
The public sector balance sheet and fiscal consolidation in South Africa

PHILIPPE BURGER, KRIGE SIEBRITS AND ESTIAN CALITZ

Stellenbosch Economic Working Papers: 11/15

KEYWORDS: FISCAL SUSTAINABILITY, PUBLIC DEBT, BUDGET DEFICIT, PRIMARY
BALANCE
JEL: H62, H63, H68

PHILIPPE BURGER
DEPARTMENT OF ECONOMICS
UNIVERSITY OF THE FREE
STATE
BLOEMFONTEIN
SOUTH AFRICA
E-MAIL: BURGERP@UFS.AC.ZA

KRIGE SIEBRITS
DEPARTMENT OF ECONOMICS
UNIVERSITY OF STELLENBOSCH
PRIVATE BAG X1, 7602
MATIELAND, SOUTH AFRICA
E-MAIL:
KRIGESIEBRITS@SUN.AC.ZA

ESTIAN CALITZ
DEPARTMENT OF ECONOMICS
UNIVERSITY OF STELLENBOSCH
PRIVATE BAG X1, 7602
MATIELAND, SOUTH AFRICA
E-MAIL: CALITZ@SUN.AC.ZA



UNIVERSITEIT
STELLENBOSCH
UNIVERSITY



A WORKING PAPER OF THE DEPARTMENT OF ECONOMICS AND THE
BUREAU FOR ECONOMIC RESEARCH AT THE UNIVERSITY OF STELLENBOSCH

The public sector balance sheet and fiscal consolidation in South Africa

P Burger (UFS), K Siebrits (US) and E Calitz (US)

Abstract: South Africa has a long record of relatively good fiscal outcomes. However, because of the Great Recession and the subsequent countercyclical fiscal policy, the fiscal situation has worsened markedly since 2010. The aim of this paper is twofold: (1) to assess how the government re-established fiscal sustainability in the past, and (2) on the basis of literature and lessons learned from this past, and given current increasing debt levels, to consider how best the government could consolidate fiscal policy and re-establish fiscal sustainability in the short- to medium term. To assess past fiscal policy the paper uses a Markov-switching model to estimate a fiscal reaction function for the primary balance. This establishes whether or not the primary balance reacted to ensure fiscal sustainability. The analysis identifies high and low debt/GDP regimes and shows that fiscal policy has been in a high debt regime since 2010. It also shows that for most of the period prior to 2010 the primary balance adjusted to ensure a sustainable debt burden. However, the reduction in the public debt/GDP ratio from 1994 to 2008 was accompanied by a similar decrease in government's fixed capital/GDP ratio. Hence, the reduction in the debt/GDP ratio contributed to fiscal sustainability, but did not improve the government's balance sheet. On the basis of these findings the paper suggests that the government has two options for restoring fiscal sustainability in the short- to medium term: (1) reduce the public debt/GDP ratio to its *pre-crisis* level, or stabilise the ratio at its *post-crisis* level. At the heart of this choice is the requirement to balance the need to finance much-needed public infrastructure with the need to return to a low debt/GDP ratio in order to have room for countercyclical fiscal policy in future recessions.

