\theta} T_t) \quad (4.2)$$

If taxation and by extension shadow economic activity remain at the same level (T_0) as in some base year, currency holdings in year t could be predicted as:

$$\hat{C}_t^* = \exp(\hat{\beta} Z_t + \theta T_t) \quad (4.3)$$

The change in currency demanded motivated by the change in taxation between the base year and year t is then computed as:

$$C_t^H = \hat{C}_t - \hat{C}_t^* \quad (4.4)$$

It should be stated that C_t^H is a measure of the increase in the amount of currency needed to fuel the shadow economy in excess of the amount already in use in this sector in the base year (Klovland, 1984).

Further, the average amount of income that can be supported by one rand of currency within a year is calculated, i.e. the income velocity of currency[35], V^H. Once this estimate is calculated, the income generated from the hidden economy is computed as:

$$Y_t^H = C_t^H \times V_t^H \quad (4.5)$$

4.3.3.2 Specification and estimation procedures

This Chapter modifies the Tanzi equation along the lines taken by Bajada (1999, 2002, 2005), Faal (2003) and Greenidge, *et al.* (2009) in estimating the shadow economy for South Africa. Tanzi's basic model relates the stock of currency demanded by the public (outside banks) to the broad money supply (M2), the volume of transactions in the regular economy and the interest rate as a measure of the

[35] This model assumes that income velocity of money in the informal economy is the same as in the formal economy, which has been criticised by Schneider and Enste (2002).

opportunity cost of holding currency. This is modified by using real currency per capita (Greenidge (2009); Faal (2003); Bajada (1999, 2002, 2005), and Klovland (1984)); and includes more possible causes of shadow economic activities in order to empirically test the hypothesis about the influence of the tax burden on the shadow economy. The functional form of the model estimated takes the form below:

$$C_t = f(TBR, ITR, YD, FINDEV, HHI, DUM) \qquad (4.6)$$

Where C_t is real currency per capita, YD is real disposable income per capita, TBR is the interest rate, FINDEV represents financial development, HHI is a concentration index which represents the complexity of the tax system. ITR is the effective direct tax rate. Currency demand is expressed in real per capita terms to eliminate the impact of inflation and population growth on the demand for currency (Greenidge, 2009; and Klovland, 1984). Disposable income is substituted for income since the excess sensitivity of taxes on currency is investigated. Taxes affect labour-leisure choices and stimulate the labour supply in the shadow economy consequently to greater use of cash (Rosen, 2008). The spread between the deposit and lending interest rates is used as a proxy for financial development.[36] The idea is that the more wealth an individual or firm hides, the less collateral he/she has to offer for securing a loan and the worse the terms and conditions are of the loan contract available (Bose, Capasso and Wurm, 2008). *A priori* one would expect that this deterioration in credit arrangements is more pronounced at the lower levels of financial development. Thus, at the lower stages of financial development, the incidence of tax evasion or the size of shadow income is higher with a resultant increase in currency in circulation.

[36] The lower the spread between the deposit and the lending rates the more developed is the financial system.

The Herfindahl index[37] (the sum of squares of revenue shares) is a measure of revenue-complexity (Schneider, *et al.* 2010; Schneider, 1994; Thieben, 2004; Clotfelter, 1983; Wagner, 1976). This index achieves its maximum value of unity if revenue is generated from a single source. A higher value of the index is thus associated with a less complex revenue system. Schneider (1994) and Neck, *et al.* (2010) argue that the effect of tax complexity is unambiguously negative because rising complexity provides more opportunities to avoid taxes legally and therefore hold more currency. Two dummy variables to capture the introduction of a microfinance programme in 2006[38] and the structural changes in 1994 are included in the model.

The analysis starts with an investigation of the time series properties of the data used as this can influence the estimation procedure chosen. Three different tests are done to determine the order of integration which are: the Augmented Dickey-Fuller (1981), the Kwiatowski, Phillips, Schmidst and Shin (1992) and the Phillips-Perron tests. The Dickey-Fuller and Phillips-Perron (1990) tests have, as their null hypothesis, that the dynamics of the respective series are characterized by a unit root. The Kwiatowski, Phillips, Schmidst and Shin (1992) test on the other hand is based on the null of stationarity. The use of three tests is justified since Perron (1989, 1997) and Zivot and Andrews (1992) have demonstrated that the Augmented Dickey-Fuller test has low power in the presence of a structural break.

[37] Tax exemptions could not be considered in this measure because they have only been calculated by the South African Revenue Service has only been available since the late 2000s.

[38] This dummy was dropped in the final model given that its relationship with currency holdings is highly insignificant.

Given that the variables are a combination of I(0) and I(1) the unrestricted error correction model employing a general-to-specific (GETs) modelling procedure is selected for estimation. The ARDL is being employed for cointegration analysis since it can be applied irrespective of whether the regressors are purely I(0), purely I (1), or mutually cointegrated (Pesaran, Shin and Smith, 2001:315). Greenidge (2009) also argues that the unrestricted error correction model minimises the possibility of estimating spurious relations whilst retaining long-run information at the same time.

Further, Krolzig (2001:831-866) Monte Carlo studies show that the GETs procedure is as good as, if not more appropriate than other cointegration techniques in dealing with small samples, even in the presence of I(1) variables. To apply the GETs procedure equation 4.6 is estimated in an unrestricted model with two lags (considered appropriate when dealing with annual data). The variables are progressively reduced by eliminating statistically insignificant coefficients and reformulating the lag structure where appropriate in terms of levels and differences to achieve orthogonality. The final parsimonious representation of the model is presented in equation 4.7:

$$\Delta \ln C_t = \alpha_0 + \alpha_1 \Delta \ln(ITR)_t + \alpha_2 \Delta(TBR)_t + \alpha_3 \Delta \ln(YD)_t + \alpha_4 \Delta \ln(HHI)_t + \alpha_5 \Delta \ln(FINDEV)_t + \beta_1 \ln(ITR)_{t-1} + \beta_2 (TBR)_{t-1} + \beta_3 \ln(YD)_{t-1} + \beta_4 \ln(C)_{t-1} + \beta_5 \ln(HHI)_{t-1} + \beta_6 (DumINST) \tag{4.7}$$

To derive estimates of the shadow economy equation 4.7 is expressed in terms of nominal currency holdings as shown in equation 4.8:

$$C_t^* = \exp(z_t + \alpha_1 \Delta \ln(ITR)_t + \beta_1 \ln(ITR)_{t-1} + \beta_4 \ln(C^*)_{t-1}) \tag{4.8}$$

Where C^* is the estimated nominal currency in the hands of the public, z_t is a matrix of all other explanatory variables in the model excluding the tax variables, which are:

the intercept, $\Delta(TBR)_t$, $\Delta\ln(YD)_t$, $\Delta\ln(HHI)_t$, $\Delta\ln(FINDEV)_t$, $(TBR)_{t-1}$, $\ln(YD)_{t-1}$, $\ln(C)_{t-1}$, $\ln(HHI)_{t-1}$ and $(DumINST)$. If $\alpha_1 = \beta_1 = 0$ then there is no excess sensitivity to taxes and thus no longer an incentive for persons to evade taxes by participating in the shadow economy. In the absence of the shadow economy, currency holdings will settle in its natural rate, which will be lower than C_t^* (Greenidge, 2009). Note that in transforming the Error Correction model from a model in changes in levels to a model in levels, it is assumed in this study that at the initial period (1965) the predicted natural logarithm of currency demand equals the actual natural logarithm of currency in circulation given that the errors are stationary and not big. Following Bajada (1999, 2002, and 2005) and adopted by Greenidge, (2009) the natural or legal level of currency demand is denoted as C_t^* where:

$$C_t^{**} = \exp(z_t + \beta_4 \ln(C^*)_{t-1}) \qquad (4.9)$$

Thus, the amount of currency in the hands of persons doing business in the shadow economy is the difference between total currency demand (4.8) and legal currency demand (4.9) or $H_t = C_t^* - C_t^{**}$. Assuming that the velocity of money in the shadow economy is the same as that of the formal economy the size of the shadow economy is estimated by $SH_t = H_t \times V_t$ and the velocity of observed net national income (Y_t) in legal currency (C_t^{**}) can be written as:

$$V_t = \frac{Y_t^*}{C_t^{**}} \qquad (4.10)$$

4.3.4 Estimating the response of the shadow economy to tax changes

In this section, the data generated from the currency demand model on the shadow economy is used to test the hypothesis that the response of shadow income to increases in taxes is symmetric with a corresponding response to decreases in

taxes. In general, the objective of this section is to measure the aggregate response of shadow economic activity to changes in the overall 'tax burden', as measured by the aggregate effective tax rate (i.e. ratio of total tax revenue/GDP). *A priori,* an increase in the tax burden will lead to an increase in shadow economic activity but the relationship is not symmetric. Moving forward, the parametric test for linearity follows Teräsvirta (1994) who suggests a method of approximating the transition function by a Taylor expansion about the null of linearity, $\gamma = 0$.[39]

4.3.4.1 Data discussion or properties

This section describes the properties of the data used for computing the shadow economy and establishing the relationship between the shadow economy and changes in effective direct tax rates in South Africa.

a) Data for estimating the Shadow Economy

In the estimation of the currency demand model for South Africa annual data for the period 1965 to 2010 is used reflecting the currency and coins in circulation per capita (see Figure 4.1). Other variables used in the model include: the Treasury bill rate, the effective income tax rate and disposable income, Herfindal Index, and Financial Development. The data have been obtained from Quarterly Bulletins published by the South African Reserve Bank. This data source, however, is complimented by annual data from the International Financial Statistics (IFS) published by the International Monetary Fund. In addition, data had to be computed for some variables (HHI and FINDEV) based on published data. All the variables with the exception of the interest rate series have been converted into their natural

[39] Refer to Chapter 3, equation 3.3b for a detailed explanation of the method.

logarithmic form. Table 4.1 presents a comprehensive overview of the variables, definitions and data sources.

Figure 4.1: Per capita notes and coins in circulation

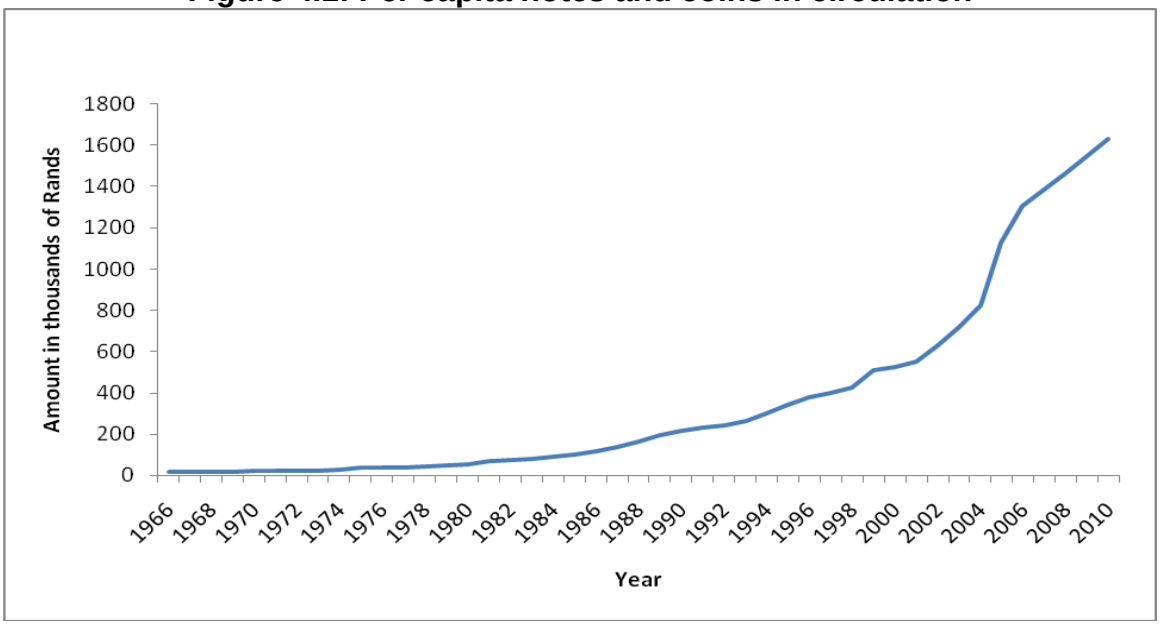


Table 4.2 shows that the real currency in circulation, real disposable income (YD), ITR and the financial development variables are integrated of order one I(1), and this is supported by all three tests carried out (i.e. KPSS, PP and ADF tests). As discussed in Section 3.31, the Dickey-Fuller and Phillips-Perron tests have as their null hypothesis that the dynamics of the respective series are characterised by a unit root, whilst the Kwiatowski, Phillips, Schmidst and Shin test is based on the null of stationarity. There is some ambiguity with the Treasury bill rate though. Whilst the ADF and PP tests support I(1) for the Herfindahl index, the KPSS test shows it is I(0). Furthermore, the KPSS null test of stationarity for the Herfindahl index and Financial Development variables can only be weakly rejected at 10% levels of significance.

Table 4.1: Description of the variables and sources

Variables	Description
Real currency per capita (C)	Stock of coins and notes in the hands of the public deflated by the GDP deflator and expressed as a ratio of the population
Real disposable income per capita (YD)	Nominal GDP less taxes on income and wealth, deflated by the GDP deflator and expressed as a ratio of the economically active population
Interest rate (TBR)	Treasury Bill rate
Effective Income Tax rate (ITR)	Direct taxes on income and wealth expressed as a percentage of GDP
Shadow Income (SH)	Own calculation using the Currency Demand Model
Financial development (FINDEV)	Ratio of bank lending and deposit rates i.e. interest rate spread
Effective total tax revenue (TTR)	Ratio of total tax revenue to GDP
Herfindahl index (HHI)	Sum of squares of revenue shares- measure of the complexity of the tax structure $(\sum_{i}^{n} r_i)$

Source: South African Reserve Bank (http://www.reservebank.co.za); and own calculation.

Table 4.2: Unit Roots Tests

Panel A: in Levels	ADF	PP	KPSS
HHI	-0.40 [0.53]	-0.42 [0.52]	0.15
C	1.14 [0.22]	-1.15 [0.23]	0.57**
YD	0.83 [0.89]	-2.76 [0.23]	0.15**
ITR	1.31 [0.94]	3.11 [0.96]	0.84***
TBR	-2.66 [0.09]	-2.05 [0.26]	0.38*
SH	-0.65 [0.43]	-0.43 [0.53]	0.80**
FINDEV	0.42 [0.80]	0.13 [0.72]	0.35*
TTR	1.12 [0.93]	1.65 [0.97]	0.78***
Panel B: First difference			
ΔHHI	-6.91***[0.00]	-6.91*** [0.00]	0.10
ΔC	-5.32***[0.00]	-5.32*** [0.00]	0.08
ΔYD	-6.25***[0.00]	-8.14*** [0.00]	0.14
ΔITR	-7.26***[0.00]	-7.34*** [0.00]	0.20
ΔTBR	-5.82***[0.00]	-5.47*** [0.00]	0.28
ΔSH	-7.33***[0.00]	-9.26*** [0.00]	0.09
ΔFINDEV	-5.65***[0.00]	-6.96*** [0.00]	0.22
ΔTTR	-5.84***[0.00]	-5.81*** [0.00]	0.31

Note *(**)(***) denotes significance at 10, 5, and 1% levels respectively. [ ] are probability values.

b) Data for estimating the shadow income and tax changes

Data for the shadow economy (SH/GDP) series is generated (Figure 4.2) using the currency demand model since, as explained already, no universally agreed series is available on the size of shadow income in South Africa. The overall tax burden, measured by the aggregate effective tax rate (Figure 4.3) is used to measure the response of shadow activity to changes in the tax rates. As stated earlier, it should be acknowledged that the effective tax measure in this study has its limitations since fluctuations in its value reflect more than just changes in tax policy and statutory rates. Whilst little can be done to deal with these issues, this should be kept in mind when interpreting the results of this study. Like Giles, *et al.* (2001) this study will be considering the response of the (relative) size of the shadow economy to *perceived* increases and decreases in the overall tax burden in the economy, rather than to actual changes in tax policy.

Like other variables in the text, the time series properties of the generated series are also tested using the ADF, PP and KPSS methods as shown in Table 4.2. After establishing the time series properties of these new variables (SH/GDP, TTR/GDP), a cointegration relationship between the series is tested using the residual-based test via the two-step procedure of Engle and Granger (1987). However, to test the robustness of the Engle-Granger test this study also uses the Johansen and Juselius (1990) cointegration test.

Figure 4.2: Trends in shadow income/GDP

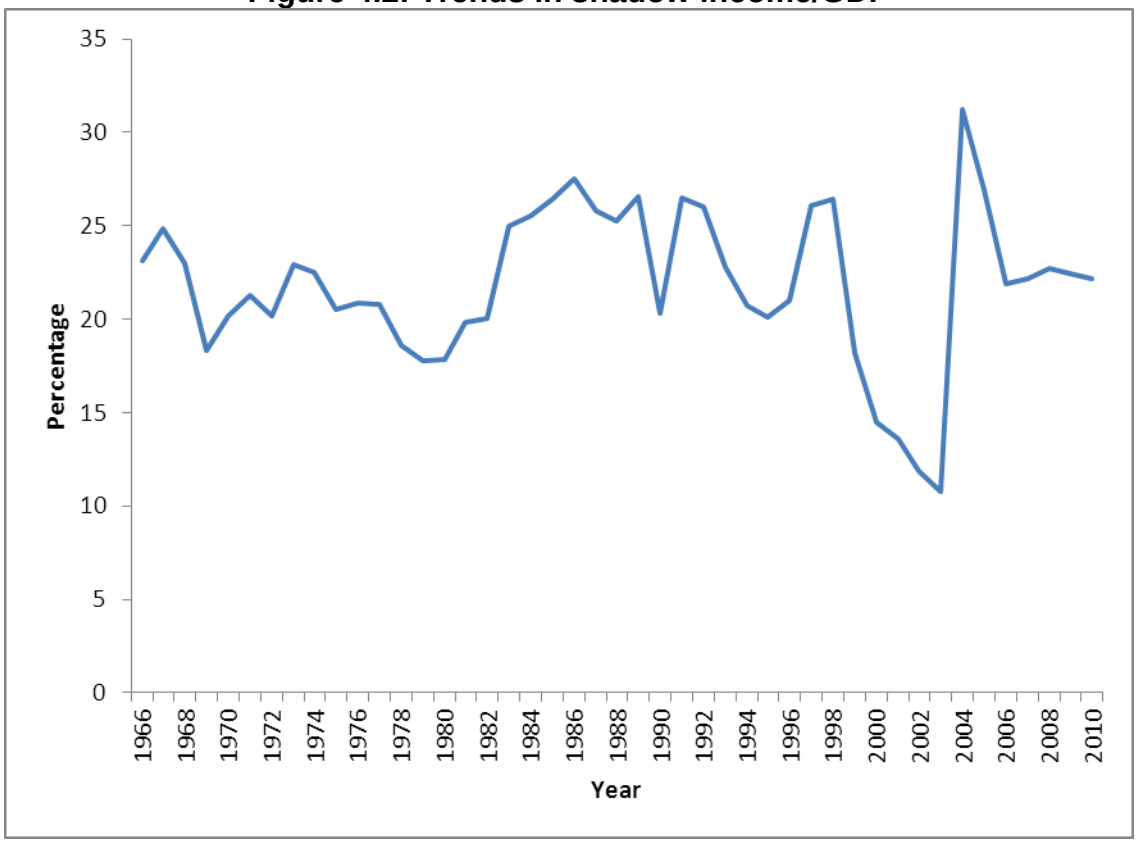
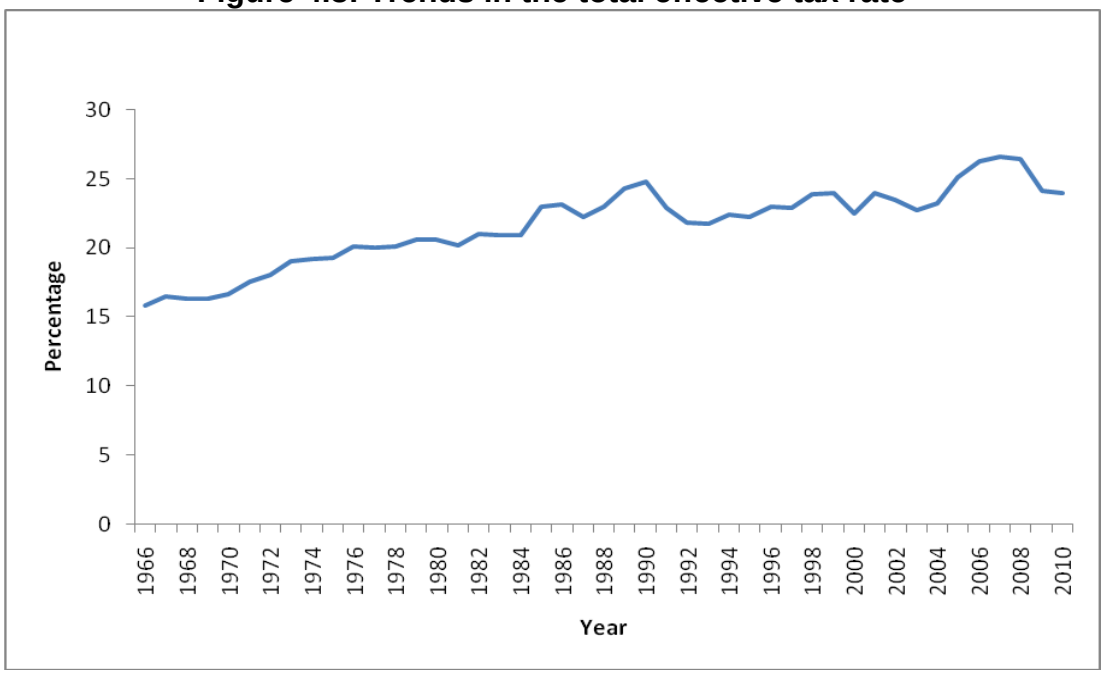


Figure 4.3: Trends in the total effective tax rate



4.3.5 Estimation results of the Currency Demand equation

This Section presents the estimated results for the currency demand equation (4.7). Table 4.3a indicates that all the variables in the final model (equation 4.7) are

correctly signed. In terms of the diagnostic tests the model is well behaved. The residuals do not suffer from non-normality, heteroscedasticity and serious problems with serial correlation. The ADF(r) statistic shows that the variables in the currency demand equation are cointegrated. An endogeneity test is conducted between real currency per capita, real disposable income, the tax rate, a financial development index, and a tax complexity index. To do this an auxiliary regression is run of the form: $\Delta \ln x = \alpha_0 + \sum_{t=1}^{p} \Delta \ln(x)_{t-1} + \sum_{t=1}^{p} \Delta \ln(c)_{t-1}$ for each of the variables of interest. The predicted values are then included in the unrestricted error correction model. An insignificant t-statistics suggest that endogeneity is not a problem and the estimates are consistent. The results are contained in Table 4.4 and show no serious evidence of endogeneity among all the variables of interest.

The coefficient on the effective income tax rate is positive indicating that an increase in the tax burden induces a higher demand for currency, consistent with Tanzi's postulate. According to the results (Tables 4.3a and 4.3b), a one percentage point increase in the average direct effective tax rate results in a 0.32% point increase in currency demand in the short run and a steady-state effect of 0.46% points. The coefficient on disposable income indicates that expansions in income increase the use of currency with a higher short run response of 0.54%, but a lower long-run elasticity of 0.30% points. The coefficient on interest rates shows a negative effect on real currency demand with a long-run elasticity of -0.32% points which is consistent with the view that it represents the opportunity cost of holding money. Thus the higher the cost of holding currency as represented by a higher Treasury bill rate, the lower the amount of money held by individuals and firms. The coefficient for financial development (-0.18%) is also consistent with the expectation that an

improvement in the financial system, represented by a higher deposit and lending rate ratio or lower spread between the two rates, will result in a smaller holding of currency.

The coefficient on tax complexity indicates that the short-run response (-0.083%) to currency holdings due to tax complexity is not significant; however, the response rate (-0.48%) is highly significant in the long-run (Table 4.3b). This result supports Neck, *et al.* (2010) and Schneider and Neck (1993) in that the more complex the tax system, the more likely shadow economic activities will occur in the economy. However, the empirical results show that the relationship is only significant in the long-run. This long-run relationship between the two variables seems to support the fiscal illusion hypothesis, which states that the more complicated the tax revenue system, the more difficult it is for taxpayers to determine the 'tax price' of public outputs and the more likely it is that they will underestimate the tax burden associated with such programmes (Schneider and Neck, 1993; Neck, *et al*. 2010). However, as Oates (1975) states, fiscal illusion (or at least tax illusion) by its very nature can only operate over a limited range. Certain kinds of taxes may remain hidden while they absorb relatively modest fractions of personal income, but as they constitute larger chunks of income, they become progressively harder to hide and thus triggers a higher response.

Table 4.3a: Unrestricted Error Correction Model Estimates

Variable	Coefficient	Std. Error	t-Statistics	Prob. value
α_0	0.0629	0.161	0.390	0.592
α_1	0.324	0.104	3.115	0.004
α_2	-0.166	0.087	-1.908	0.055
α_3	0.536	0.198	2.712	0.012
α_4	-0.084	0.121	-0.694	0.494
α_5	-0.181	0.084	-2.155	0.038
α_6	0.138	0.122	1.131	0.270
β_1	0.212	0.107	1.981	0.043
β_2	-0.149	0.047	-3.170	0.003
β_3	0.139	0.239	0.581	0.565
β_4	-0.463	0.094	-4.901	0.000
β_5	-0.220	0.110	-2.000	0.042
β_6	-0.054	0.034	-1.588	0.115
$\overline{R}^2$	0.61	ARCH	[0.34]	
JB	[0.40]	DW	1.82	
LM(lag 2)	[0.09]	AIC	-3.87	
S.E. Regression	0.031	SC	-3.30	
		ADF(r)	-7.205 [0.00]	

JB is Jargue-Bera Test, ARCH (Autoregressive Conditional Heteroscedasticity), AIC (Akaike info criterion), DW (Durbin Watson stat. ADF-Augmented Dickey Fuller Unit Root test), and [ ] are probability values.

Table 4.3b: Long-run elasticities (Long-run response of real currency per capita with respect to): [40]

Variable	Coefficient
Real Disposable Income	0.30
Treasury Bill rate	- 0.32
Average effective Income Tax Rate	0.46
Tax Complexity Index (HHI)	-0.48

[40] The long-run parameter is obtained by using $\theta = \frac{\beta_i}{\beta_4}$; where i = 1 …….6. See Bajada (1999, 2001, 2002); Greenidge, *et al*. (2009); Pesaran, *et al*. (2001).

Table 4.4: Endogeneity Test

Variable	Coefficient	Standard error	t-statistics	Prob. Value
ΔITR	0.16	0.334	0.479	0.626
ΔYD	1.618	1.524	1.062	0.296
ΔTBR	-0.121	0.080	-1.507	0.141
ΔFINDEV	-0.116	0.081	-1.434	0.161
ΔHHI	0.429	0.384	-1.115	0.273

Table 4.5 shows that shadow income as a percentage of GDP had increased since 1966, reaching a high 27.54% in 1986, but then declined reaching a minimum of 10.74% in 2003. However, in 2004 there was sharp increase to 31.23% but it slightly declined again to 26.89% in the following year. From 2007 to 2010, the shadow economy averaged 22.39% and in 2010 it amounted to 22.18%. It should be noted that the series generated in this study is lower when compared to those generated by Schneider (2007) and Elgin and Oztunali (2012) for similar periods in South Africa. For instance, using the MIMIC model, Schneider estimates an average of 27.94% for shadow income in South Africa between 2000 and 2004 , Elgin and Oztunali (using a two sector dynamic general equilibrium model) estimate it to be 26.80% whilst the findings in this study estimate the size to be 16.39% for the same period. Similarly, for 2008, Elgin and Oztunali estimate an average shadow income of 24.87% for South Africa whilst for the same period; this study estimates the percentage to be 22.75%. These differences could be due to differences in model specification and the definition of the term shadow economy. As stated earlier, this study uses the ARDL model with the effective income tax rate as one of the explanatory variables of currency holding because of the lack of comprehensive time series data on the marginal tax rate. However, it should be acknowledged that marginal rates are more appropriate since an agent's decision to work in the underground economy is more likely to be affected at the margin. Although average

tax rates may be a crude substitute, it is expected that the use of average tax rates produce similar results to what marginal tax rates would have produced had it been available (Bajada, 1999).

With regards to definitional issues, Oztunali (2012) includes both shadow and informal[41] as part of his model (i.e. a much broader definition) thus generating higher values for this sector. Schneider (2006) on the other hand defines the shadow economy as all economic activities which would generally be taxable if they were reported to the state (tax) authorities and uses the Dynamic Multiple Indicator Multiple Causes approach to generate the series. This method, as already discussed in the previous section, is criticised by Breusch (2005) as vague in its specification, sensitive to the units of measurement and relies on estimates from another source for the base year.

This study modifies the Tanzi equation along the lines taken by Bajada (1999, 2002, 2005), Faal (2003) and Greenidge (2009) and therefore captures shadow currency demand by introducing effective income tax variables. The study captures only those shadow activities that are the result of income taxes. In short, this study gives a narrower definition of shadow economy to include all market-based production of goods and services that are deliberately concealed from government to avoid payment of income taxes.

[41] Informal sector activities occur due to the small scale and temporary nature of the business, labour restrictions and because of illegal activities, whilst shadow economic activities are due mainly to tax evasion. Small scale business below the tax threshold (though engaged in informal activities) is excluded from the definition of shadow economic activities.

Table 4.5: Shadow Income to GDP ratio

Year	Shadow Income (Rm)	GDP (Rm)	Shadow income/GDP
1965	0	7859	0
1966	1984	8568	23.16
1967	2376	9559	24.86
1968	2380	10340	23.02
1969	2136	11654	18.33
1970	2577	12791	20.15
1971	3004	14136	21.25
1972	3216	15953	20.16
1973	4522	19740	22.91
1974	5465	24277	22.51
1975	5598	27323	20.49
1976	6432	30848	20.85
1977	7126	34261	20.80
1978	7323	39416	18.58
1979	8356	47100	17.74
1980	11210	62730	17.87
1981	14422	72654	19.85
1982	16534	82462	20.05
1983	23597	94350	25.01
1984	28232	110584	25.53
1985	33686	127598	26.40
1986	41143	149395	27.54
1987	45076	174647	25.81
1988	53011	209613	25.29
1989	66795	251676	26.54
1990	58862	289816	20.31
1991	87942	331980	26.49
1992	96927	372225	26.04
1993	97030	426133	22.77
1994	99992	482120	20.74
1995	110058	548100	20.08
1996	129956	617954	21.03
1997	179044	685730	26.11
1998	196000	742424	26.41
1999	148009	813683	18.19
2000	133711	922148	14.50
2001	138823	1020007	13.61
2002	139242	1171086	11.89
2003	136670	1272537	10.74
2004	441990	1415273	31.23
2005	422464	1571082	26.89
2006	386889	1767422	21.89
2007	446984	2016166	22.17
2008	517367	2274139	22.75
2009	538135	2395969	22.46
2010	590600	2662757	22.18

Source: www.reservebank.co.za and author's computation

The Currency Demand model is also not free from criticism; key among which are the choice of a base year and the tendency of such a model to underestimate the shadow income. The Currency Demand model assumes that the share of currency in the money supply in a base year represents 'normal' behaviour; therefore any deviations from this ratio are then used to gauge the size of the shadow economy. This study selects the first year in the time series as the base year since it is difficult to identify any specific year with no shadow economic activity in South Africa. The choice of base year is one of the criticisms of the Currency Demand model.

Despite these limitations in the use of the Currency Demand model, the series generated by this study is consistent with tax policy changes in South Africa. For instance, the period beginning in the early 1980s and ending with the transition to a new constitution and political environment (1994) was marked by increased government expenditures and taxation, with the average statutory PIT rate reaching 35% and CIT (50%) in 1986 (Section 1.3). Since 1994, the democratic government has embarked on major fiscal reforms, ranging from institutional to the rationalisation and harmonisation of its tax rates and brackets (see Section 1.3. for detail on tax reform changes in South Africa), hence the relative decline in shadow income except for a spike in 2004 which could have been due to data error. Taking the average effective tax rate, the estimated shadow income (loss in taxable income) would have generated an additional tax revenue of 6.9% of GDP in 2010 which incidentally is higher than the fiscal balance of -4.8% for the same period and more than twice the medium-term estimate of 3.0%. Intuitively, although the different methods[42] and

[42] As discussed in Section 4.3, there is no 'best' or commonly accepted method; each approach has its specific strengths and weaknesses as well as specific insights and results.

studies provide a rather wide range of estimates, there is a common finding namely that the size of the shadow economy in South Africa should not be underestimated.

4.3.6 Linear estimation techniques

In Table 4.2 the time series properties of both shadow economy/GDP and the total tax revenue/GDP series are investigated. The results show that both series are I(1), and hence are non-stationary. The cointegration relationship between the series is investigated using the Johansen (1991) likelihood ratio test. The results of the Johansen likelihood ratio 'trace test' of the null of no cointegration are shown in Table 4.6. The Table shows that the null of zero cointegrating vectors can be rejected but not the null of one cointegrating vector for SH and TTR, implying that there is one stationary relation at the 5% level of significance. The existence of cointegration indicates some causality between SH and TTR in one or both directions. Table 4.7 shows that the null of weak exogeneity for the SH variable is rejected but the null hypothesis of weak exogeneity for TTR cannot be rejected. This supports the estimation of a single equation with SH as the dependent variable. The fitted conditional error-correction model for the shadow economy-to-GDP ratio using the Ordinary Least Square (OLS) method is shown as:

$$\Delta SH_t = \underset{(0.0367)}{0.018} + \underset{(0.126)}{0.222}\Delta SH_{t-1} - \underset{(0.286)}{0.175}\Delta SH_{t-5} + \underset{(0.134)}{0.273}\Delta TTR_{t-1} + \underset{0.289}{0.583}\Delta TTR_{t-3} - \underset{(0.116)}{0.282}ECM$$

$$T = 39;\ R^2 = 0.73;\ JB = [0.42];\ LM(1) = [0.59];\ LM(2) = [0.51];\ AIC = -3.5;\ SC = -3.2$$

The values in parentheses for the coefficients are standard errors, ECM is the equilibrium error series generated using the Engle-Granger method, T is the number of usable observations, R^2 is the adjusted coefficient of determination and LM is the Breusch-Godfrey Serial Correlation LM test at lags 1 and 2. The probability values are reported for the LM tests. AIC and SC are the Akaike and Schwarz Information

Criteria. The linear model seems quite satisfactory, with the post-estimation residuals tests indicating normality with no problem of serial correlation. However, to test the robustness of the β parameter in the linear model, Table 4.8 reports VECM results.

As stated in the previous Chapter, the *minus* in front at the long-run component of Table 4.8 indicates a *positive* relationship between the variable to which the parameter applies and the variable on which the vector is normalised. The long-run relationship shows that for every 1% increase in the total tax burden, the shadow economy will increase by 0.197%. The error-correction term for the shadow economy equation shows a response to deviations from the long-run relationship equal to -0.518 indicating that slightly over half of the deviation is corrected in the first period after the deviation occurs.

Testing whether the β parameter in the OLS estimation is equal to β in the VECM the t-statistics test shows that the null $\beta^{OLS} = \beta^{VECM}$ cannot be rejected;[43] hence this provides some indication of robustness in the cointegration parameter beta.

Table 4.6: Unrestricted Co-integration Rank (Trace) Test

Hypothesised No. of CE(s)	Eigenvalue	Trace Statistics	Critical value	Probability value
None*	0.278	15.510	15.495	0.0497
At most 1	0.042	1.813	3.841	0.1781

*Rejection of null hypothesis: Trace test indicates one co-integration equation at the 5% level.

[43] T-statistics is computed as: $t = \frac{(\hat{\beta}^{OLS} - \hat{\beta}^{VECM}) - (\beta^{OLS}\beta^{VECM})}{Se(\hat{\beta}^{OLS} - \hat{\beta}^{VECM})}$ where $\beta^{OLS}\beta^{VECM} = 0$ and the standard error of $(\hat{\beta}^{OLS} - \hat{\beta}^{VECM})$ is computed using the delta method.

Table 4.7: Exogeneity Test

Variable	Restriction	Restricted Log likelihood	LR statistic	Degree of Freedom	Probability	Conclusion
Ln_SH	$\alpha_{11} = 0$	379.002	9.714	1	0.0158	Endogenous
Ln_TTR	$\alpha_{21} = 0$	211.420	1.241	1	0.6603	Exogenous

Table 4.8: VECM results

Cointegration Equations:		
$(LSH)_{t-1}$	1	
$(LTTR)_{t-1}$	-0.197	
	(0.102)	
C	-0.459	
Error Correction Equations:	Δ(SH)	Δ(TTR)
Cointegration Equation 1	-0.518	- 0.185
	(0.172)	(0.124)
$\Delta(LSH)_{t-1}$	0.160	0.046
	(0.054)	(0.012)
$\Delta(TTR)_{t-1}$	0.314	0.483
	(0.135)	(0.152)
C	0.156	0.008
	(0.128)	(0.011)
Adjusted R-squared	0.64	0.40
AIC	-3.92	-2.21
SC	-3.48	- 1.93

Values in ( ) represent standard errors.