JEL codes: H62, H63, H68

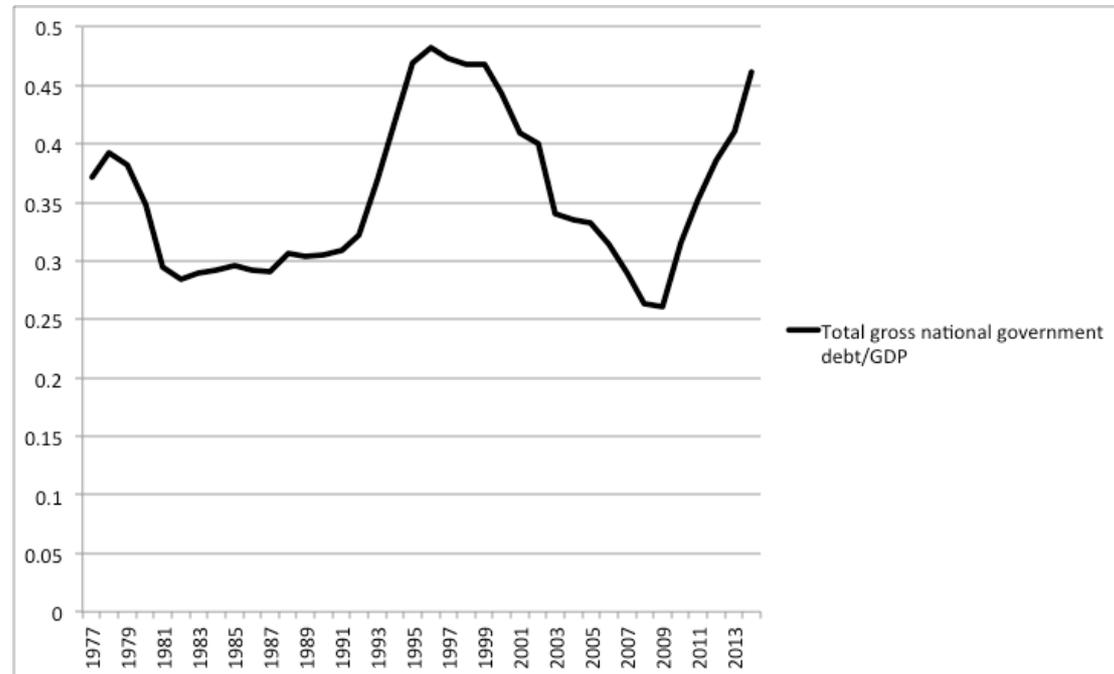
Key words: Fiscal sustainability, public debt, budget deficit, primary balance

1. Introduction

Several studies have shown that fiscal policy has been sustainable in South Africa ever since the Second World War (cf. Section 2). However, the fiscal situation has worsened markedly from 2010 onwards, largely because of the effects of the Great Recession and the strong countercyclical policy response to this shock. The consolidated budget balance deteriorated from a surplus of 1.7% of GDP in 2007/08 to a deficit of 4.2% in 2009/10 (National Treasury, 2009: 49; 2012: 38). Partly because of the anaemic economic recovery, the deficit has been persistent: it was estimated at 3.9% of GDP at the end of the 2014/15 fiscal year (National Treasury, 2015: 30). As shown in Figure 1, this resulted in a sharp increase in the gross loan debt of the central government from 26.6% of GDP in 2007/08 to an estimated 46.2% in 2014/15 (cf. National Treasury 2015: 208-209). Hence, it has

become evident that a concerted fiscal consolidation effort is required to stabilise the public finances and to ensure fiscal sustainability in the medium to longer run.

Figure 1 – South Africa’s gross national debt/GDP ratio, 1980-2013



Source: South African Reserve Bank.

The South African Government committed itself to a consolidation plan in the *2014 Medium Term Budget Policy Statement* (National Treasury, 2014) and spelt out the details in the 2015 Budget (National Treasury, 2015). The medium-term estimates summarised in Table 1 show that the fiscal authorities envisage a drop of 1.4 percentage points in the budget deficit to 2.5% of GDP by the end of the 2017/18 fiscal year. This is to be effected by increasing the revenue-to-GDP ratio by 1.1 percentage points of GDP and by reducing the non-interest spending/GDP ratio by 0.4 percentage points of GDP (interest payments on public debt is projected to increase by 0.1 percentage point of GDP). The envisaged revenue-dominated consolidation is designed to stabilise the government debt burden by 2017/18 at an expected 47.6% of GDP in gross terms (National Treasury, 2015: 38, 209). Given this background, the aim of this paper is twofold:

1. To assess if and how the government re-established fiscal sustainability in the past, and
2. On the basis of lessons learned from this past, and after confirming the current *unsustainability* of fiscal policy, to consider how best the government could restore fiscal sustainability in the short- to medium term.

Table 1 – National Treasury’s envisaged medium-term consolidation of the fiscal framework for South Africa

Percentages of GDP	2014/15	2015/16	2016/17	2017/18
	Revised estimates	Medium-term estimates		
Revenue	28.1	28.4	29.3	29.2
Expenditure	32.0	32.2	31.9	31.7
Non-interest	28.9	29.1	28.7	28.5
Interest	3.1	3.2	3.2	3.2
Budget balance	-3.9	-3.9	-2.6	-2.5

Source: National Treasury (2015: 30).