4.3.7 Linearity testing and model selection

To run the Teräsvirta linearity test, all the variables in the linear error correction model are *a priori* regarded as potential transition variables (Cipollini, 2001*)*. The results are given in Table 4.9. The null of linearity is rejected when $\Delta(ttr)_{t-2}$ is the transition variable. This implies that in South Africa it takes 2 years for changes in the tax burden, either tax increases or reductions to reflect significantly on the growth or reduction of shadow income. Table 4.9 also shows that at d = 2, the logistic representation of the data is most preferred. Given that this study also focuses on determining the tax rate at which the propensity to evade begins to accelerate, a logistic quadratic function is also estimated.

Table 4.9: LM-Type for non-linearity and model selection

Transition Variable	LM	H_{01}	H_{02}	H_{03}
$\Delta lttr_{-1}$	0.417	0.417	0.253	0.204
$\Delta lttr_{-2}$	0.000	0.000	0.011	0.027
$\Delta lttr_{-3}$	0.061	0.061	0.102	0.109
$\Delta lttr_{-4}$	0.395	0.395	0.388	0.413
Ecm_{-1}	0.315	0.315	0.549	0.581
Ecm_{-2}	0.310	0.310	0.238	0.144
Ecm_{-3}	0.611	0.611	0.551	0.469
Ecm_{-4}	0.161	0.161	0.137	0.427

Note: ρ-values of F-variants of the LM-type tests used in the specification procedure of Escribano and Jorda (2001).

4.3.7 Non-Linear model estimation specification

Having established a non-linear relationship the parameters of both the logistic and the quadratic logistic functions are estimated using the non-linear least squares (NLS) technique. The non-linear estimation, after removing the insignificant parameters is specified in 4.11:

$$\Delta SH_t = \phi_0 + \phi_1 \Delta(SH)_{t-1} + \phi_2 \Delta(SH)_{t-5} + \phi_3 \Delta(ttr)_{t-1} + \phi_4 \Delta(ttr)_{t-3} + \phi_5 (ecm)_{t-1} + \\ \psi[\varphi_0 + \varphi_1 \Delta(SH)_{t-1} + \varphi_2 \Delta(SH)_{t-5} + \varphi_3 \Delta(ttr)_{t-1} + \varphi_4 \Delta(ttr)_{t-3} + \varphi_5 (ecm)_{t-1}] \qquad (4.11)$$

The asymmetric representation is both in the form of logistic and quadratic logistic functions and specified in equations 4.12 and 4.13, respectively. The logistic function is specified as:

$$\psi\{\Delta(ttr)_{t-d};\gamma,\tau\} = \frac{1}{1+\exp[-\gamma(\Delta ttr_{t-d} - \tau)/\sigma_{ttr}]} \qquad (4.12)$$

with the quadratic logistics expressed as:

$$\psi\{\Delta(ttr)_{t-d};\gamma,\tau\} = 1 - \frac{1}{1+\exp[-\gamma(\Delta ttr_{t-d} - \tau_1)(\Delta ttr_{t-d} + \tau_2)]} \qquad \tau_1 \neq \tau_2 \qquad (4.13)$$

The parameter $\gamma > 0$ which determines the smoothness of the transition regime has an estimate of 25.10 in the case of the logistic function and 16.23 in the quadratic logistic function.[44] Following Granger and Teräsvirta (1993) and Teräsvirta (1994), the γ is made dimension-free by dividing it by the standard deviation $\sigma\Delta(ttr)_{t-d}$. In the logistic function, the threshold is set at zero so as to distinguish between positive and negative movements in the effective tax burden. If the effective total tax rate becomes increasingly large, i.e. $\Delta(ttr)_{t-2} \to +\infty$ the transition function is equal to one (1) and the relevant parameters are a summation over ϕ and φ; whilst when the effective tax rate is declining, i.e. $\Delta(ttr)_{t-3} \to -\infty$ the model becomes linear (equation 4.11 and 4.12). In the quadratic logistics case (Equations 4.11 and 4.13), the thresholds are estimated to lie between -3.64% to +2.13% of GDP. In this case, for $\Delta(ttr)_{t-3} > \tau_1$ and $\Delta(ttr)_{t-3} < \tau_2$ (i.e. within the band) the model becomes linear, whilst for $\Delta(ttr)_{t-3} < \tau_1$ and $\Delta(ttr)_{t-3} > \tau_2$ (i.e. outside the band) the transition function is equal to one (1) and the relevant parameters are a summation over ϕ and φ.

Table 4.10 columns 2 and 3 report the logistic smooth transition and the quadratic logistic smooth transition models, respectively. Tests of the residuals show no serious problems with serial correlation, no non-normality of residuals and, finally, no heteroscedasticity. Although the two models produce good results based on the AIC, the quadratic model performs better. The error-correction terms are of the expected

[44] It turns out to be notoriously difficult to obtain a precise estimate of the smoothness parameter γ. One reason for this is that for large values of γ, the shape of the logistic function changes only little. Hence, to obtain an accurate estimate of γ one needs many observations in the immediate neighbourhood of the threshold τ. As this is typically not the case, the estimate of γ is rather imprecise in general and often appears to be insignificant when judged by its *t* –statistic (Franses and Dijk van Dick, 1998 for details). The main point to be taken is that insignificance of the estimate of γ should not be interpreted as evidence against the presence of STR-type nonlinearity. This should be assessed by means of different diagnostic tests.

signs and statistically significant. Table 4.10 column 2 also shows that an increase in the effective tax rate results in a 0.50% point increase in shadow income whilst a decrease in the effective tax rate only reduces the shadow income by 0.26% points. Column 3 of the Table indicates that as long as the effective tax burden falls within the band of -3.64% to +2.13% of GDP, the response of the shadow economy is insignificant at 0.19% points, however, outside the band the response (0.35%) of the shadow economy to tax changes is significant at the 1% level of significance.

This result supports Giles, *et al.* (2001), who argues that agents may be relatively quicker to move into the underground sector to avoid an increased tax burden, but if their activities go undetected, they may exhibit inertia in the face of a subsequent tax decrease. The implication of this finding is that any attempt by the fiscal authorities to increase the tax burden above the estimated threshold of 2.13% in order to close the budget deficit will trigger a response from the shadow economy which could result in an increased leakage from the tax base and a further worsening of the fiscal deficit.[45]

[45] Thus, the finding in this study support the view that tax increases to deal with deficit problems should be carefully considered. If possible, this should be prevented given the already substantial shadow economy in the country. Although this has not been investigated a more efficient way could be to improve on the efficiency of revenue collection and tax law enforcement.

Table 4.10: Model Estimates from 1966-2010

Variable	Logistic Model		Quadratic Logistic Model	
ϕ_0	-0.024	(0.073)	0.155	(0.169)
ϕ_1	-0.437*	(0.255)	0.264	(0.175)
ϕ_2	0.344**	(0.125)	0.272**	(0.123)
ϕ_3	0.264**	(0.118)	0.188	(0.181)
ϕ_4	0.103	(0.130)	0.121	(0.166)
ϕ_5	-0.192*	(0.095)	-0.216*	(0.114)
φ_0	0.012	(0.037)	0.056	(0.223)
φ_1	-0.312**	(0.115)	-0.573***	(0.146)
φ_2	0.124	(0.542)	0.376**	(0.174)
φ_3	0.238*	(0.130)	0.164	(0.187)
φ_4	0.156	(0.196)	0.253*	(0.132)
φ_5	-0.251*	(0.131)	-0.307**	(0.128)
$\phi_3+\varphi_3$	0.502***	(0.162)	0.352***	(0.107)
$\phi_5+\varphi_5$	-0.443***	(0.159)	- 0.523***	(0.149)
τ	0.0		-0.0364 +0.0213	
γ	25.10	(22.983)	16.23	(18.591)
$\overline{R}^2$	0.52		0.67	
S.E. Regression	0.049		0.033	
AIC	-3.62		-3.87	
SC	-3.28		-3.30	
JB	[0.14]		[0.58]	
ARCH	[0.12]		[0.62]	
LM	[0.066]		[0.11]	

Note: *{**}{***} denotes significance at 10, 5 and 1% respectively; JB-Jarque-Bera Test, ARCH-Autoregressive Conditional Heteroscedasticity, AIC-Akaike info criterion . [ ] are probability values and ( ) are standard errors. The Delta method is used to calculate the standard errors of $(\phi_3+\varphi_3)$ and $(\phi_5+\varphi_5)$.

4.4 Summary and Conclusion

This study, like many others, links the protection of the tax base to changes in the tax burden i.e., the higher the tax burden, the greater the risk of leakages from the base or the smaller the base becomes. Amongst the important issues discussed in

this Chapter is the determination of the tax rate at which the propensity to evade or avoid tax begins to accelerate. Given that there is no reliable time series data on the shadow economy in South Africa, this study attempts to generate such a series to test the hypothesis that the response of the shadow economy to increases in the effective tax burden is symmetric with the corresponding response to decreases in taxes. The study reports that on average, the size of the South African shadow economy is 22.18% of GDP given the estimated revenue evaded of about 7% of GDP.

The study argues that the evaded revenue is relatively large and that it justifies serious attempts by the fiscal authorities to limit shadow economic activities (for example, the amount of tax evaded would be sufficient to cover the projected fiscal deficit of 3% of GDP without resorting to a further increase in the tax burden). The results show that businesses and individuals are likely to react quicker when the tax burden changes fall outside the band of -3.64% to +2.13% of GDP but remain neutral as long as they are within this band. The implication of this finding is that any attempt by the fiscal authorities to increase the tax burden above the estimated threshold of 2.13% in order to close the budget deficit will trigger a response from the shadow economy, thereby reducing the tax base and further worsening the fiscal deficit. Rather, other measures should be explored first such as improving the efficiency of collection and tax auditing.

It is suggested that levels below 2.13% would be optimal for tax changes to avoid further growth in shadow income but it should be noted that this rate may not necessarily be optimal in terms of maximising the growth in GDP. The next Chapter, therefore, investigates the impact of fiscal structural changes on the economy's performance and its implication for fiscal sustainability.

CHAPTER FIVE: AN EMPIRICAL INVESTIGATION INTO THE MACROECONOMIC EFFECTS OF FISCAL POLICY STRUCTURE IN SOUTH AFRICA

5.1 Introduction

Governments' recourse to fiscal policy to mitigate the effects of the recent 2007 global economic crisis has renewed interest in the role of fiscal policy in influencing economic growth. To bring fiscal balances back on track, fiscal authorities have the option of changing taxes and or changing public spending, but the decision that is critical to any fiscal authority is which taxes and/or which spending components should be changed.

The theoretical literature reviewed in Section 2.4 suggests that in the endogenous growth literature fiscal policy has potentially important effects on the long-run growth rate of the economy. In this context, the impact of productive government spending on growth becomes important. However, there is no consensus yet in the literature about the exact nature of which public expenditures are productive or unproductive (Olabisi and Funlayo, 2012; Bose, *et al.* 2007). In general, there is still a debate about the macroeconomic effects of fiscal policy with no clear consensus about the way in which the effects of fiscal policy on the economy are transmitted, or the way in which fiscal shocks affect an economy and its implication for fiscal sustainability (Afonso and Soussa, 2012). Against this background, this analysis contributes to the debate by estimating a Bayesian Structural Vector Autoregression (BSVAR) model to analyse the effects of fiscal policy on economic performance and its implication for fiscal sustainability in South Africa using annual data for the period 1960 to 2010.

The analysis shows that total government spending increases have a “crowding–in effect as GDP per capita and private investment respond positively. When government expenditure is disaggregated into consumption and capital expenditure per capita, the analysis shows that a one standard deviation positive shock in government consumption expenditure per capita increases real GDP per capita with a multiplier effect of 0.22, which is higher than the growth multiplier effect (0.16) of government investment expenditure per capita. In addition, the effect of the total tax burden on the GDP and private investment is negative and persistent in the long-term (i.e. after 4 years).

At an aggregate level therefore, the net effect of fiscal policy is that it is growth enhancing in the short and medium terms but in the long- term, the growth promoting effects of increased public intervention are offset by the growth inhibiting effects of increased taxes; indicating that fiscal sustainability is not a threat in the short-term but could be in the long-term.

This Chapter recommends that fiscal authorities should guard against populist spending patterns and prioritise those expenditures that result in capacity building and enhancing growth and employment. In this regard, the declining trend in the proportional expenditure on education and health has to be investigated. Furthermore, the heavy reliance of fiscal authorities on direct taxes to achieve fiscal balance should be reconsidered since the analyses in this study shows that such taxes negatively affects growth.

5.2 Background

Different governments have a range of economic and social objectives that they endeavour to achieve either through regulations and/or the design of their fiscal structures (i.e. the composition of its expenditure and taxation). Political debates often tend to focus on the preferred set of economic and social objectives whereas economic debates tend to focus on the efficiency and effectiveness of policy in contributing to the achievement of these objectives (Barker, *et al.* 2008). The empirical results reviewed in Section 2.4 show that over the past decade and a half, a substantial volume of empirical research has been directed towards identifying the elements of public expenditures (at its aggregate and disaggregated levels) that bear significant relationship with economic growth. These studies vary in terms of data sets and econometric techniques and often produce conflicting results. One of the reasons given for this is the differences in the set of conditioning variables across studies (Bose, *et al.* 2007; Levine and Renelt, 1992). In contrast, the second category consists of a handful of studies (Bose, *et al.* 2007; Kneller, *et al.* 1999; and Mofidi and Stone, 1990) suggest that this variation in results, in part at least, reflects the widespread tendency among researchers to ignore the implications of the government budget constraint in their regressions. In particular, Kneller, *et al.* (1999) adopted by *Bose, et al.* (2007) and Ghosh and Gregorious (2008) emphasises the need to consider both the sources and uses of funds simultaneously for a meaningful evaluation of the effects of taxes or expenditure on economic growth.

In addition, most of the conclusions drawn regarding the growth effects of public expenditure are based either on the experiences of a set of developed countries or on the basis of large samples consisting of a mixture of developed and developing

countries (Bose *et al*. 2007). The vast majority of these studies are cross-country/ or panel data studies. Though these studies have merit they severely suffer from the heterogeneity of the underlying data set (Durlauf 2000:252). Countries differ from each other in many respects such as in their political-economic systems, cultures, history, geography, etc. The resulting econometric problem is coined "parameter heterogeneity" (e.g. Temple. 2000:181-205).

In South Africa, the debate on the efficacy of fiscal policy in stimulating growth seems to have received little attention in the empirical literature (Jooste, Liu and Naraidoo 2012; Ocran, 2009) even though in recent times a debate has been growing amongst unions and the Communist Party proposing that the fiscal policy directions since 1994 have to make way for larger government (Ocran, 2009). Furthermore, the empirical literature that does exist is restricted by relatively short time series and highly aggregated fiscal data in the VAR framework. The existing studies also do not fully analyse the fiscal policy-growth relationship and its implication for fiscal sustainability.

This study, therefore, contributes to the debate by analysing the effects of fiscal policy compositional changes on key macroeconomic variables and its implications for fiscal sustainability, using the Bayesian Structural Vector Auto-Regression (BSVAR) method. The study covers the period between 1960 and 2010. The financing of any particular public expenditure *per se,* is not analysed but the financing variable i.e. taxes (direct and indirect) is included in the model estimated to avoid the coefficient biases that would result from their omission (Kneller, *et al.* 1999; Bose, *et al.* 2007; Ghosh and Gregorious, 2008). Therefore, by focussing exclusively

on a developing country (i.e. South Africa), and also recognising the implication of the government budget constraint in a BSVAR model, this study aims to make a meaningful contribution to the literature in this regard.

The rest of the Chapter is organised as follows: Section 5.3 discusses the methodological issues related to the specification and identification of the VAR model, taking into account the uncertainty regarding the posterior impulse-response functions and explains the model specification and data used in the study. Section 5.4 presents the empirical analyses and discusses the results. Section 5.5 concludes with the main findings and policy implications.

5.3 Methodology

One of the main challenges in estimating the relationship between fiscal policy and growth in an endogenous growth model (such as the Barro model, 1990) as specified in Section 2.4, is the classification of expenditures into productive and non-productive and of taxation into distortionary and non-distortionary categories. But more importantly, because of the complex interaction in the public-policy growth model, the analytical variables in the framework are theoretically featured as endogenous and dynamic. Finally, there is a problem of model uncertainty which results either from theoretical uncertainty or/and statistical uncertainty.[46] These problems of scale, endogeneity and persistence mean that a structural model may tend to “over fit” the data (Brandt 2009).

[46] Theoretical uncertainty includes the specification of the variables in the model and their endogenous relationships. Statistical uncertainty encompasses the uncertainty about the estimated parameters, which itself may be due to indeterminate theoretical structure (Brandt 2009).

Another methodological issue of concern is drawing statistical inferences of the null hypothesis testing based on observed data and presumed asymptotic properties of probability distribution. In the conventional frequentist approach, commonly known as the least-squared (LS) and maximum likelihood estimation (MLE) methods, the point estimate inference from sampling data rests on the asymptotical properties of probability distribution. The standard procedure of frequentist analysis tests the null hypothesis against alternative hypotheses and calculates the p-value that is defined as the probability under the null hypothesis of observing an outcome at least as extreme as the outcome actually observed. However, the statistical inference of null hypothesis statistical testing (NHST) based on observed data and the presumed asymptotic properties lead to different results when the size of data is small. The NHST's inconsistency problem not only weakens theoretical explanation but also limits the extent of theoretical generalization (Shor, Bafumi and Park 2007).

This Chapter, therefore, uses the Bayesian Structural VAR which addresses the problems of scale, endogeneity, persistence, and specification uncertainty.[47] The BSVAR builds its estimation method on the assumption that each variable in the model is conditioned to the others. Thus, in the BSVAR, unlike the NHST method, not only the contemporaneous effects between variables but also the lagged influences from the corresponding variables in the structure are taken into account. The BSVAR therefore addresses the problem of endogeneity simultaneously and or temporally (Brandt 2009). Another advantage of the use of BSVAR is that in a small sample model estimates derived from the frequentist analysis are invalid and not steady to represent the asymptotic properties of the presumed distribution. In a

[47] See Brandt and Freeman (2009) for details on issues of BSVAR and endogeneity, identification and model uncertainty.

Bayesian framework the use of Gibb sampling to set up full conditional distributions and the Markov Chain Monte Carlo (MCMC) simulation, the BSVAR estimates have a stationary distribution (Sims, 2007).

The BSVAR is, however, not without criticism. Its reliance on prior information has been criticised by the frequentists as subjective and that such prior setting can greatly influence the model posteriors which may improperly lead to statistical results that are far away from the realities derived from the data. However, Gill's response (2004: 328) to the criticism should be noted when she asserts that there is nothing inherently wrong with the prior dominating likelihood function.

5.3.1 Model specification (Bayesian Structural Vector Autoregression with Sims-Zha Prior)

This analysis applies the BSVAR model with Sims and Zha Prior to analyse the simultaneous causal relationships between the variables of interest, systematically incorporate prior beliefs about the dynamics among fiscal variables and economic activities and gauge the degree of uncertainty about the causal inferences.

Following Brandt and Freeman (2009:113-142), the Structural Vector Autoregression (SVAR) model has one equation for each of the endogenous variables in the system. Each of the endogenous variables is a function of the contemporaneous (time "0") and past (lagged) values of all of the endogenous variables in the system. This produces a dynamic simultaneous equation model as specified below:

$$\underset{1\times m}{y_t}\, A_0 + \sum_{l}^{p} \underset{1\times m}{y_{t-l}}\, \underset{m\times m}{A_l} = \underset{1\times m}{d} + \underset{1\times m}{\varepsilon_t} \qquad t = 1, 2 \ldots\ldots T \qquad (5.1)$$

This is a *m*-dimensional VAR for a sample of size *T* with y_t a vector of observations for *m* variables at time t, A_ℓ the coefficient matrix for the ℓth lag, $\ell = 1,.....,p$, *p* the maximum number of lags (assumed known), d is a vector of constants and, ε_t ,a vector of i.i.d. normal structural shocks such that the condition below holds i.e.

$$E[\varepsilon_t | y_{t-s}, s > 0] = \underset{1\times m}{0}; \quad E[\varepsilon_t' \varepsilon_t | y_{t-s}, s > 0] = \underset{m\times m}{I}$$

Equation 5.1 is a structural VAR or SVAR which assumes that the A_0, the contemporaneous coefficient matrix for the structural model, is non-singular and subject only to linear restrictions. The word structural is used to define a model that is a dynamic simultaneous system of equations with the contemporaneous relationships identified by the A_0 matrix (Brandt and Freeman, 2009:113-142). The Bayesian version of this model or BSVAR incorporates informed beliefs about the dynamics of the variables. These beliefs are represented in a prior distribution for the parameters (Brandt, 2009). Sims and Zha (1998) suggest that the prior for A_ℓ is conditioned on the specification decision for A_0. For a given A_0, let a_0 be a vector that is the columns of A_0 stacked in column-major order for each equation.

For A_ℓ parameters that describe the lag dynamics, let A_+ be an $((m^2 p + 1) \times m$ matrix that stacks the lag coefficients and the constant (rows) for each equation (columns). Additionally, let a_+ be a vector that stacks the columns of A_+ in column major order (so the first equation's coefficient, then the second equation's, etc.). The prior over a_0 and a_+ denoted $\pi(a)$ then is:

$$\pi(a) = \pi(a_0)\phi(\tilde{a}_+ \psi) \tag{5.2}$$

Where $\tilde{a}_+$ is the mean parameter in the prior density and $a_+, \phi(.,.)$ a multivariate normal with mean $\tilde{a}_+$ and covariance ψ (Brandt and Freeman, 2009). The prior for equation 5.2 addresses the scale problem, which normally occurs in macro modelling, by putting lower probability on the coefficients of the lagged effects shrinking these parameters toward zero (Sims and Zha, 1998). The Sims-Zha prior parameterises the belief about the conditional mean of the coefficients of the lagged effects in a_+ given a_0 in equation 5.2. The prior mean is assumed to be that the best predictor of a series tomorrow is its value today. The posterior density for the model parameters is then formed by combining the likelihood for equation 5.1 and the prior:

$$\Pr(A_0, A_\ell, \ell = 1,....p) \alpha \phi(a_+, a_0 | Y) \phi(\tilde{a}_+, \psi) \pi(a_0) \qquad (5.3)$$

Estimation and sampling from the posterior of this model is via a Markov Chain Monte Carlo Gibbs Sampler (Waggoner and Zha, 2003). The broad idea about Gibbs sampling is that the coefficients are assumed to be interdependent and the estimated values can be obtained through specifying the conditional probability function among variables. In more technical terms a Markov Chain simulation algorithm from the joint posterior distribution can be set up by simulating individual parameters from the series of full conditional distribution (Gills, 2004:323-37).

The conditional prior covariance of the parameters, $V(a_+|a_0)=\Psi$ is specified to reflect the following beliefs about the series:

i. The standard deviations around the first lag coefficients are proportionate to all the other lags;

ii. The weight of each variable's own lags is the same as that of other variables lags;

iii. The standard deviations of the coefficients of the longer lags are proportionately smaller than those on the earlier lags (lag coefficient shrink to zero over time and have smaller variance at higher lags).

iv. The standard deviation of the intercept is proportional to the standard deviation of the residuals for the equation;

v. The standard deviation of the sums of the autoregressive coefficients should be proportional to the residuals for the respective equation (consistent with the possibility of co-integration); and

vi. The variance of the initial conditions should be proportional to the mean of the series. These are " dummy initial observations" that capture trends or beliefs about stationarity and are correlated across the equations.

Sims and Zha further generate hyper-parameters to scale the conditional standard deviations of the dynamic simultaneous equation regression coefficients on the lag of variable j in equation 5.4. Each diagonal element of Ψ corresponds to the variance of the VAR parameters and is assumed to have the form:

$$\overline{\psi}_{\ell,j,i} = \left(\frac{\lambda_0 \lambda_1}{\sigma_j l^{\lambda_3}}\right)^2 \qquad (5.4)$$

Where the lambda zero (λ_0) controls the tightness of the beliefs on A_0, the hyper-parameter, lambda one (λ_1) controls what Litterman (1986) refers to as the overall tightness of beliefs around the random walk prior, or the standard deviation of the first lags and λ_3 controls the rate at which prior variance shrinks with increasing lag length. The vector parameters $\sigma_j,...,\sigma_m$ are scale factors allowing overall coefficient covariance to be scaled by each variable on its own lagged values. The constant in the model receives a separate prior variance of:

$$(\lambda_0 \lambda_4)^2$$

Any exogenous variables can be given a separate prior variance proportionate to a parameter lambda five (λ_5), so that the prior variance on exogenous variables is:

$$(\lambda_0 \lambda_5)^2$$

Furthermore, Sims and Zha propose that two dummy observations be added to the data to account for unit roots, trends and cointegration. The μ_5 is a prior weight on dummy observations for a sum of coefficient prior that implies beliefs about the presence of unit roots; whilst the parameter μ_6 is the prior weight for dummy observations for trends and weights for initial observation.

Brandt and Freeman (2009), summarises the hyper-parameters of Sims and Zha as shown in Table 5.1:

Table 5.1: Hyper-parameters of Sims and Zha reference prior

Parameter	Range	Interpretation
λ_0	[0,1]	Overall scale of the error covariance matrix
λ_1	>0	Standard deviation around A1 (persistence)
λ_2	$=1$	Weight of own lag versus other lags
λ_3	>0	Lag decay
λ_4	≥ 0	Scale of standard deviation of intercept
λ_5	≥ 0	Scale of SD of exogenous variable coefficients
μ_5	≥ 0	Sum of autoregressive coefficients component
μ_6	≥ 0	Dummy initial observations component

Source: Brandt and Freeman, 2009

5.3.2 Estimation technique

The BSVAR model estimated in this study takes the following form:

$$\underset{1\times m}{X_t}\ \underset{m\times m}{A_0} = C_0 + \sum_{\ell=1}^{p} X_{t-\ell} A_\ell + \varepsilon_t \tag{5.12}$$

$$v_t = A_0^{-1}\varepsilon_t \tag{5.13}$$

where:

$$X_t = [g_t, t_t, y_t, \pi_t, i_t]$$

The A_i are m x m parameter matrices for the contemporaneous and lagged effects of the endogenous variables. M is the number of variables in the system; ε_t the fundamental economic shocks that span the space of the innovations to X_t; v_t the VAR innovation whilst g_t, t_t, y_t, π_t and i_t represent, respectively, the log of real per capita government spending, the log of real per capita net taxes, the log of real per capita GDP, inflation and a short term interest rate.[48] The variables in X contain all the variables that enter the government inter-temporal budget constraint, thus in the above model, the inter-temporal budget constraint links the fiscal variables to the macroeconomic variables.

In addition, another set of five variable VAR models is estimated, adding in turn the major components of GDP, which are real per capita private consumption and real per capita private investment. Furthermore, disaggregated real per capita tax was included in the baseline model i.e. tax variables were disaggregated into direct (labour and corporate) tax and indirect (VAT and other domestic indirect taxes).

[48] This set of variables is the same as the one used by Favero (2008) and Perotti (2005).

Finally, government expenditure was also disaggregated into consumption[49] and investment expenditure and included into the base line model.

The classification of indirect tax as non-distortionary is based on the assumption that the utility function does not contain leisure as an argument and therefore there is no substitution effect between work and leisure, but direct tax does have a substitution effects (Barro, 1992). This assumption is, however, further analysed in this Chapter. To identify a fiscal shock the analysis uses the recursive approach which restricts the identity matrix and A_0 to a lower triangular matrix with unit diagonal, which implies the decomposition of variance-covariance matrix through Choleski decomposition.

For the five–variable system, there are 5 x 5 = 25 such responses but many of these responses are not of direct interest to this study. The fiscal variables are ordered first since the study is interested in how other macroeconomic variables react contemporaneously to shocks in the fiscal variables. Thus, in the baseline model government expenditure is ordered first, tax revenue is ordered second, output is ordered third, Inflation is ordered fourth and the interest rate is ordered last.[50] The relationship between the reduced–form disturbances u_t and the structural disturbances e_t therefore take the form:

[49] Government consumption expenditure includes expenditure on Education, Health, Social Protection, Defense, Housing, Environmental Protection, and General Services; whilst investment expenditure mainly includes infrastructure expenditure.

[50] This ordering is also consistent with Favero, (2008), Perotti (2004), Fatas and Mihov, (2001). Ordering the fiscal variables first is equivalent to assuming that all automatic elasticities of fiscal variables to GDP, inflation and interest rates are equal zero.

$$\begin{vmatrix} 1 & 0 & 0 & 0 & 0 \\ -\alpha_{tg} & 1 & 0 & 0 & 0 \\ -\alpha_{yg} & -\alpha_{yt} & 1 & 0 & 0 \\ -\alpha_{\pi g} & -\alpha_{\pi t} & -\alpha_{\pi y} & 1 & 0 \\ -\alpha_{rg} & -\alpha_{rt} & -\alpha_{ry} & -\alpha_{r\pi} & 1 \end{vmatrix} \begin{vmatrix} u_t^g \\ u_t^t \\ u_t^y \\ u_t^\pi \\ u_t^r \end{vmatrix} = \begin{vmatrix} \beta_{11} & 0 & 0 & 0 & 0 \\ 0 & \beta_{22} & 0 & 0 & 0 \\ 0 & 0 & \beta_{33} & 0 & 0 \\ 0 & 0 & 0 & \beta_{44} & 0 \\ 0 & 0 & 0 & 0 & \beta_{55} \end{vmatrix} \begin{vmatrix} e_t^g \\ e_t^t \\ e_t^1 \\ e_t^2 \\ e_t^3 \end{vmatrix}$$

The e_t^i (i =1, 2, 3) are non- fiscal shocks and have no structural interpretation. The implication of the above ordering is that: fiscal policy variables, say government expenditure, do not react contemporaneously to shocks to other variables in the system; output does not react contemporaneously to inflation and the interest rate shocks, but it is affected contemporaneously by fiscal policy shocks; and interest rates are affected contemporaneously by all shocks in the system. Note that after the initial period the variables in the system are allowed to interact freely (Caldara, 2008). For example interest rate shocks can affect output in all periods after the first period in which the shock occurred.[51]

In addition to the observed data set described above, the models include informed assumptions about the dynamics of the variables selected. The confidence bands are constructed using a Monte Carlo Markov-Chain (MCMC) Gibbs Sampler based on 100,000 draws. The results are provided in terms of impulse responses, reporting the median of the posterior distribution of the responses as well as error bands based on 68% posterior regions (point wise).

[51] The SVAR model in this study is estimated using Patrick Brandt's Markov Switching Bayesian Vector Autoregression (MSBVAR) package in R-software.

5.3.3 Data discussion

The analysis uses annual South African data over the period 1960 to 2010 as shown in Figure 5. The choice of annual data hinges on the fact that there is just one well publicised fiscal event per year in the country which is the annual budget. The definition of the fiscal variables in this study is consistent with related literature. Specifically, government expenditure is the sum of government consumption and investment, whilst net taxes are defined net of social transfers. The data has been obtained from the Quarterly Bulletin published by the South African Reserve Bank.

This data source, however, was complemented by annual data from the International Financial Statistics (IFS) published by the International Monetary Fund. The variables used in the BSVAR estimation include: real expenditure per capita (EXP); real government consumption expenditure per capita (GCON); real indirect tax (INDT) per capita; real direct tax (DT) per capita; real gross domestic product (GDP) per capita; real private investment (PINV) per capita; Treasury Bill rate (TBR); Inflation rate (INF); real government investment expenditure (GINV); and real government tax revenue (REV). All the variables, except inflation and interest rates have been converted into their natural logarithmic form (denoted by L) and deflated by the GDP deflator. The time series properties of the data are investigated and the results of the Augmented Dickey-Fuller (1981) and the Phillips-Perron tests suggest that the null hypothesis of the presence of unit root in the variables in levels could not be rejected. The results of the Kwiatkowski, Phillips, Schmidt and Shin (1992) test also support the presence of unit root as the null hypothesis of stationarity in the variables of interest is rejected.

The plots in Figure 5.1 also support the findings of the tests. The findings indicate that all the variables are non-stationary. Non-stationarity is a key feature of many time series data, one that could create major difficulties for classical inference. However, Bayesian time series analysts have made fuller provisions for non-stationarity. The Sims and Zha methodology adds hyper-parameters that capture beliefs about the sum of the coefficients of lagged dependent variables (the number of unit roots in the system of variables) and about the possibility of cointegration among these stochastic trends. However, to avoid the collinearity problem, which might arise from the use of fiscal variables in endogenous growth as discussed in Section 2.4, this study uses growth rates of fiscal as well as non-fiscal variables instead of levels.

Figure 5.1: Variables for the BSVAR estimation

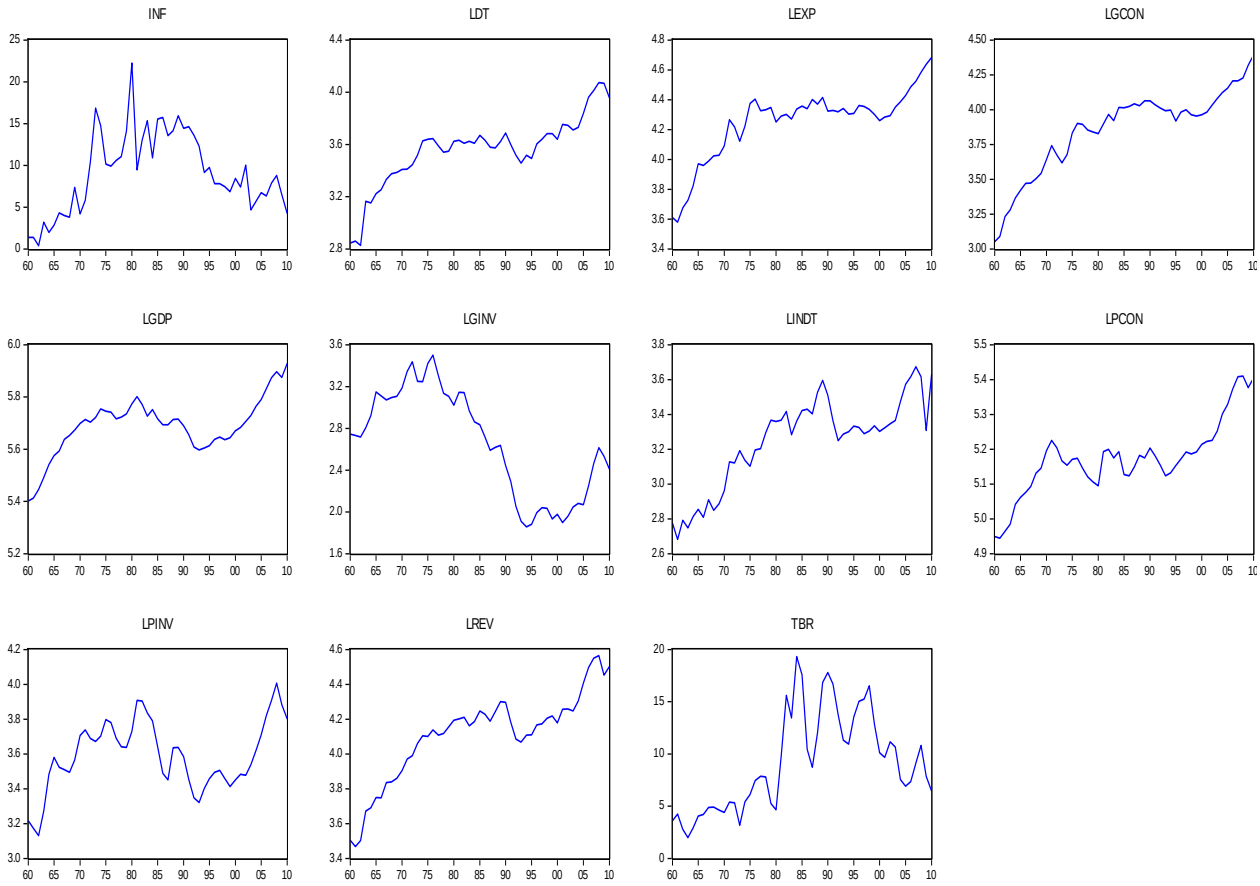


Table 5.2 gives details of definitions and data sources for all variables in the baseline and sensitivity analysis.

Table 5.2: Description of the variables and sources

Variables	Description
Real Expenditure per capita (EXP)	Total national government expenditure to population deflated by the GDP deflator. It includes capital and consumption expenditures
Real Revenue per capita (REV)	Total national revenue per capita deflated by the GDP deflator net of social transfers.
Real indirect tax revenue per capita (INDT)	Value added tax revenue plus other domestic indirect taxes per capita deflated by the GDP deflator.
Real GDP per capita (GDP)	Gross Domestic Production at current prices per capita deflated by the GDP deflator.
Real Private Consumption per capita (PCON)	Private or household consumption expenditure at current prices per capita deflated by the GDP deflator.
Inflation (INF)	Changes in the GDP deflator.
Real Private Investment (PINV)	Gross fixed capital formation per capita of private business deflated by GDP deflator.
Interest rate (TBR)	Treasury Bill rate.
Real Direct Tax per capita (DT)	Taxes on income and wealth per capita deflated by the GDP deflator.
Real government investment expenditure (GINV)	Capital expenditure per capita deflated by GDP deflator.
Real government consumption expenditure(GCON)	Government expenditure on goods and services plus employees compensation per capita deflated by GDP deflator.

Source: www.reservebank.co.za

5.3.4 Setting of priors

The analysis employs a mix of two informative prior settings initiated by Erikson, Mackuen, and Stimson (1998) and Sims and Zha (1998) and diffuses priors as reported in Table 5.3. The first prior “SZ-Tight” column represents a model with strong prior beliefs about unit roots and some cointegration but with little drift in the variables. The second “SZ-Loose” prior indicates the belief that some parameters in

the system have larger variances and less unit roots (Brandt, 2009). The third column is the "diffuse prior" which have vague beliefs about the stochastic trends, stochastic drifts and cointegration.