With regard to the first question, the discussion below will indicate that fiscal policy was sustainable in most years from the early 1980s until 2010: except during the mid-1990s, the primary balance improved whenever the debt burden deteriorated. However, since 2010 fiscal policy has been unsustainable, with the primary balance not reacting to the increasing debt burden. This raises the question whether or not the government in the short to medium run should implement an adjustment process similar to the one that re-established and maintained fiscal sustainability from the late 1990s to 2008. In answering this question, the analysis heeds Easterly’s (1999) warning that a reduction in the debt/GDP burden, such as the drop that occurred from the late 1990s to 2008, should not be assessed in isolation from movements in the government’s asset position. Easterly (1999) argued that the reductions in the public debt burdens of several countries were accompanied by reductions in governments’ asset stocks. Therefore, these reductions in debt burdens did not represent improvements in governments’ balance sheets. The analysis below will indicate that this was the case in South Africa too in the period since 1994. This reality raises a question about what adjustment process the government should pursue to re-establish fiscal sustainability in the short- to medium term.

2. Fiscal consolidation - Theory and evidence

Research on fiscal consolidation attempts has focused on two sets of issues: the efficacy of particular mixtures of fiscal policy instruments for achieving durable reductions in fiscal deficits and public debt burdens, and the effects of fiscal tightening on output and employment.

Fiscal deficit/GDP ratios can be reduced by reducing government expenditure and/or increasing government revenue as percentages of GDP. Several empirical studies compare the effectiveness and durability of these options. Most analyses of attempted fiscal consolidations in OECD countries find that expenditure reductions (especially cuts to transfer payments and the government wage bill) trump tax increases as a strategy for reducing deficits. Furthermore, the deficit-reducing effects of spending cuts are usually more durable (i.e. less likely to be reversed within a few years) than those of tax increases (Alesina and Ardagna, 1998; 2010; 2013; Alesina and Perotti, 1997; Ardagna, 2004; Guichard *et al.*,

2007; McDermott and Wescott, 1996; Von Hagen and Strauch, 2001). Analyses of emerging market and other developing economies also find that spending cuts contribute to durable reductions in fiscal deficits. However, in such countries revenue increases are also important elements of successful and durable fiscal consolidations (Adam and Bevan, 2003; Baldacci *et al.*, 2004; Baldacci *et al.*, 2006; Gupta *et al.*, 2003; Gupta *et al.*, 2004). As pointed out by Baldacci *et al.* (2004: 60), such countries usually have considerable scope for increasing tax revenues without having to raise tax rates, for example, by improving the administration of the tax system and by curbing tax evasion.

Nonetheless, cuts in transfers and salary bills and increases in revenue are not the only elements of successful fiscal consolidations in developing economies. Baldacci *et al.* (2004) and Gupta *et al.* (2003) found that protecting or even increasing the share of capital spending in total government outlays during consolidation efforts increases the probability of success and persistence. These findings are related to Easterly's (1999: 57) statement that "[f]iscal adjustment is an illusion when it lowers the budget deficit or public debt but leaves government net worth unchanged". According to Easterly (1999), the fiscal consolidations required by the International Monetary Fund and the World Bank as elements of their adjustment programmes have often turned out to be illusory: many governments have reduced deficits in part by reducing asset formation and by accumulating hidden liabilities of various kinds. Milesi-Ferretti and Moriyama (2006) found indications of the same phenomenon in European countries from 1992 to 1997 (that is, during a period when these countries were reducing fiscal deficits and public debt levels to meet the Maastricht Treaty convergence criteria for membership of the European Monetary Union).

3. Fiscal sustainability

Was fiscal policy in South Africa sustainable during the past few decades? Several authors investigated this question and concluded that fiscal policy was sustainable. Studies on fiscal sustainability in South Africa can be classified according to the two strands of international econometric literature. The first strand of literature considers whether or not government expenditure and revenue are cointegrated and uses that as an indication of fiscal sustainability (see, for example, Lusinyan and Thornton, 2009). The second strand considers whether or not the primary balance reacts to public debt so as to keep public debt in check. The first strand slightly predates the second and the second has since been established as superior to the first (Bohn, 1998, but also see 1995, 2007 and 2010). Hence, our analysis proceeds in terms of the second strand.

3.1 The fiscal reaction function

Bohn (1998, but also see 1995, 2007 and 2010) showed that the sustainability of fiscal policy can be assessed by estimating a fiscal reaction function. He also

showed that doing so is superior to merely considering whether or not revenue and expenditure are cointegrated.