Table 5.3: BSVAR Hyper-Parameters

Hyper-Parameters	SZ-Tight	SZ-Loose	Diffuse	Selected Priors
Error covariance matrix scale (λ_0)	0.6	0.6	1	0.6
SD of A1 (persistence) (λ_1)	0.1	0.25	1	0.25
Decay of lag variance (λ_3)	1	2	10	2
SD of intercept (λ_4)	0.1	0.5	1	0.5
SD of exogenous variables(λ_5)	0.07	0.1	0.75	0.01
Sum of autoregressive coefficients component (μ_5)	5	2	0	5
Correlation of coefficients/initial condition component (μ_6)	5	2	0	2

Table adapted from Brandt (2009)

In Column 4 of Table 5.3 the values of the hyper-parameters in the model estimated are selected. The choice of these hyper-parameters was guided, in part, by some empirical findings of the variables in question such as the unit root test and analyses of the first moment. As stated in Table 5.1, the hyper-parameter λ_0 controls the overall tightness of the prior. The diffuse prior treat this hyper-parameter as 1 implying that there is no belief of this overall prior setting working in the model specification and thus the diffuse model is completely derived from its sample. The BSVAR model depends on both the likelihood function and the prior and therefore the hyper-parameter λ_0 is assigned a value of 0.6 to avoid the model specification depending too closely on prior settings. Tighter λ_0 minimises the posterior information from samples. The model used assigns a smaller value of 0.25 to the hyper-

parameter λ_1 indicating some belief that the variables in the system follow random walks and are non- stationary.

The hyper-parameter λ_5 which defines the tightness around exogenous variable coefficients is assigned a value 0.01, given that there is no exogenous variable in the system of equations other than the weakly exogenous predetermined past values and one can thus expect that they have least influence on the overall modelling variance. The hyper-parameter μ_5 is used to set prior belief about the presence of unit roots. A value of 5 has been given to this hyper-parameter implying a strong belief in the absence of unit roots effects, since all the I(1) variables have been made stationary in the model used. The value for the Dummy Initial Observations Component μ_6 is set at 2, reflecting some belief that the prior precision of the coefficients in the model is proportionate to the sample correlation of the variables. In terms of the number of lags, this study arbitrarily decided on lag two for all endogenous variables.

5.4 Results

This section presents the impulse response analyses for the respective BSVAR models using error bands of 68% posterior regions (point wise). The simulated models consider a shock from fiscal policy variables (i.e. real government expenditure per capita, further disaggregated into real government consumption and capital expenditure; and real tax revenue per capita, also further disaggregated into real direct and indirect per capita taxes) and their effects on real GDP per capita, private consumption, private investment, inflation and the interest rate.

Consistent with the objective of this Chapter, the focus is on the fiscal policy effect on growth of the economy, therefore the impact of non-fiscal policy variables on other macroeconomic variables is not analysed but only shown. The responses are shown in Figures 5.2, 5.3, 5.4 and 5.5. The rows in these Figures are the responses to shock of the variable on the left axis. The columns correspond to the variables that have been shocked with positive one standard deviation innovations. The inside line refers to the median responses and the outer lines are 68% posterior probability intervals from the estimated VAR. The fiscal policy shock is identified using a recursive identification method based on the work of Christiano *et al.* (2005) adopted by Afonso and Sousa (2012). The estimation is done by applying the Bayesian Structural Vector Autoregression (B-SVAR) model, thereby accounting for the posterior uncertainty of the impulse-response functions.

In Figure 5.2, one can see that a one standard deviation shock in total government expenditure per capita increases GDP per capita contemporaneously by close to 1 percentage point (i.e. 0.9%) and reach a peak at 4 years but the effect dies out after nine years. In terms of the multiplier, the response shows a sizeable multiplier effect[52] (0.2) of total government expenditure per capita on the real growth rate of GDP per capita. The Government expenditure per capita shock, however, has a negligible or insignificant effect on the interest rate. This finding is similar to Afonso and Sousa (2012:4439-4454)[53] and tend to support the Keynesian models and corroborated by Blanchard and Perotti (2002) which predict that government

[52] The Multiplier at year one is defined as the ratio of the response of e.g. GDP at year one to government spending in the same year.

[53] Afonso and Sousa (2012) investigate the effect of fiscal policy on US economic activity, and report that without debt feedback, GDP responds positively to government expenditure shock and that the response is sizeable and reaches a peak after eight quarters. Perotti (2002) however finds a positive response of output to a positive government expenditure shock with a multiplier close to one.

spending has an expansionary effect on the economy and that there is no crowding-out effects. The New Keynesian models predict that government spending causes a shift in labour demand, for instance because of countercyclical markups generated by nominal price rigidities or other reasons (Perotti 2007); the resulting increase in the real wage triggers an increase in consumption of a non-Ricardian consumer, implying a rise in aggregate demand, leading to further expansion in output and employment.

Figure 5.2 further depicts that a one standard deviation positive shock in the effective total tax burden does not contemporaneously affect the growth of real GDP per capita in the short-run but in the long-run (i.e. after 4 years) the effect on real GDP per capita growth is negative (though small) and persistent. In a country like South Africa, where jobs are not readily available, one would expect labour to be inelastic to changes in wages in the short-run i.e. people cannot easily change hours worked when wages change due to a higher total tax burden, an indication of some form of rigidity or market inefficiency. Its effect on the real interest rate is, however, negative but negligible. The effect of a per capita government spending shock on prices or inflation is positive and persistent. This finding supports Perotti (2002) but contradicts Fatas and Mihow (2001) and Mounford and Uhlig (2002) who find a negative effect of government spending on prices or inflation. The net effect of fiscal policy, therefore, is that it is growth enhancing in the short - and medium - terms leading to fiscal sustainability (since $r < g$) but in the long- term, the growth promoting effects of increased public intervention is offset by the growth inhibiting effects of increased taxes; hence, the response of fiscal policy to growth is zero or even negative resulting in fiscal unsustainability.

Figure 5.2: Response to Structural one S.D. Innovations

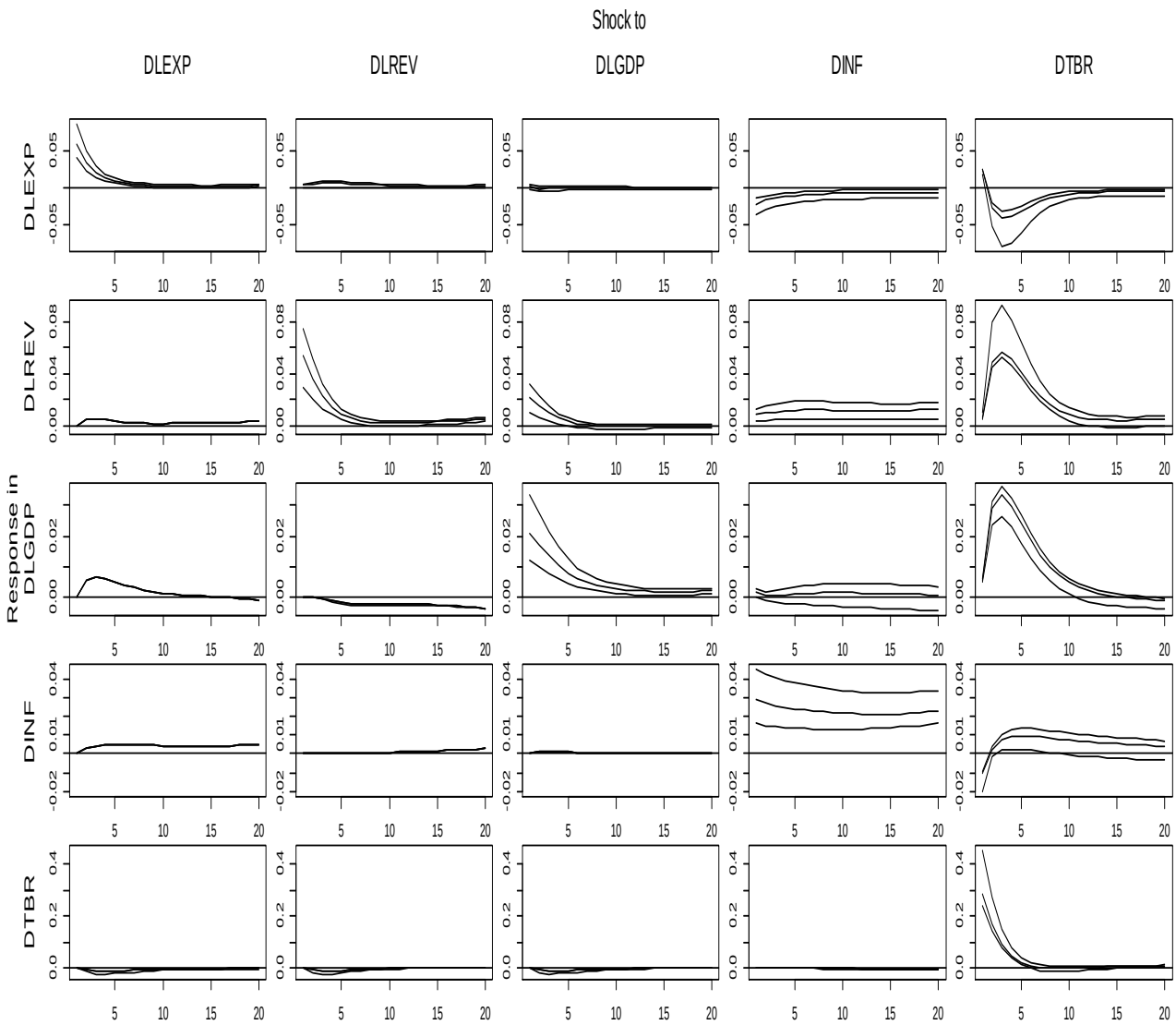


Figure 5.3 reports the contemporaneous relationship between fiscal variables and the major components of GDP, namely, private consumption and private investment. As shown in the Figure, the impulse response of private investment to a one standard deviation of total government expenditure is positive, though small, whilst there is no short-run effect on private consumption but in the long-run its effect is negative and insignificant. This result is similar to Fatas and Mihov (2001) and Favero (2002) who use a Cholesky ordering to identify fiscal shocks and show that

increases in government expenditures are expansionary, but lead to an increase in private investment that more than compensates for the fall in private consumption. The effect of taxes is also shown in Figure 5.3, i.e. at one standard deviation shock in the tax burden, private investment is contemporaneously unaffected but in the medium-term it reduces private investment although by an insignificant amount.

Figure 5.4 reports the contemporaneous effect of direct and indirect taxes on the GDP per capita. The Figure shows that a one standard deviation positive shock in direct tax contemporaneously 'crowds-out' the GDP per capita, with a significant multiplier effect of 0.33, and the effect is persistent implying that direct taxes are distortionary as they affect the investment decisions of agents (inter-temporal substitution effect of labour supply), creating tax wedges and hence distorting the steady-state rate of growth (Barro, 1990; Kneller, Bleaney and Gemmell, 2001).

The effect of indirect tax, however, is non-distortionary on real GDP per capita. Its effect is in fact positive in the short - and medium - term but dies out after 15 years. The non-distortionary or even positive effect of indirect taxes (mainly VAT) can also be explained in line with Barro (1990), Bleaney and Kneller (2001) who argue that these taxes do not affect investment decisions because of the assumed nature of the preference function[54], and hence have no effect on the rate of growth. Bleaney and Kneller (2001) further argue that since the income and substitution effects operate in opposite directions in the choice between labour and leisure, the impact of consumption taxation on labour input may in practice be small (Bleaney and Kneller,

[54] Here the utility function does not contain leisure as an argument. With leisure as an argument in the utility function, consumption taxes will have some impact by distorting labour-leisure choice. However, Kneller, and Bleaney argue that whether they are non-distortionary or merely less distortionary than other taxes is a question that can be answered in an empirical estimation.

2001). Consequently, tax systems that are more consumption-based should be more favourable to growth (Nijkamp and Poot, 2004).

When government expenditure is disaggregated into consumption and capital expenditure per capita the analysis in Figure 5.5 shows that a one standard deviation positive shock in per capita government consumption expenditure increases real GDP per capita with a sizeable multiplier of 0.2, which is higher than the growth multiplier effect (0.1) of government investment expenditure per capita. These positive effects die out after 10 years. The findings in Figure 5.5 are in a way similar to that of Devarajan *et al.* (1996) and Ghosh and Gregorius (2008) who attempt to empirically determine the components of public expenditure that are more productive in developing countries and find somewhat surprisingly, that an increase in the share of current (rather than capital) expenditures have a positive and statistically significant effect on growth. The later study even finds a negative effect of capital expenditure on growth.

Bose, *et al.* (2007) on the other hand find that the share of government capital expenditure in GDP is positively and significantly correlated with economic growth, but current expenditure is negative. The positive and significant effect of consumption expenditure per capita on per capita growth in South Africa may be due to the fact that as from 1994, about 46% of government consumption allocation has been on the social sector of which allocations to Education and Health account for a larger share, when compared to allocations to other social services (Section 1.3). *A priori* higher proportional allocations to Health and Education could enhance human capital and are therefore productive. There has been some slight decline though in the proportional share of Education expenditure since the late 1990s.

Figure 5.3: Response to Structural one S.D. Innovations

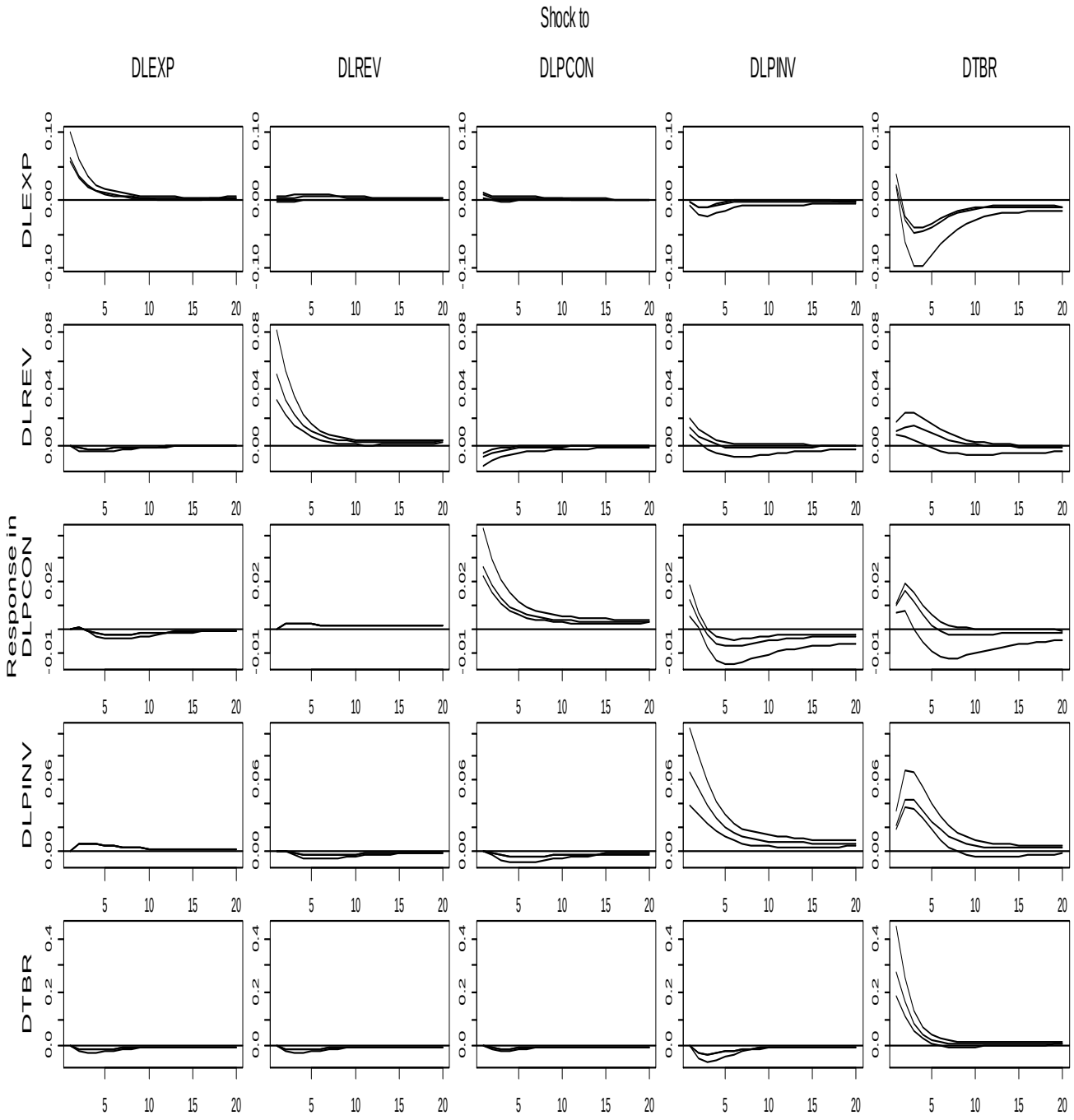


Figure 5.4: Response to Structural one S.D. Innovations

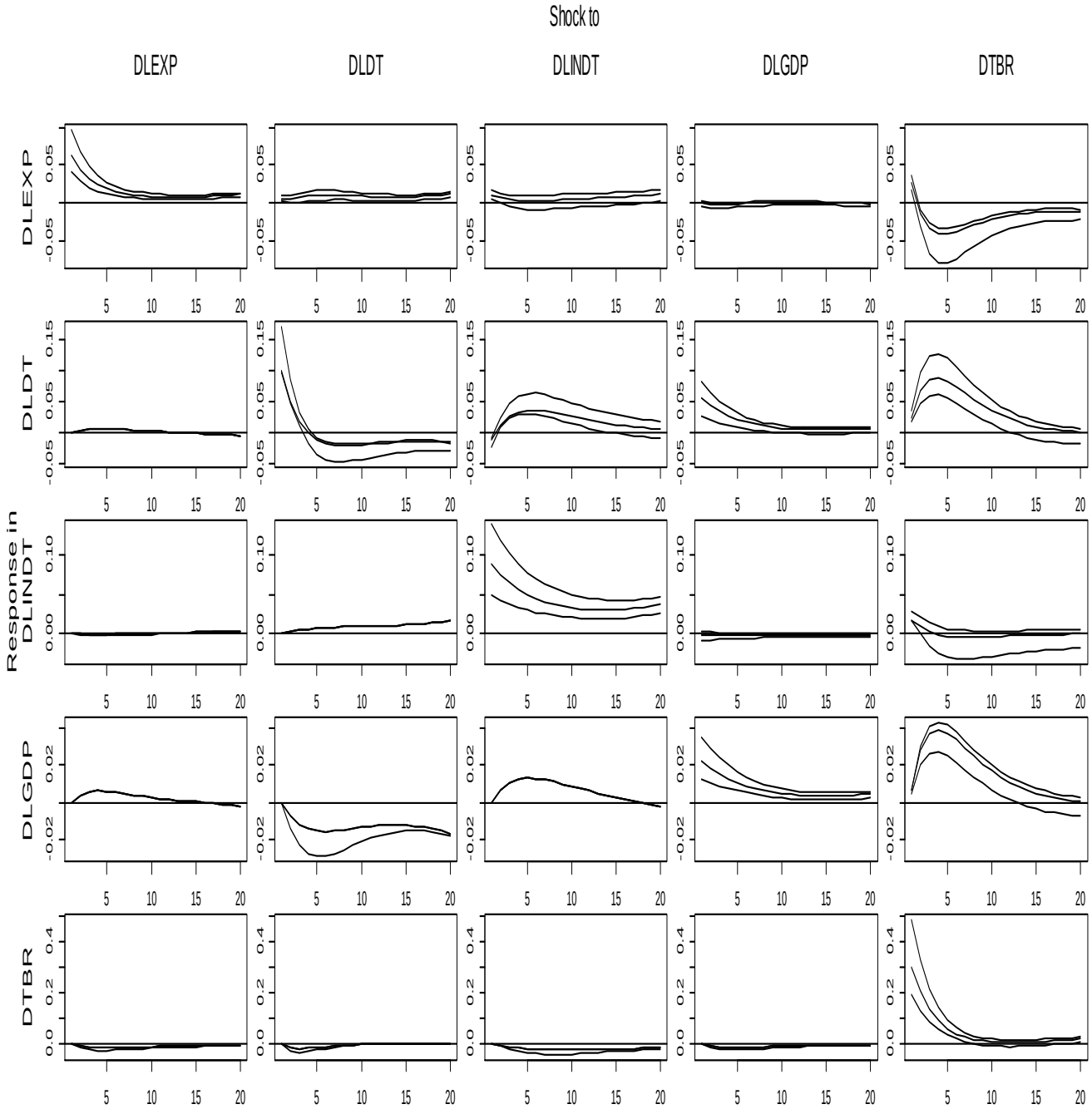
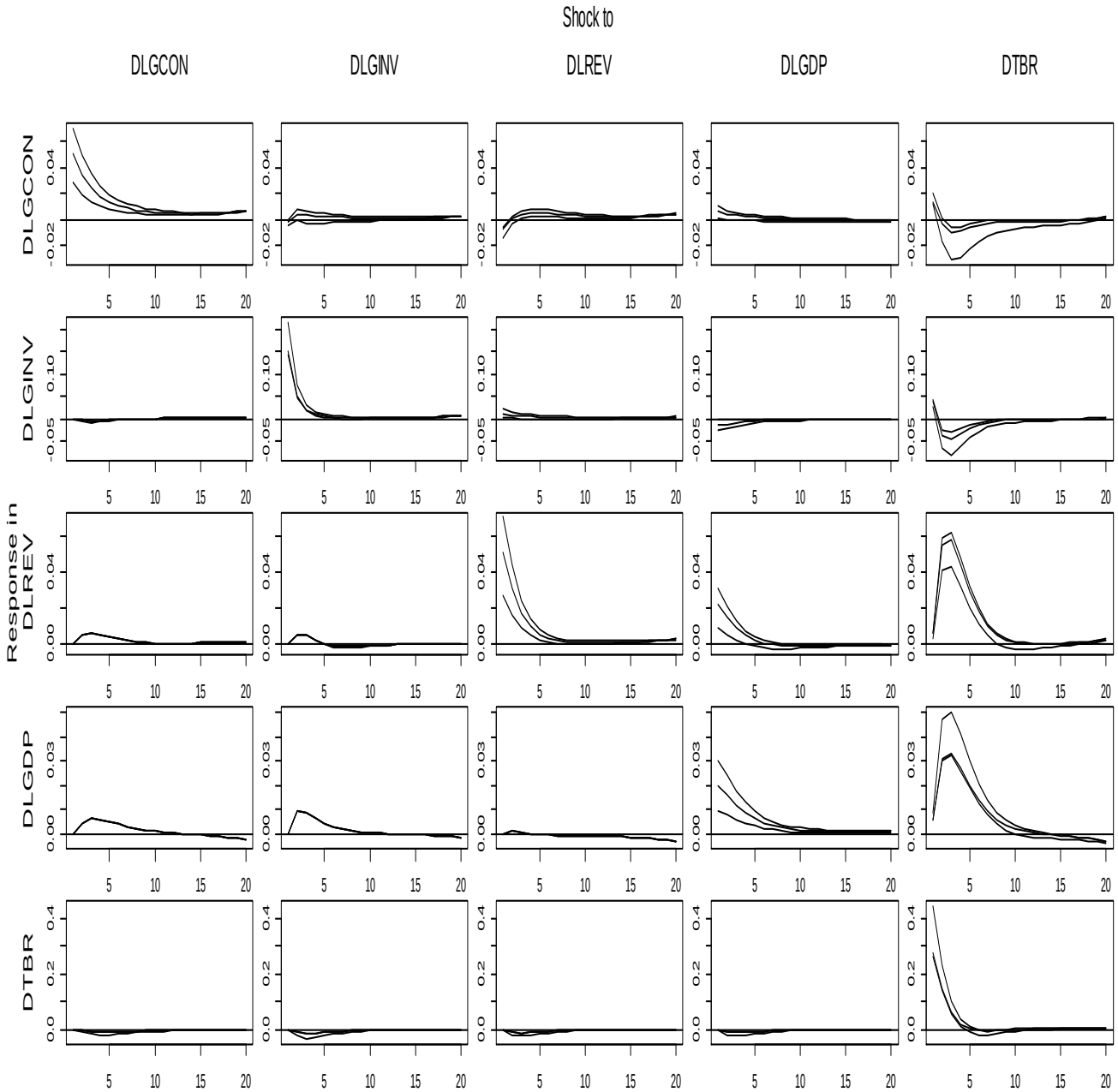


Figure 5.5: Response to Structural one S.D. Innovations



5.6 Conclusion

The effects of fiscal policy on economic activities are elusive in the literature. This study therefore contributes to the debate by estimating a Bayesian Structural Vector Autoregression (BSVAR) model to analyse the effects of fiscal policy on economic

activities and its implication for fiscal sustainability in South Africa using annual data for the period 1960 to 2010. The findings are reported in terms of impulse responses, reporting the median of the posterior distribution of the responses as well as the error bands based on 68% posterior regions (point wise). The results show that positive total government spending per capita shocks in general have a "crowding–in" effect as GDP per capita and private investment respond positively thus supporting the "Keynesian effect" of fiscal policy. The growth in government consumption as well as capital expenditure has positive effects but the growth in the multiplier effect is larger in consumption per capita expenditure compared to capital expenditure per capita.

The effect of the total tax burden on the GDP and private investment is negative and persistent in the long-term (i.e. after 4 years). At the aggregate level therefore, the net effect of fiscal policy is that it is growth enhancing in the short - and medium-terms leading to fiscal sustainability (since $r < g$) but in the long-term, the growth promoting effects of increased public intervention are offset by the growth inhibiting effects of increased taxes; hence, the response of fiscal policy to growth is close to zero which is a threat to fiscal sustainability. The analysis also reveals that a direct tax is more distortionary whilst indirect taxes do not have a distortionary impact in the short-term. Thus, there is a need for the fiscal authorities in South Africa to consider a shift towards more indirect taxes away from direct taxes. The analysis in this Chapter further suggests that the reprioritisation of consumption expenditure i.e. a reduction in weak or non-productive spending and a corresponding increase in highly productive spending is important for growth enhancement which is essential for long-term fiscal sustainability in South Africa.

CHAPTER SIX: CONCLUSIONS AND POLICY RECOMMENDATIONS

6.1 Introduction

This Chapter summarises the conclusions related to the major findings and provides policy recommendations based on the research results discussed in the preceding Chapters. It is structured as follows: Section 6.2 summarises the main findings of the research; Section 6.3 outlines some policy recommendations; and Section 6.4 concludes by highlighting the limitations of the study with some suggestions for further research in the same or related fields.

6.2 Summary of main findings

In this study, fiscal sustainability is defined consistent with the government inter-temporal budget constraint framework, which argues that an economy's ability to fulfil its debt obligations is dependent on sustaining the budgetary position where government spending net of interest payments in present value terms does not exceed discounted public revenue over the existing path of the economy. Fiscal sustainability analysis in this context, therefore, considers the revenue side of the budget as well as expenditure obligations.

Reviewing the tax structure, it was found that the rates of the main taxes of South Africa compare less favourably to other emerging economies and similar worldwide averages. For instance, even though fiscal authorities have reduced the CIT rate from a high 50% to 28%, this rate is still higher when compared to other upper middle economies and the rest of the world's average. The country compares no better either when the PIT rate is considered but its VAT rate compares favourably to that of other economies. A high marginal tax rate relative to other economies could

negatively affect private sector growth and by implication growth of the GDP. With regards to budget allocations it is showed that collectively, socio-economic expenditures account for about half of government consumption expenditure. It is important to note that there was a reduction (although marginal) in the proportional allocation to Education whilst at the same time the proportional allocations to Social Protection, Public Order and Safety and Social Grants have increased.[55] Defence expenditure was proportionally high pre-1994 and immediately after the first democratic election, but declined in the later years of the democratic South Africa. Beyond 1994, the policy of fiscal prudence resulted in a substantial decline in real debt cost whilst the real growth rate of the economy increased considerably, thereby reducing the (r-g) gap. Nevertheless, the decline in the growth of the economy after 2008, in part due to the slowdown in the world economy, has caused the (r-g) gap to increase again.

Moving forward, fiscal authorities are proposing an improvement in the fiscal balance in the medium-term to 3% of GDP which they envisage to be made possible by capping public sector wages as well as tax increases. This study, however, cautions that the highly unionised nature of the workforce may be an obstacle to implementing a public sector wage cap. This may result in compromising other spending categories like capital expansion. Furthermore, an increased tax burden may inhibit both future consumption expenditure and savings, which *a priori* will negatively affect

[55] It should be noted that although the ratio of expenditure on Education to GDP has decreased, the absolute amount continuous to increase. In fact Education is still the single largest vote on the budget. Thus, increasing the expenditure flow on Education in itself may not contribute to improved productivity of the labour force. What may be more important is improving the efficiency of service delivery in this sector but this should be supported by sufficient financing.

growth, more so if capital-spending objectives are not achieved, thereby posing a risk to long-term fiscal sustainability.

The theoretical literature reviewed on the concept of fiscal sustainability seems to suggest two main schools of thought. According to the first school (Domar model) it is normal for the real interest rate to be higher than the rate of real economic activity and that government could grow the economy out of the burden of public debt by relying on the income multiplier. The other school (Mainstream school) requires the real growth rate to be higher than the real interest rate to maintain dynamic efficiency. Thus, **(**r - g) represents the nexus between growth theory which describes the justification to run a primary deficit and fiscal sustainability theory that describes the ability to run primary deficits.

The mainstream theory, which forms the basis for this study, suggests that fiscal sustainability depends on whether the (r- g) gap is positive or negative. If the gap is positive (i.e. r > g), a primary deficit reduces inter-temporal utility and drives the economy away from the “golden rule” of capital accumulation. On the other hand, if negative (i.e. r < g), a deficit improves inter-temporal utility and drives the economy closer to the optimal level of capital accumulation.

Consistent with the inter-temporal budget rule, this study suggests that fiscal policy in South Africa over the sample period has been sustainable but likely to be adjusted more quickly when the budget deficit exceeds 4.02% of GDP but the stabilisation policies by fiscal authorities are fairly neutral at deficit levels below this threshold; that is, at deficit levels of 4.02% of GDP and below. The fiscal reaction speed of the South African government (i.e. increasing the tax burden) to lower the large deficit

levels towards a band of tolerable values, indicate that they are indeed concerned about solvency. Thus, on the basis of this historical fiscal stance, it can be expected that fiscal policy will remain sustainable in the medium-term and that the government's projection to reduce the fiscal deficit from a high 5.3% of GDP in 2010 to 3.0% in 2015 is plausible.

However, it could be argued that for a country like South Africa the scope for a cut in public expenditure is likely to be very limited, considering the huge backlogs in social service provision and relatively vibrant labour unions. Therefore, the fiscal authorities will have to look more carefully at the revenue side of the budget. This study supports other studies in the empirical literature stating that the structure of the tax system does seem to matter for private investment and economic growth. Identifying possible leakages that erode the tax base should also be considered. As a result, shadow economic activity is being investigated in this study.

The results show that on average, the size of the South African shadow economy amounts to 22.18% of GDP with estimated revenue evaded at about 7% of GDP. Further analysis shows that there is a strong positive relationship between the tax burden and shadow income but that this relationship is not symmetric. In South Africa, businesses and individuals are likely to react quicker when the tax burden changes fall outside the band of -3.64% to +2.13% of GDP but remains neutral as long as they are within this band. The implication of this finding is that any attempt by the fiscal authorities to increase the tax burden by more than the estimated threshold of 2.13% in order to close the budget deficit might trigger a significant response from the shadow economy, thereby reducing the tax base and further worsening the fiscal

deficit. Thus, instead of increasing the tax burden outside the estimated tax band it might be more useful to protect the revenue base through other measures such as improving efficiency in tax administration in the form of enforcement of tax laws and auditing as opposed to marginal tax rate changes. Further, the impact of changes in indirect taxes such as VAT seem to be non-distortive which suggest that the fiscal authorities have a re-look at the composition of the total tax burden of this country.

Next, the analysis shows that total government spending increases have a 'crowding–in' effect as GDP per capita and private investment respond positively. The increase in per capita government consumption expenditure has a larger growth multiplier effect than per capita capital expenditure.

In addition, the effect of the total tax burden on the GDP is negative and persistent in the long-term (i.e. after 4 years). At the aggregate level therefore, the net effect of expansionary fiscal policy is that it is growth enhancing in the short- and medium-terms leading to fiscal sustainability (since $r < g$) but in the long-term, the growth promoting effects of increased public intervention are offset by the growth inhibiting effects of increased taxes; hence, the response of fiscal policy to growth is minima leading to fiscal unsustainability.

6.3 Policy recommendations

The major findings of this study suggest that fiscal policy makers should take cognisance of the following in their policy formulation:

Firstly, the nature of fiscal policy in South Africa over the post-1994 period has shown to be successful from a fiscal sustainability perspective and should therefore be continued. However, the fact that government only seem to be pro-active in the case when the budget deficit exceeds the 4% margin and actually seem to be fairly neutral at deficit levels below this ratio should be investigated. By implementing drastic tax increases in such a scenario could be detrimental to the growth of the revenue base. Conversely, tax relief at lower levels of the margin outlined, and even in times of surpluses could be growth enhancing and should be implemented actively.

Secondly, this study shows that the tax burden does seem to affect growth in the shadow economy. In fact the amount of tax revenue evaded is sufficiently large enough to enable government to achieve its projected medium-term fiscal deficit of 3% of GDP. Thus, if the revenue collection effort could be further strengthened, the South African government may be able to maintain fiscal sustainability in the medium-term without imposing too great a hardship on taxpayers in the country by means of tax increases. As noted earlier the tax burden on individuals and companies is already high compared to that of other countries at a similar level of economic development and there seems to be an increasing trend to add to the statutory rates which might affect the government's revenue base. Therefore, request for additional taxes to boost revenue might only trigger a further growth in the shadow economy, as the projected tax burden increase exceeds the estimated threshold of 2.13% proposed in this study. Such a reaction from shadow income poses a threat to long term fiscal sustainability.

Thirdly, in their attempt to expand and secure the revenue base fiscal authorities in South Africa should consider further adjustments to the composition of the revenue base. The continuous reliance of the government on direct taxes is shown to adversely affect growth per capita, which could destabilise the fiscal gains already achieved. The results, therefore, support the international trend towards a shift to indirect taxes from direct taxes. This might be politically sensitive given the proportionally large unrecorded sector but the "regressive" nature of such a switch could be dealt with in various ways, including differential rates, zero rating, exemptions, etc. However, it might require strong leadership to implement.

Fourthly, expenditure priorities have to be carefully considered. Fiscal authorities should guard against populist spending patterns and prioritise those expenditures that result in capacity building and enhancing growth and employment. In this regard, the declining trend in the proportional share of expenditure on Education has to be noted.[56] Thus, only by prioritising its expenditures to affect productivity and enhance efficiency within such "productive" areas, would government be able to contribute toward enhancing growth which in turn is essential for long-term fiscal sustainability.

Thus, to enhance long-term fiscal sustainability would require continuous adjustment of policies including the speed of policy adjustment, the stabilisation of the tax burden but with a redirection of focus from direct to indirect taxes; the protection of the revenue base, in particular a reduction in the existing level of tax revenue evaded and the reprioritisation of government expenditures.

[56] As mentioned earlier, of great importance is the improvement of the efficiency of service delivery given the already high level of funding. However a declining trend in the share of expenditure on Education could implicate a shift in priorities which might be detrimental from a growth and productivity perspective.

6.4 Suggestions for future studies

In this study, fiscal sustainability has been analysed in the context of the mainstream view of the government's inter-temporal budget constraint, which considers the causes of fiscal unsustainability to lie in the difference between the levels of expenditure and revenue. The study however, does not include a broader social and political context of fiscal sustainability. In a middle income country like South Africa where the role of government is politically and socially important and controversial, future research should explore how the quest to enhance fiscal consolidation would affect political and social stability which might in turn endanger the sustainability of such fiscal policies. Furthermore, should more quality data becomes available, the quantifying of the fiscal implications of expected developments such as demographic changes, developments in health cost and public pension liabilities would also require future research.

Secondly, in analysing the growth effect of fiscal policy, this study has not considered the possible non-linear effects of fiscal policy on growth. Thus, in future studies, it would be interesting to use a Markov-Switching framework to propose an alternative way of measuring the impact of fiscal policy on output growth dynamics in the short-run. The advantage of a Markov-Switching model is that it separates periods of low growth from periods of high growth allowing the probabilistic structure of the transition from one regime to the next to be a function of fiscal variables.

REFERENCES

Akyuz, Y. 2007. Debt sustainability in emerging markets: A critical appraisal. *DESA Working Paper* No.61, ST/ESA/2007/DWP 61.

Afonso, A. 2005. Fiscal policy sustainability: some unpleasant European case. *FinanzArchiv: Public Finance Analysis,* 61(1):19-44.

Afonso, A. & Rault, C. 2008. 3-Step analysis of public finance sustainability. The case of the European Union. *European Central Bank Working Paper Series*, 908, June.

Afonso, A. & Sousa, R. M. 2012. The macroeconomic effects of fiscal policy. *Applied Economics,* 44(34) 4439-4454.

Alesina, A. & Perotti, R. 1995. The political economy and budget deficits. IMF Staff papers, March 1-31. Washington, D. C. International Monetary Fund.

Allingham, M. G. & Sandmo, A. 1972. Income tax evasion: a theoretical analysis. *Journal of Public Economics,* 1(3): 323-338.