In essence, the reaction function considers the reaction of the primary balance, revenue or expenditure (possibly as ratios of GDP) to a change in public debt (also possibly as ratio of GDP). Starting with the budget constraint of government (Equation (1)), we derive Bohn's fiscal reaction function (Bohn, 1998).

$$D_t = D_{t-1} + i_t D_{t-1} - B_t \quad (1a)$$

which when expressed as a ratio of GDP is:

$$\begin{aligned} (D/Y)_t &= ((1+i)/(1+n))(D/Y)_{t-1} - (B/Y)_t \\ &= ((1+r)(1+p)/(1+g)(1+p))(D/Y)_{t-1} - (B/Y)_t \\ &= ((1+r)/(1+g))(D/Y)_{t-1} - (B/Y)_t \end{aligned} \quad (1b)$$

where D is public debt, i and r are the nominal and real interest rate on government bonds, n and g are the nominal and real economic growth rates, p is inflation, and B is the primary balance (+ surplus; - deficit). From Equation (1b) one can get:

$$\Delta(D/Y)_t = [(r_t - g_t)/(1 + g_t)](D/Y)_{t-1} - (B/Y)_t \quad (2)$$

where r is the real interest rate, g is the real economic growth rate, and Y is nominal GDP. We define $\alpha_t^* = (r_t - g_t)/(1 + g_t)$ and set $\Delta(D/Y)_t = 0$ to get the primary balance required to ensure a stable debt/GDP ratio:

$$(B/Y)_t^{Required} = \alpha_t^*(D/Y)_{t-1} = [(r_t - g_t)/(1 + g_t)](D/Y)_{t-1} \quad (3)$$

To establish whether the government acted to keep its debt/GDP ratio stable over time, one can estimate what value α_t^* took in reality. Thus, one can estimate:

$$(B/Y)_t^{Actual} = \alpha(D/Y)_{t-1} + \varepsilon_t \quad (4)$$

Equation 4 is now expanded to include a lag of the primary balance that allows for inertia in government behaviour (De Mello, 2005:10). We also add a constant (α_1) to allow for an (explicit or implicit) debt/GDP target not equal to zero. The output gap, \hat{y}_{t-1} , is included as a control variable. The fiscal reaction function then becomes:

$$(B/Y)_t^{Actual} = \alpha_1 + \alpha_2(B/Y)_{t-1}^{Actual} + \alpha_3(D/Y)_{t-1} + \alpha_4\hat{y}_{t-1} + \varepsilon_t \quad (5)$$

With respect to South Africa Burger, Stuart, Jooste and Cuevas (2012) used various econometric techniques to estimate Equation (5) and thus to investigate the reaction of the primary balance to public debt. The methods include VAR, TAR, VECM as well as state-space modelling, with samples running from the

1940s onwards for the state-space model and from the 1970s onwards for the other models. All these methods indicate that fiscal policy was sustainable over the sample periods. With respect to the reaction of the primary balance to changes in debt, Burger and Marinkov (2012) used a model that controlled for various political administrations to confirm that fiscal policy was sustainable for a sample that reaches back to the 1940s.

Equations (3) and (5) together can be used to establish whether or not fiscal policy is sustainable in the longer run, with sustainability meaning that the debt/GDP ratio is stable and does not explode over time. The debt/GDP ratio will stabilise (i.e. reach an equilibrium) or explode (either in a positive or negative direction) depending on α_t^* in Equation (3) and α_2 and α_3 in Equation (5). If $\alpha_t^* < \alpha_3/(1 - \alpha_2)$ both the debt/GDP ratio and the primary balance/GDP ratio will stabilise.¹ The debt/GDP ratio can stabilise either at a positive or negative level (of course, negative levels are very rare in reality). To calculate this level we first take the unconditional expected values for $(B/Y)_t^{Actual}$, $(D/Y)_{t-1}$, \hat{y}_{t-1} and α_t^* in Equations (3) and (5) and set $(B/Y)_t^{Required} = E((B/Y)_t^{Actual})$, while also noting that $E(\hat{y})_{t-1} = 0$ and $\alpha^* = E(\alpha_t^*)$ and in equilibrium $E((B/Y)_t^{Actual}) = E((B/Y)_{t-1}^{Actual})$. This yields:

$$(D/Y)^{Stable} = - (\alpha_1/(1 - \alpha_2))/((\alpha_3/(1 - \alpha_2) - \alpha^*) \quad (6)$$