Arendse, J. A., Jordan, K., Kolitz, M. A. & Stein, M. L. 2000. Silke: South African Tax System (2 Eds.). Butterworth, Cape Town.

Arghyrou, M. G. & Luintel, K.B. 2007. Government solvency: revisiting some EMU countries. *Journal of Macroeconomics,* 29:387-410.

Baharumshah, A. Z. & Lau, E. 2007. Regime changes and the sustainability of fiscal imbalance in East Asian countries. *Economic Modelling,* 24(6): 878-89.

Bajada, C. 1999. Estimates of the underground economy in Australia. *Economic Record,* 75 (231): 369-384.

Bajada, C. 2002. Estimating the uses of currency in Australia. *Economic papers,* 21(3):14-30.

Bajada, C. 2005. Unemployment and the underground economy in Australia. *Applied Economics,* 37(2):177-189.

Baldacci, E., McHugh, J. & Petrova, I. 2011. Measuring fiscal vulnerability and fiscal stress: a proposed set of indicators*. IMF Working Paper*, WP/11/94.

Ballabriga, F. C. & Martinez-Mongay, C. 2005. Sustainability of EU public finances. *European Central Commission Directorate-General for Economic and Financial Affairs Economic Papers,* 225: 1-30.

Barker, F. C., Buckle, R. A. & Clair, R. W. 2008. Roles of fiscal policy in New Zealand. *New Zealand Treasury Working Pape*r 08/02.

Barro, R. J. 1990. Government spending in a simple model of endogenous growth, *Journal of Political Economy,* 98(2): 103-25.

Barro, R. J. & Salai-Martin, X. 1992. Public finance in models of economic growth. *Review of Economic Studies,* 59(4): 645-661.

Barro, M. & Kneller, R. 2000. Testing the endogenous growth model: public expenditure, taxation and growth over the long-run. Discussion Paper No. 00/25, University of Nottingham.

Bernanke, B. S. 1986. Alternative explanations of the money-income correlation. *Carnegie-Rochester Conference Series on Public Policy,* 25(1): 49-99.

Blanchard, O. & Perotti, R. 2002. An empirical characterisation of the dynamic effects of changes in government spending and taxes on output. *Quarterly Journal of Economics,* 117(4):1329-1368.

Blanchard, O. 1993. Suggestions for a new set of fiscal indicators: In: Verbon, H.A.A. and Van Windens, F.A.A.M (eds.) 1993. *The political Economy of Government Debt,* 307-25.

Blanchard, O. Chouraqui, J. & Sarton, N. 1990. The sustainability of fiscal policy: new answers to old questions. *OECD Economic Studies,* 15(1):7-36.

Bleaney, M. Gemmell, N. & Kneller, R. 2001. Testing the endogenous growth model: public expenditure, taxation, and growth over the long run. *Canadian Journal of Economics/Revue Canadienne d'Economique,* 34(1): 36-56.

Bohn, H. 1998. The behaviour of the U.S. public debt and deficits. *The Quarterly Journal of Economics,* 113(3): 949-963.

Bohn, H. 2007. Are stationary and cointegration restrictions really necessary for the inter-temporal budget constraint? *Journal of Monetary Economics,* 54(7):1837-47.

Bose, N., Capasso, S. & Wurm, M. 2008. The impact of banking development on the size of the shadow economy. *Centre for Studies in Economics and Finance Working Paper*, No. 207, University of Salerno-Italy.

Bose, N., Haque, M. E. & Osborn, D. R. 2007. Public expenditure and economic growth: a disaggregated analysis for developing countries. *The Manchester School,* 75(5): 533-56.

Bravo, A.B.S. & Silvestre, A.L. 2002. Inter-temporal sustainability of fiscal policies: some tests for European countries. *European Journal of Political Economy,* 18(3): 517-528.

Brandt, P. T. & Freeman, J. R. 2006. Advances in Bayesian Time Series modelling. *Political Analysis,* 14(1):1-36.

Brandt, P. T. & Freeman, J.R. 2009. Modelling macro-political dynamics. *Political Analysis,* 17(2):113-142.

Braum, M. 2007. Fiscal policy in Latin America. A paper prepared for the Consulta de San Jose, a joint IDB-Consensus Centre Project. Available online at: www.iadb.org/document.cfmid=1186230.

Bravo, A.B.S. & Silvestre, A. L. 2002. Intertemporal sustainability of fiscal Policies: some tests for European countries. *European Journal of Political Economy,*18(3): 517-528.

Breusch, T. 2005a. The Canadian underground economy: An examination of Giles and Tedds. *Canadian Tax Journal,* 53(2): 367-91.

Breusch, T. 2005b. Australia's cash economy: are estimates credible*? The Economic Record,* 81 (255): 394-403.

Brock, W. A., Dechert, W. & Scheinkman, J. 1987. A test for independence based on the correlation dimension. *Working Paper,* University of Wisconsin at Madison, University of Houston, and University of Chicago. Available at: gopher.econ.wisc.edu

Burger, P. 2003. Sustainable fiscal policy and economic stability: theory and practice. *Edward Elgar Publishing, (First eds.)* Massachusettes, USA.

Burger, P., Stuart, I., Jooste, C. & Cuevas, A. 2012. Fiscal sustainability and the fiscal reaction function for South Africa. *South African Journal of Economics,* 80(2): 209-27.

Burnside, C. Eichenbaum, M. & Fisher, J.D.M., 2004. Fiscal shocks and their consequences. *Journal of Economic Theory,* 115(1): 89-117.

Buti, M. 1990. Monetary and fiscal rules for public debt sustainability. Economic papers, Inter Paper 84, Commission of the European Communities.

Cagan, P. 1958. The demand for currency relative to the total money supply. *Journal of Political Economy,* 66(3):302-328.

Caldara, D. & Kamps, C. 2008. What are the effects of fiscal policy shocks? A VAR-based comparative analysis. *European Central Bank (ECB) Working Paper Series* 877.

Canagarajah, S., Brownbridge, M., Paliu, A. & Dumitru, I. 2012. The challenges to long run fiscal sustainability in Romania. *Policy Research Working Paper, WPS* 5927.

Caragata, P. J. 1995. The Integration of the Formal and Informal Financial Sectors in Albania. Mission Report for the International Monetary Fund, Washington, D.C.

Caragata, P. J. & Giles, D.E.A. 2000. Simulating the relationship between the hidden economy and the tax size and tax mix in New Zealand. In: *Taxation and the Limits of Government,* eds. Scully, G.W. and Caragata, P. J., Kluwer Boston, 221-40

Cashin, P., Haque, N. U. & Olekalns, N. 2003. Tax smoothing, tax tilting and fiscal sustainability in Pakistan. *Economic Modelling,* 20(1):47-67.

Castro, F. & Cos, P.H. 2008. The economic effects of fiscal policy: the case of Spain. *Journal of Macroeconomics,* 30(3):1005-28.

Cebula, R. J. 1997. A Note on the impact of the United States federal budget deficit on the intermediate-term interest rate, 1960-94. *Applied Economics Letters, Taylor and Francis Journals,* 4(11): 711-714.

Chand, S. K. & Moene, K.O. 1999. Controlling fiscal corruption. *World Development,* 27(7): 1129-1140.

Chouragui, J., Jones, B. & Montador, R. B. 1986. Public debt in the medium term context and its implication for fiscal policy. *OECD Working Paper,* No. 30, Paris.

Christiano, L. J., Eichenbaum, M. & Evans, C.L. 1999. Monetary policy shocks: what have we learned and to what end? In: Taylor, J., Woodford, *M. eds. Handbook of Macroeconomics, IA*, Elsevier Amsterdam.

Chung, M. K. 2002. Fiscal sustainability in the wake of economic crisis in Korea. *Journal of Asian Economics,* 13(5): 659-669.

Cicek, D. & Elgin, C. 2011. Cyclicality of fiscal policy and the shadow economy. *Empirical Economics,* 41(3): 725-737.

Cipollini, A. 2001. Testing for government intertemporal solvency: a smooth transition error correction model approach. *The Manchester School* 69(6): 643-655.

Cipollini, A. Fattouh, B. & Mouratidis, F. 2009. Fiscal readjustments in the United States: a nonlinear time series analysis. *Economic Inquiry,* 47(1): 34-54.

Clotfelter, C. T. 1983. Tax evasion and tax rates: an analysis of individual returns. *The Review of Economics and Statistics,* 65(3): 363-373.

Colombier, C. 2008. Government and growth, group of Economic Advisors. *Swiss Federal Finance Administration, Working Paper,* 4.

Cottarelli, C. 2011. The Risk Octagon: A comprehensive framework for assessing sovereign risks. A paper, presented at University of Rome "La Sapienza," January. Available at: www.imf.org/external/np/fad/news/2011/docs/Cottarelli1.pdf.

Croce, E. & Juan-Ramon, V. H. 2003. Assessing fiscal sustainability: a cross-country comparison. *IMF Working Paper* WP/03/145, International Monetary Fund, Washington, DC.

Cronje, A. 1995. Deficit financing and the public debt in South Africa. Discussion Paper 2, the Budget Project. University of Cape Town, School of Economics.

Cunado, J., Gil-Alana, L. A. & Perez de Gracia, F. 2004. Is the US fiscal deficit sustainable? A fractionally integrated approach. *Journal of Economics and Business, Elsevier,* 56(6): 501-526.

De Castro Fernández, F. & Hernández De Cos, P. 2006. The economic effects of exogenous fiscal shocks in Spain: a SVAR approach. *ECB Working Paper Series,* No.647.

Dell'Anno, R. & Schneider, F. 2003. The Shadow Economy of Italy and other OECD Countries: What do we know? *Journal of Public Finance and Public Choice*, 21(2): 97-120.

D'Erasmo, P. N. & Moscoso Boedo, H. J. 2012. Financial structure, informality and development. *Journal of Monetary Economics*, forthcoming.

Devarajan, S., Swaroop, V. & Zou, H. 1996. The composition of public expenditure and economic growth. *Journal of Monetary Economics,* 37(2): 313-344.

Dickey, D. A. & Fuller, W. A. 1981. Likelihood ratio tests for autoregressive time series with a unit root. *Econometrica,* 49(4): 1057-1072.

Divaris, C. & Stein, M. L. 2010. South African Income Tax Guide. LexisNix, Cape Town.

Domar, E. 1944. The burden of debt and national income. *American Economic Review,* 34(4): 798-827.

Durlauf, S. 2000. Econometric analysis and the study of Economic Growth: A sceptical perspective. *Macroeconomics and the Real World (1):* In: *Econometric Techniques and Macroeconomics* (eds.).

Dwyer, G. P., Locke P. & Yu, W. 1996. Index arbitrage and nonlinear dynamics between the S&P 500 futures and cash. *Review of Financial Studies,* 9(1): 301-332.

Easterly, W. & Schmidt-Hebbel, K. 1994. Fiscal adjustment and macroeconomic performance: a synthesis. In: Easterly, W., Rodriquez, C.A. & Schmidt-Hebbel, K. 1994. *Public Sector Deficit and Macroeconomic Performance,* 15-78.

Edelberg, W., Eichenbaum, M. & Fisher, J. 1999. Understanding the effects of shocks to government purchases. *Review of Economic Dynamics,* 2(1): 166-206.

Elgin, C. 2012. Cyclicality of the informal economy. *Working Papers* 2012/02, Bogazici University, Department of Economics.

Eltis, W. 1998. Debt, deficits and default. In: Maloney, J. (eds.). 1998. *Debt and Deficits: An Historic Perspective,* 116-132.

Engle, R. F. & Granger, C.W.J. 1987. Cointegration and error correction: representation, estimation and testing. *Econometrica,* 55(2): 251-276.

Escribano, A. & Jorda, O. 2001. Testing nonlinearity: decision rules for selecting between logistic and exponential STAR models. *Spanish Economic Review,* 3(3): 193-209.

Faal, E. 2003. Currency demand, the underground economy, and tax evasion: the case of Guyana. *Working Paper* 03/07, International Monetary Fund.

Fatas, A. & Mihov, I. 2001. The effects of fiscal policy on consumption and employment: theory and evidence. Discussion Paper Series No. 2760.

Favero, C. 2002. How do European monetary and fiscal authorities behave? Discussion Paper No. 3426, Centre for Economic Policy Research.

Favero, C. & Giavazzi, F. 2008. Debt and the effects of fiscal policy. *University of Bocconi, Working Paper,* No. DP6092.

Ferwerda, J., Deleana, I. & Unger, B. 2010. Revaluating the Tanzi-Model to estimate the underground economy. Utrecht School of Economics, Tjalling C. Koopmans Research Institute, Discussion Paper Series 10-04.

Feige, E. L. 1979. How big is the irregular economy? *Challenge,* 22(1): 5-13.

Feve, P. & Henin, P. Y. 2000. Assessing effective sustainability of fiscal policy within the G-7. *Oxford Bulletin of Economics and Statistics,* 62(2): 175-195.

Feld, L. P. & Frey, B. S. 2007. Tax compliance as the result of a psychological tax contract: the role of incentives and responsive regulation. *Law and Policy,* 29(1): 102-120.

Fjeldstad, O. H. & Schulz-Herzenberg, C. 2012. Peoples' views of taxation in Africa: a review of research on determinants of tax compliance. *CMI Working Paper Series,* WP2012: 7 Bergen: Chr. Michelsen Institute.

Franzsen Commission. 1968. First report of the Commission of Enquiry into Fiscal and Monetary Policy in South Africa (Chairman: D.G. Franzsen) RP 24/1969, Pretoria, Government Printer.

Freeman, J., Williams, J. T. & T. Lin, T. 1989. Vecto Autoregression and the study of politics. *American Journal of Political Science,* 33(4): 842-77.

Gali, J., Valles, J. & Lopez-Salido, J. D. 2007. Understanding the effects of government spending on consumption. *Journal of the European Economic Association,* 5(1): 227-270.

Ghosh, S. & Gregorious, A. 2008. The composition of government spending and growth: is current or capital spending better? *Oxford Papers,* 60(3):484-516.

Ghosh, S. & Roy, U. 2004. Fiscal policy, long-run growth, and welfare in stock-flow model of public goods. *Canadian Journal of Economics,* 37(3): 742-756.

Giavazzi, F. & Pagano, M. 1990. Can severe fiscal contractions be expansionary? Tales of two small European countries. In: NBER Macroeconomics Annual (eds.) O.J. Blanchard and S. Fischer, MIT Press, Cambridge, MA, 75-110.

Giles, D. E. A. & Caragata, P. J. 2001. The learning path of the hidden Economy: the tax burden and tax evasion in New Zealand. *Applied Economics,* 33(14): 1857-1867.

Giles, D. E. A. & Johnson, B. J. 2002. Taxes, Risk-Aversion, and the Size of the Underground Economy: A Nonparametric Analysis with New Zealand Data. *Pacific Economic Review,* 7(1): 97-113.

Giles, D. E. A. & Tedds, L. M. 2002. Taxes and the Canadian underground economy. *Canadian Tax Foundation,* Toronto.

Giles, D. E. A., Werkneh, G. T. & Johnson, B. J. 2001. Asymmetric responses of the underground economy of tax changes: evidence from New Zealand data. *Economic Record,* 77(237): 148-159.

Gill, J. 2004. Introducing the special issue of political analysis on Bayesian methods. *Political Analysis,* 12(4): 323-37.

Giordano, R., Mamigliano, S., Neri, S. & Perotti, R. 2007. The effects of fiscal policy in Italy: evidence from a VAR model. *European Journal of Political Economy,* 23(3): 707-33.

Granger, C. & Terasvirta, T. 1993. Modelling nonlinear economic relationships, advanced text in econometrics. *London Oxford Economic Press.*

Greenidge, K., Holder, C. & Mayers S. 2009. Estimating the size of the informal economy in Barbados. *Business, Finance & Economics in Emerging Economies,* 4(1):197-227.

Greiner, A., Koeller, U. & Semmler, W. 2006. Testing sustainability of German fiscal policy: evidence for the period 1960-2003. *Empirica,* 33(2): 127-140.

Grote, M. 2008. The South African tax reforms since 1994 to 2005: some key lessons. National Treasury, Pretoria, South Africa.

Gupta, S., Clements, B., Baldacci, E. & Mulas-Granados, C. 2005. Fiscal policy, expenditure composition and growth in low-income countries. *Journal of International Money and Finance,* 24(3): 441-463.

Hakkio, C. S. & Rush, M. 1991. Is the budget deficit 'Too Large'? *Economic Inquiry,* 29(3): 429-445.

Hamilton, J. D. & Flavin, M. A. 1986. On the limitations of government borrowing: a framework for empirical testing. *American Economic Review,* 76(4): 808-819.

Harberger, A. C. 1964. Principles of efficiency: the measurement of waste. *American Economic Review,* 54(3): 58-76.

Hatemi, J. A. 2002. Fiscal policy in Sweden: effects of EMU criteria convergence. *Economic Modelling,* 19(1): 121-136.

Heppke-Falk, K. H., Tenhofen, J. & Wolff, G.B. 2010. The macroeconomic effects of exogenous fiscal policy shocks in Germany: a disaggregated SVAR analysis. *Journal of Economics and Statistics,* 230(3): 328-355.

Hill, R. & Kabir, M. 1996. Tax rates, the tax mix and the growth of the underground economy in Canada: what can we infer? *Canadian Tax Journal,* 44(6):1552-1583.

International Monetary Fund. 2011. Shifting gears tackling challenges on the road to fiscal adjustment, World economic and Financial Surveys, Fiscal Monitor, April. Washington, D.C.

International Monetary Fund. 2010. Fiscal exit: from strategy to implementation, World Economic and Financial Survey. Fiscal Monitor, November. Washington D.C.

International Monetary Fund. 2004. Global financial stability report, market development and issues,02. April. Washington D. C.

Jaimovich, D. & Panizza, U. 2010. Public Debt around the World: A New Dataset of Central Government Debt. *Taylor and Francis Journals,* 17(1): 19-24.

Jansen, E. S. & Teräsvirta, T. 1996. Testing parameter constancy and super exogeneity in econometric equations. *Oxford Bulletin of Economic and Statistics*, 58 (4): 735-765.

Johansen, S. 1991. Estimation and hypothesis testing of cointegration vectors in Gaussian Vector Autoregressive Models. *Econometrica,* 59(6): 1551-1580.

Johnson, S., Kaufmann D. & Zoido-Lobatón, P. 1998a. Regulatory discretion and the unofficial economy. *American Economic Review*, 88(2): 387–392.

Jooste C., Liu, G. & Naraidoo, R. 2012. Analysing the effects of fiscal policy shocks in the South African Economy. Department of Economics, *University of Pretoria Working Paper Series,* No. 2012-06.

Joubert, J. & Bradshaw, D. 2005. Population ageing and health changes in the Chronic Diseases of Lifesyle in South Africa 1995-2005, Medical Research Centre South Africa.