Note that if α_1 is negative (positive) the debt/GDP ratio will stabilise at a positive (negative) value. In equilibrium Equation (5) also becomes:

$$(B/Y)_t^{Actual} = \alpha_1/(1 - \alpha_2) + (\alpha_3/(1 - \alpha_2))(D/Y)_{t-1} + (\alpha_4/(1 - \alpha_2))(\hat{y})_{t-1} \quad (7)$$

If $\alpha^* > \alpha_3/(1 - \alpha_2)$, and unless the debt/GDP and the primary balance/GDP ratios find themselves at their equilibrium values, the debt/GDP ratio (and the primary balance/GDP ratio) will explode, either in a positive or negative direction. The explosion will be positive if the initial debt/GDP ratio exceeds the equilibrium debt/GDP ratio, and negative otherwise. If $\alpha^* = \alpha_3/(1 - \alpha_2)$, the debt/GDP and the primary balance/GDP ratios will be first-difference stationary. Note that these conditions about α_1 , α_3 and α^* hold irrespective of whether α^* and α_3 are negative or positive (also see Bohn, 2007: 1844).

To deal with the possibility that the government may or may not react to the debt/GDP ratio, depending on the sign of the $(r_t - g_t)/(1 + g_t)$ gap, Equation 5 can be estimated with a Markov-switching model. A number of studies have used Markov-switching models in which the probabilities of different fiscal policy regimes can vary endogenously (*cf.* Afonso *et al.*, 2009; Claeys, 2005; Favero and

¹ As long as $\alpha_3/(1 - \alpha_2)$ in Equation 5 is equal to or larger than α^* in Equation 5, fiscal policy will be sustainable. However, this condition is limited to cases where $r > g$. Bispham (1987:67-70) showed that when $r < g$, fiscal policy technically speaking cannot become unsustainable if unsustainability is defined as a public debt/GDP ratio that moves to infinity in finite time – it will always converge to a stable level.

Monacelli, 2005). Generally, these studies impose two regimes *a priori* – e.g. a fiscal active and a fiscal passive regime as in Leeper (1991) – and then compare these models to a single-regime model as well as to higher-regime models. (The reason for imposing two regimes is that there is no criterion for an optimal number of regimes in a Markov-switching model (Claeys, 2005; Afonso *et al.*, 2009)). However, two regimes can also be imposed when expecting one regime to apply when $r > g$ (a case where $\alpha_3 > 0$) and another when $r < g$ (a case where $\alpha_3 \leq 0$). Neither of these two regimes is necessarily fiscally irresponsible; they merely represent two sets of behaviour that, each in its specific setting, represents a sustainable fiscal policy.

3.2 Data

Annual data for the primary balance and gross debt for fiscal years 1976/77 to 2012/13 were obtained from the South African Reserve Bank (SARB) on request. Quarterly nominal and seasonally unadjusted GDP data originate from the SARB's online download facility and were used to calculate nominal GDP values for the fiscal years. The output gap was generated by applying a Kalman filter to real GDP data (this is preferable to the use of a Hodrick-Prescott filter, which suffers from an end-point problem). The primary balance and gross debt values were expressed as ratios of nominal GDP. A fiscal reaction function was estimated for the primary balance/GDP ratio. The primary balance reaction function establishes whether or not the primary balance/GDP ratio reacts to a one-period lag of the debt/GDP ratio.

Bohn (2007) argued that one should not be overly concerned with the stationarity of the primary balance and debt series (whether or not expressed as ratios of GDP) because, if differencing these series any number of times renders them stationary, then a government satisfies its intertemporal budget constraint. Instead Bohn argues for the use of “error-correction-type policy reaction functions”, such as the fiscal reaction function defined above, in which he does not explicitly control or account for the stationarity properties of the data.

3.3 Estimation method

To allow for the possibility of changing behaviour over the sample period, the regressions below were estimated using a Markov-switching (MS) model. The model does not suffer from serial correlation and clear regimes are discernible. The linearity test rejected the null of linearity and, hence, the section below presents the Markov-switching model. As is standard practice in error-correction models, the model includes a lag of the dependent variable to deal with serial correlation.

The MS models (Hamilton 1989, 1996) have mostly been applied to economic growth, although increasingly they are applied to other variables. MS models

assume a number of regimes that are unobservable at time t but are determined by an unobservable process s_t . Assuming two regimes the MS model is given by:

$$y_t = \phi_{0,s_t} + \phi_{1,t-1}y_{t-1} + \phi_{k,s_{t-i}}x_{k,t-i} + \delta_{m,t-j}z_{m,t-j} + \varepsilon_t \quad (8)$$

Where :

y_t is an endogenous variable at lag $t-l$

$x_{k,t-i}$ represents regime-dependent exogenous variable k at lag $t-i$

$z_{k,t-i}$ represents linear exogenous variable m at lag $t-j$

$s_t = 0, 1$ denoting the presence of two regimes

ϕ_{0,s_t} represents the constant term which is assumed to be different for the two regimes

$\phi_{1,t-1}$ represents the linear coefficients on the AR(1) term

$\phi_{k,s_{t-i}}$ represents the regime-dependent coefficients on the regime-dependent variables

$\delta_{m,t-j}$ represents the linear coefficients on the non-regime dependent variables

ε_t represents the error term which is assumed to be independently and identically distributed around a zero mean. Note that its variance can be either constant or regime-dependent.²

In an MS framework, the process s_t is assumed to be a first-order Markov process (Hamilton, 1989), which implies that the current regime s_t depends on s_{t-1} . This implies the following transition probabilities for Regimes 0 and 1:

$$\begin{aligned} P(s_t = 0 | s_{t-1} = 0) &= p_{00} \\ P(s_t = 1 | s_{t-1} = 0) &= p_{01} \\ P(s_t = 0 | s_{t-1} = 1) &= p_{10} \\ P(s_t = 1 | s_{t-1} = 1) &= p_{11} \end{aligned} \quad (9)$$

Where:

p_{00}, p_{01}, p_{10} and p_{11} are non-negative

$$p_{00} + p_{01} = 1$$

$$p_{10} + p_{11} = 1$$

In addition, the unconditional probabilities of each regime can be derived using the theory of ergodic Markov chains (see Franses and van Dijk, 2000). These unconditional probabilities are given by:

$$P(s_t = 0) = \frac{1-p_{11}}{2-p_{00}-p_{11}} \quad (10.1)$$

$$P(s_t = 1) = \frac{1-p_{00}}{2-p_{00}-p_{11}} \quad (10.2)$$

² The variance of the residual term can also be assumed to be different across the two regimes. In other words, instead of $\sigma = k$, we can assume $\sigma_0 = k_0$ and $\sigma_1 = k_1$ for Regime 0 and Regime 1, respectively.

Furthermore, the transition probabilities (p_{ij}) must be positive and their sum for each regime must be equal to 1.

3.4 Fiscal reaction functions for expenditure and revenue

This section presents estimates for Equation (5) estimated with a Markov-switching model. The analysis, summarised in Table 2 and Figure 2, shows that in one regime (Regime 0) the primary balance/GDP ratio reacts to changes in the debt/GDP ratio, while in the other regime (Regime 1) it does not. During the late 1970s, early 1980s, the mid-1990s and since the outbreak of the global financial and economic crisis, the primary balance did not react to the debt/GDP ratio. The analysis also shows that in the regime where the primary balance reacts to the debt/GDP ratio, fiscal policy is countercyclical (i.e. during recessions the deficit increases), with the opposite being true for the other regime. The diagnostics show the presence of normality and the absence of autocorrelation and ARCH effects in the residuals. In addition, at a 5% level the null hypothesis of linearity can be rejected.