Kadiyala, K. R. & Karlsson, S. 1998. Numerical methods for estimation and inference in a Bayesian VAR-model. *Journal of Applied Econometrics,* 12(2): 99-132.

Katz Commission. 1994. Interim reports into certain aspects of the tax structure of South Africa. 1994-1999, Government Printer, Pretoria, South Africa.

Kaufmann, D. & Kaliberda, A. 1996. Integrating the unofficial economy into the dynamics of post-socialist economies: a framework for analysis and evidence. In:

Economic Transition in Russia and the New States of Eurasia, edited by Bartlomiej Kaminski, Armonk, N.Y and M. E. Sharpe.

Kesselman, J. R. 1989. Income tax evasion: an inter-sectoral analysis. *Journal of Public Economics*, 38(2): 137-182.

King, R. & Rebelo, S. 1990. Public policy and economic growth: Developing neoclassical implications. *Journal of Political Economy,* 98(1): 126-151.

Kirchgaessner, G. 1983. Size and development of the West German shadow economy. *Journal of Institutional and Theoretical Economics (Zeitschrift fur die gesamte Staatswissenschaft),* 139(2): 197-214.

Kirchgaessner, G. & Prohl, S. 2006. Sustainability of Swiss fiscal policy. Cesifo *Working Paper*, no. 1689.

Klovland, J. T. 1984. Tax evasion and the demand for currency in Norway and Sweden, Is there a Hidden Relationship? *The Scandinavian Journal of Economics,* 86(4): 423-439.

Kneller, R., Bleaney, M. F. & Gemmell, N. 1999. Fiscal policy and growth: evidence from OECD countries. *Journal of Public Economics,* 74(2): 171-190.

Koskela, E. 1983. A note on progression, penalty schemes and tax evasion. *Journal of Public Economics,* 22(1): 127-133.

Krolzig, H. M. & Hendry, D. F. 2001. Computer Automation of General-to-Specific Model Selection Procedures. *Journal of Economic Dynamics and Control,* 25(6-7): 831-866.

Kunst, R. M. 1992. Dynamic patterns in interest rates: threshold cointegration with ARCH. Discussion Paper, Institute for Advanced Studies, Vienna.

Kunst, R. M. 1995. Determining long-run equilibrium structures in bivariate threshold autoregressions: a multiple decision approach. Discussion Paper, Institute of Advanced Studies Vienna.

Kwiatkowski, D., Phillips, P.C.B., Schmidt, P. & Shin, Y. 1992. Testing the null hypothesis of stationary against alternative of a unit root; how sure are we that economic time series have a unit root? *Journal of Econometrics,* 54(1): 159-178.

Litterman, R. B. 1986. Forecasting with Bayesian Vector Autoregressions: five years of experience. *Journal of Business, Economics and Statistics,* 4(1): 25-38.

Lemieux, T., Fortin, B. & Frechette, P. 1994. The effect of taxes on labour supply in the underground economy. *American Economic Review,* 84(1): 231-254.

Lucas, R. 1990. Supply-side economics: an analytical review. *Oxford Economic Paper,* 42 (2): 293-316.

Lutkepohl, H. 1990. Asymptotic distribution of Impulse response functions and forecast error variance decompositions in Vector Autoregressive methods. *Review of Economics and Statistics,* 72(1): 53-78.

Makrydakis, S., Tzavalis, E. & Balfoussias, A. 1999. Policy regime changes and long-run sustainability of fiscal policy: an application to Greece. *Economic Modelling* 16(1): 71-86.

Manuel, T. 2004. Longer term fiscal policy issues in South Africa. Paper presented at the Bureau for Economic Research 60th anniversary conference Somerest West, 18 November 2004.

Maurin, A., Sookram, S. & Watson, P.K. 2006. Measuring the size of the hidden economy in Trinidad and Tobago. *International Economic Journal,* 20(3): 321-341.

Margo Commission. 1987. Report of the Commission of inquiry into the tax structure of the Republic of South Africa (Chairman: C.S. Margo), RP34/1987. Pretoria: Government Printer.

Marfan, M. 2008. Fiscal policy and economic cycles: The Chilean fiscal rule, presentation prepared for the G-20 workshop, Buenos Aries, June 19-20, 2008.

Martin, G. M. 2000. US deficit sustainability: a new approach on multiple endogenous breaks. *Journal of Applied Econometrics,* 15(1): 83-105.

Masson, P. R. & Mussa, M. 1995. Long-term tendencies in budget deficits and debt. Proceedings, Federal Reserve Bank of Kansas City, 5-55.

Mckerchar, M. & Evans, C. 2009. Sustaining growth in developing economies through improved taxpayer compliance: challenges for policy makers and revenue authorities. *eJournal of Tax Research,* 7(2):171-201.

McMillan, D. G. 2004. Non-Linear Error Corrections: Evidence for UK Interest Rates. *Manchester School,* 72(5): 1463-6786.

Mendoza, E.G. & Ostry, J.D. 2008. International evidence on fiscal solvency: Is fiscal policy responsible? *Journal of Monetary Economics,* 55(6):1081-1093.

Monacelli, T. & Perotti, R. 2006. Fiscal policy, the trade balance, and the real exchange rate: implications for international risk sharing. University of Boccioni manuscript, available at: www.cepr.org/meets/wkcn/1/1662/papers/monacelli.pdf.

Moore, M. 2004. Revenue, state formation and the quality of governance in developing countries. *International Political Science Review,* 25(3): 297-319.

Mountford, A. & Uhlig, H. 2009. What are the effects of fiscal policy shocks? *Journal of Applied Econometrics*, 24(6): 960-992.

National Treasury & South African Revenue Service. 2010. Tax Statistics, a joint publication between National Treasury and the South African Revenue Service.

National Treasury, Republic of South Africa. 2001. Budget Review. Available online at: www.treasury.gov.za.

National Treasury, Republic of South Africa. 2011. Budget Review. Available online at: www.treasury.gov.za.

Ndahiriwe, K. & Gupta, R. 2007. Temporal causality between taxes and public expenditures: The Case of South Africa. *University of Pretoria Working Paper,* 2007-09.

Neck, R., Schneider, F. & Wachter, N. 2010. The Shadow Economy under Changing Tax Systems and Structures. Paper for presentation at the IIPF Congress, Uppsala.

Nijkamp, P. & Poot, J. 2004. Meta-analysis of the effect of fiscal policy on long-run growth. *European Journal of Political Economy,* 20(1): 91-124.

Oates, W. E. 1975. On the nature and measurement of fiscal illusion: A survey. In: G. Brennan eds., *Taxation and Fiscal Federalism: Essays in Honour of Russel Mathew*, 65-82.

Ocran, M. K. 2009. Fiscal policy and economic growth in South Africa. A paper presented at the Conference on Economic Development in Africa, St. Catherine's College, Oxford University, United Kingdom. March 22-24.

Olabisi, A. S. & Funlayo, O. E. 2012. Composition of public expenditure and economic growth in Nigeria. *Journal of Emerging Trends in Economics and Management Sciences,* 3(4): 403-407.

Pagan, A. R. 1987. Three Econometric Methodologies: A critical appraisal. *Journal of Economic Surveys,* 1 (1):3-24.

Perotti, R. 1999. Fiscal policy in good times and bad. *Quarterly Journal of Economics,* 114(4): 1399-436.

Perotti, R. 2005. Estimating the effects of fiscal policy in OECD countries. Center for Economic Policy Research (CEPR) Discussion Paper 168.

Perotti, R. 2007. In search of the transmission mechanism of fiscal policy, In: D. Acemoglu, K. Rogoff, and M. Woodford (eds.), NBER Macroeconomic Annual.

Perncavel, J. H. 1979. A note on income tax evasion, labour supply and nonlinear tax schedules. *Journal of Public Economics,* 12(1): 115-124.

Pesaran, H., Shin, Y. & Smith, R. 2001. Bound testing approaches to the analysis of level relationships. *Journal of Applied Econometrics,* 16(1): 289-326.

Phillips, P.C.B. & Perron, P. 1988. Testing for unit root in time series regression, *Biometrika,* 75(2): 335-346.

Phillips, P. C. B. & Outiaris, S. 1990. Asymptotic properties of residual based tests for cointegration. *Econometrica,* 58(1): 165-193.

Podrecca, E. 1993. Recent growth theories: an assessment. *Rivista Internationale di Science Economiche e Commerciali,* 40(5): 411-422.

Polito, V., & Wickens, M. R. 2005. Measuring fiscal sustainability. CEPR Disscussion Paper, 5312.

Prichard, W. 2010. Taxation and state building: towards a governance focused tax reform agenda. *IDS Working Paper* 341, Brighton: Institute of Development Studies.

Quintos, C. E. 1995. Sustainability of the deficit process with structural shifts. *Journal of Business and Economic Statistics,* 13(4): 409-417.

Rahman, A. 1992. The informal financial sector in Bangladesh: An appraisal of its role in development. *Development and Change,* 23(3): 147-168.

Ramey, V. A. 2011. Identifying government spending shocks: It's all in the timing. *Quarterly Journal of Economics,* 126(1): 1-50.

Ramey, V. & Shapiro, M. 1998. Costly capital reallocation and the effects of government spending. *Carnegie Rochester Conference on Public Policy,* 48(1): 145-194.

Romer, C. & Romer, D. H. 2010. The macroeconomic effects of tax changes: estimates based on a new measure of fiscal shocks. *American Economic Review,* 100(3): 763-781.

Rosen, H. S. & Gayer, T. 2008. Public Finance, (Eighth Edition) McGraw-Hill International Edition.

Roux, A. 1993. The public debt: A medium-term perspective. *The South African Journal of Economics,* 61(4): 324-333.

Saunders, S.G. 2005. Estimates of the Informal Economy in South Africa: some macroeconomic policy implications. Doctoral Thesis, Faculty of Economic and Financial Services, University of Johannesburg.

Sardoni, C. 2008. The sustainability of fiscal policy: an old answer to an old question? Paper presented at the macroeconomic policies on shaky foundation conference-, Whither Mainstream Economics, 31 Oct.-1 November Berlin.

Sarno, L. 2001. The behaviour of US public debt: a non-linear perspective. *Economics Letters,* 74(1):119–25.

Schoeman, N. J. 1994. Public debt and the economy. Paper presented at the EBM Conference at RAU, 28-29 November.

Schoeman, N. J. & Caner, S. 2006. The effect of taxation on the growth of employment in the underground economy in South Africa. Available online at www.bilkent.edu.tr

Schneider, F. & Enste, D. H. 2000. Shadow Economies: Size, Causes, and Consequences. *Journal of Economic Literature,* 38(1): 77-114.

Schneider, F. 1994. Can the shadow economy be reduced through major tax reforms? An empirical investigation for Austria. *Supplement to Public Finance,* 49(1): 137-152.

Schneider, F. 2007. Shadow economies and corruption all over the world: new estimates for 145 countries. *Ejournal,* 9(1):1-47.

Schneider, F., Buehn, A. & Montenegro, C.E. 2010. New estimates for the shadow economies all over the world. *International Economic Journal,* 24(4): 443-461.

Shor, B., Bafumi, J., Keele, L. & Park, D. 2007. A Bayesian multilevel modelling approach to Time Series Cross Sectional data. *Political Analysis,* 15(2): 165-181.

Sims, C. A. 1980. Macroeconomics and reality. *Econometrica,* 48(1): 1-48.

Sims, C. A. & Zha, T. A. 1998. Bayesian methods for Dynamic Multivariate models. *International Economic Review,* 39(4): 949-68.

Slemrod, J. 1985. An Empirical Test for Tax Evasion. *Review of Economics and Statistics,* 67(2): 232-238.

South African Reserve Bank. 2011. Quarterly Bullentin, available at: www.reservebank.co.za.

Stahler, N. & Thomas, C. 2012. FidMOD- a DSGE model for fiscal policy simulations. *Economic Modelling,* 29(2):239-261.

Stolan, A. & Campeanu, E. 2010. Fiscal policy reaction in the short term for assessing fiscal sustainability in the long run in Central and Eastern European Countries. *Finance a uver-Czech Journal of Economics and Finance,* 60(6): 501-518.

Swanepoel, A. S. & Schoeman, N. J. 2002. Tax revenue as an automatic fiscal stabilizer: a South African perspective. *South African Journal of Economic and Management Sciences,* 5(4): 566-588.

Swanson, N. R. 1999. Finite sample properties of a simple LM test for neglected nonlinearity in error correction regression equations. *Statistica Neerlandica,* 5(1): 76-95.

Temple, J. 2000. Growth regressions and what the textbooks don't tell you. *Bulletin of Economic Research*, 52(3): 181-205.

Tanzi, V. 1983. The Underground Economy in the United States: Annual Estimates, 1930-1980. *International Monetary Fund Staff Papers,* 30(2): 283-305.

Tanzi, V. 2000a. Corruption, government activities and markets. In: Tanzi, V. (ed.) *Policies, Institutions and the Dark Side of Economics.* Cheltenham: Edward Elgar.

Tanzi, V. 2000b. A primer on tax evasion. In: Tanzi, V. (ed.) *Policies, institutions and the dark side of economics.* Cheltenham: Edward Elgar.

Teräsvirta, T. 1998. Modelling economic relationships with smooth transition regressions. In: A. Ullah and D.E.A Gilles (eds.), *Handbook of Applied Economic Statistics,* New York, Marcel Dekker.

Teräsvirta, T. 1994. Specification, estimation, and evaluation of smooth transition autoregressive models. *Journal of American Statistical Association,* 89(425): 2008-218.

Thiessen, U. 2003. The impact of fiscal policy and deregulation on shadow economies in transition countries: The case of Ukraine. *Public Choice,* 114(3-4): 295-318

Torgler, B. & Schneider, F. 2007. What shapes attitudes toward paying taxes? Evidence from multicultural European countries. *Social Science Quarterly,* 88(2): 443-467.

Trandel, G. & Snow, A. 1999. Progressive Income Taxation and the Underground Economy. *Economic Letters,* 62(2): 217-222.

Tsay, R. S. 2005. Analysis of Financial Time Series, 2nd(ed). University of Chicago,Graduate School of Business.

Trehan, B. & Walsh, C.E. 1988. Common Trends, the government budget constraint and revenue smoothing. *Journal of Economic Dynamics and Control,* 12(2-3): 425-444.

Uctum, M. & Wickens, M. 2000. Debt and deficit ceiling, and sustainability of fiscal policy: an intertemporal analysis. *Oxford Bulletin of Economics and Statistics,* 62(2): 197-222.

United States Agency for International Development. 2010. South Africa's tax system from 30,000 feet, Fiscal Reform and Economic Governance. Available at www.collectingtaxes.net.

Van Dijk, D. & Franses, P. H. 2000. Nonlinear error-correction models for interest rates in Netherlands. In: *Nonlinear Econometric Modelling in Time Series Analysis: Proceeding of Eleventh International Symposium in Economic Theory.* Cambridge University Press, 203-227.

Van Dijk, D., Teräsvirta, T. & Franses, P.H. 2002. Smooth Transition Autoregressive Models- a survey of recent developments. *Econometric Reviews,* 21(1): 1-47.

Van der Merwe, E. 1994. Is South Africa in a debt trap? EPSG Occasional paper No.6, Economic Policy Study Group. Johannesburg.

Waggoner, D. F. & Zha, T. A. 2003. A Gibbs sampler for structural vector autoregressions. *Journal of Economic Dynamics and Control,* 28(2): 349-66.

Wagner, R. E. 1976. Revenue structure, fiscal illusion and budgetary choice. *Public Choice,* 24: 45-61.

Watson, H. 1985. Tax evasion and labour markets. *Journal of Public Finance,* 27(2): 231-246.

Wilcox, D. W. 1989. The sustainability of government deficits: Implications of the present value borrowing constraint. *Journal of Money, Credit and Banking,* 21(3): 291-306.

Wu, J. L. 1998. Are Budget Deficits “Too Large”? The evidence from Taiwan. *Journal of Asian Economics,* 9(3): 519-528.

Yitzhaki, S. 1974. A note on income tax evasion: a theoretical analysis. *Journal of Public Economics,* 3(1): 201-202.

Zee, H. H. 1988. The sustainability and optimality of government debt. *IMF Staff Papers,* 35(4): 658-685.

APPENDICES

Appendix 1: Tax Indicators-Definition of terms

CIT Rate (CITR):- a tax structure indicator. It is the general rate applied for corporate income tax.

CIT Revenue Productivity (CITPROD):- a tax revenue performance indicator. It represents how well corporate income tax does in terms of revenue collection, given the tax rate. It is calculated by dividing total corporate income tax revenue by GDP and then dividing this by the corporate income tax rate.

CIT Revenues (CITY):- a reference indicator. It is the level of corporate income tax collections as percentage of GDP.

PIT Maximum Rate (PITMAXR):- a tax structure indicator. It is the highest marginal tax rate applied under the personal income tax system on the richest income class of taxpayers.

PIT Minimum Rate (PITMINR):- a tax structure indicator. It is the lowest non-zero positive marginal tax rate applied to the lowest income group in the personal income tax system.

PIT Minimum Income Level (PITMINL):- a tax structure indicator. It is the lowest level of income at which the lowest marginal personal income tax rate is imposed, expressed as a multiple of per capita GDP.

PIT Maximum Income Level (PITMAXL):- a tax structure indicator. It is the lowest level of income at which the top marginal personal income tax rate is imposed, expressed as a multiple of per capita GDP.

PIT Revenue Productivity (PITPROD):- a performance indicator. It attempts to provide some sense of how well the personal income tax in a country does in terms of producing revenue. It is calculated by taking the actual revenue collected as a percentage of GDP (PITY), divided by the weighted average PIT rate, or PITR.

PIT Revenues (PITY):- a reference indicator. It is the level of personal income tax collections as percentage of GDP.

Tax Administration Costs (Cost):- a performance indicator which relates the cost of administering the tax system to the total revenue collected by the tax administration. The lower this cost indicator is, the more efficient the overall tax system is in collecting all taxes. This cost effectiveness indicator can be affected by the revenue productivity of the major taxes.

VAT Rate (VATR):- a tax structure indicator. It is the general rate at which most goods and services are taxed under the value added tax system.

VAT Productivity (VATPROD):- a tax revenue performance indicator. It is a measure of how well the VAT produces revenue for the government, given the VAT rate. It is calculated by dividing the VAT collections by GDP and then dividing this by the VAT rate.

VAT Gross Compliance Ratio (VATGCR):- also a measure of how well VAT produces revenue for government, but is a bit more refined than the VATPROD indicator, since it takes into account the fact that VAT is mostly only applied to final consumption by households and individuals. It is calculated by dividing VAT revenues by total private consumption in the economy and then dividing this by the VAT rate.

VAT Collections (VATY):- a reference indicator. This is the level of VAT collections as a percentage of GDP.

VAT Threshold (Threshold):- This is a tax structure indicator related to Value-added tax (VAT). It indicates the amount of annual turnover, or supply/import of goods and services, above which taxpayers must file regular VAT returns. It also often represents the threshold above which businesses must register with the authorities as VAT payers.