Figure 2 – Regime classification for the primary balance/GDP

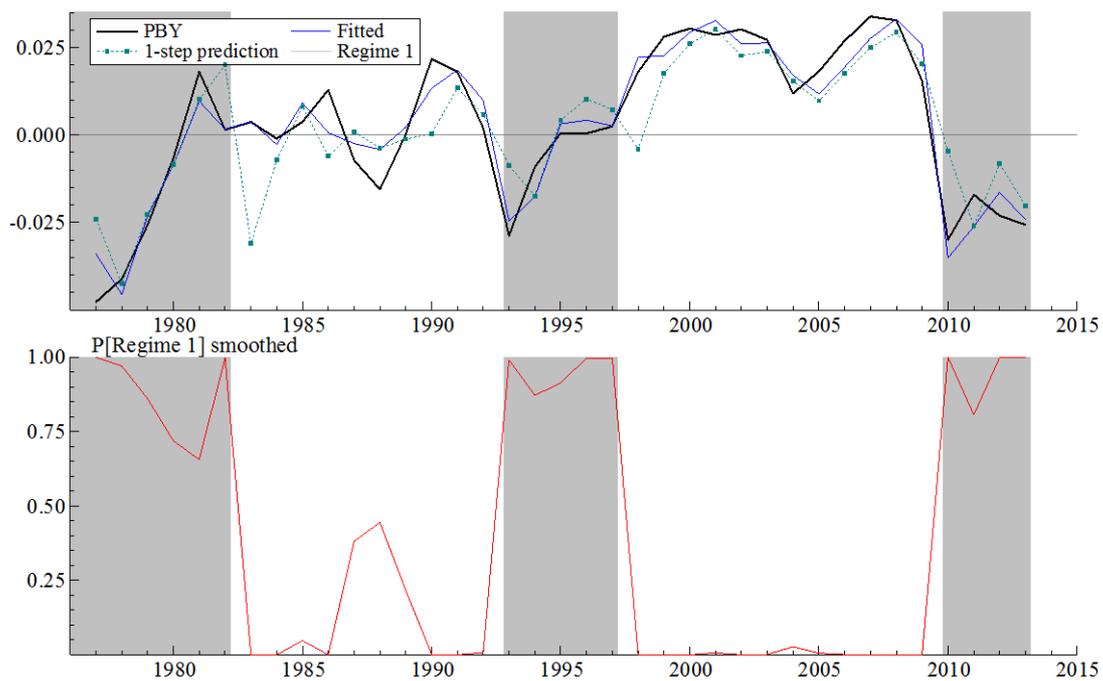


Table 2 –Fiscal reaction functions for the primary balance/GDP

Switching	Regime 0	Regime 1
Gap _t	0.446 (0.003)	0.514 (0.001)
Gap _{t-1}	-0.196 (0.109)	-0.887 (0.000)
Debt _{t-1}	0.082 (0.002)	0.028 (0.310)
Linear		
Constant	-0.021 (0.029)	
PB/Y _{t-1}	0.564 (0.000)	
Sigma	0.007 [0.001]	
p{0 0}	0.854 [0.139]	
p{1 1}	0.796 [0.202]	
Mean value	0.003	
Linearity LR-test χ^2 (prob)	0.047	
Portmanteau (5): χ^2 (prob)	0.101	
ARCH(1,1) test	0.361	
Normality: χ^2 (prob)	0.993	
Transition probabilities	Regime 0,t	Regime 1,t
Regime 0, t+1	0.854	0.204
Regime 1,t+1	0.146	0.796
Regime classification	<p>Regime 0 years avg.prob. 1983 - 1992 10 0.890 1998 - 2009 12 0.997 Total: 22 years (59.46%) with average duration of 11.00 years.</p> <p>Regime 1 years avg.prob. 1977 - 1982 6 0.867 1993 - 1997 5 0.954 2010 - 2013 4 0.951 Total: 15 years (40.54%) with average duration of 5.00 years.</p>	

Values in () are p-values; values in [] are standard errors

The question now arises: how did the government improve its primary balance and reduced its debt/GDP ratio in the past and, in particular, during the period from the late 1990s to 2008? As mentioned above, Easterly (1999) showed that a number of countries attained an improvement in the liability side of the government's balance sheet (i.e. a reduction in the debt/GDP ratio) by letting the asset side deteriorate. Hence, the net worth of such governments did not improve. Was this the pattern in South Africa, too, especially during the period from the late 1990s to 2008? The next section considers this question.

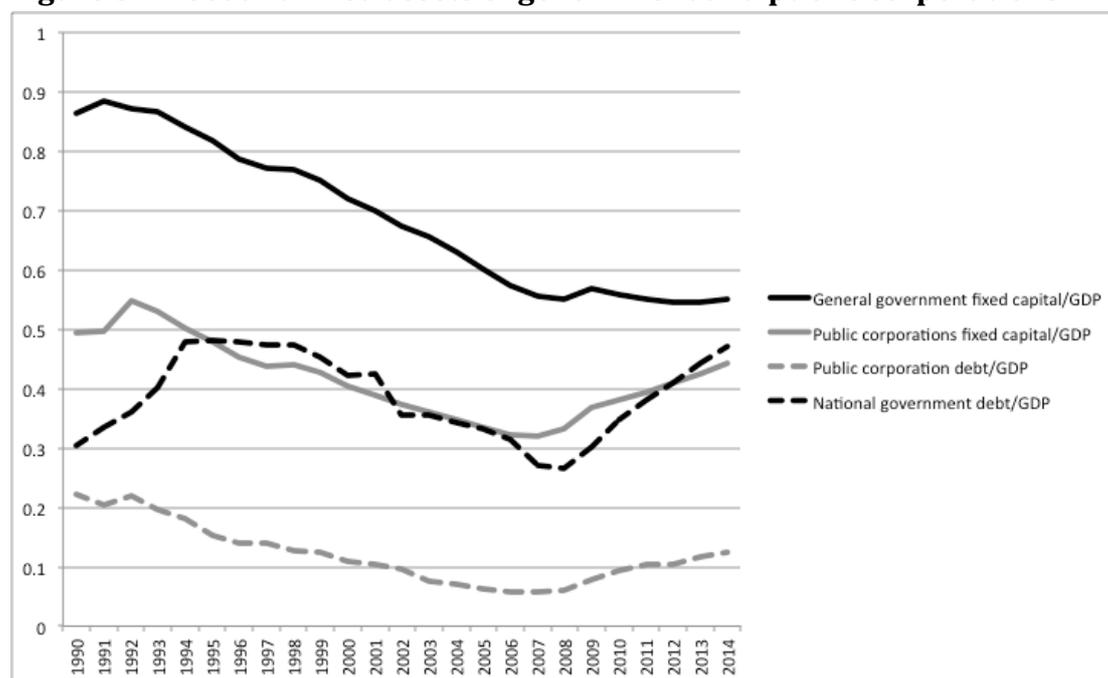
4. Government's balance sheet and fiscal sustainability in the short and long run

During the 2000s the government not only achieved a sufficient primary surplus/GDP ratio to stabilise the public debt/GDP ratio, it also increased the primary surplus/GDP ratio to the extent that the public debt/GDP ratio decreased from about 48% in the late 1990s of GDP to 27% in 2008. Thus, in terms of equation (3), the actual primary balance exceeded the required primary balance dictated by the size of public debt and the excess of the real interest rate over the real economic growth rate. This significant decrease in the government's debt burden ensured the sustainability of fiscal policy at the time,

but did not represent an improvement in the government's net worth. As Figure 3 shows, the decrease in the public debt/GDP ratio accompanied an almost equal drop (as % of GDP) in the fixed capital/GDP ratio of general government.^{3,4}

It could therefore be argued that in the period 2000-2008 an alternative to running a primary surplus/GDP ratio so large that it decreased the public debt/GDP ratio, would have been to merely stabilise the public debt/GDP ratio. In addition to stabilising the public debt/GDP ratio, this alternative also would have required a substitution of capital for current expenditure that would have ensured that the general government's fixed asset/GDP ratio did not decrease.

Figure 3 – Debt and fixed assets of government and public corporations



³ The data used here includes only fixed assets and not financial assets held for instance by the IDC or the foreign reserves held for the government by the South African Reserve Bank (SARB). The analysis excludes the financial assets because government is not primarily a financial institution (with the exception of the SARB, where the use of foreign reserves are in any case more associated with the execution of monetary policy than fiscal policy). Hence, the focus is on fixed (and not financial) assets as it is fixed assets that are mostly used in the execution of fiscal policy.

⁴ Note that the public debt/GDP ratio applies to national government, while the fixed asset/GDP ratio applies to general government. However, provincial authorities do not issue bonds, while municipal bonds in size equaled a mere 1% of the public debt/GDP ratio in December 2014, with data only available from 1990. Furthermore, provinces rely on national government transfers for roughly 95% of their revenue, so that in effect national government borrows on behalf of provinces. Hence, the national public debt/GDP ratio can be compared to the general government fixed capital/GDP ratio when assessing the general government balance sheet. In addition, municipal budgets do not form part of the central government's budget, but they do rely on central government infrastructure transfers for a large part of their infrastructure investment. Therefore, even though there is no unitary budget striving towards fiscal sustainability, the central government policy effectively constrains and thus determines the impact of sub-national government structures on fiscal sustainability.

Since the advent of the international financial crisis in 2009, the public debt/GDP ratio has been increasing while the general government fixed capital/GDP ratio has remained unchanged. Thus, in effect, the general government's net worth has been deteriorating since 2009. Note that this deterioration has coincided with the advent of the unsustainable fiscal policy regime identified in the analysis above for the primary balance of the national government.

Figure 3 furthermore shows that the public corporations experienced the same trends as the general government, namely a decrease in the fixed asset/GDP ratio accompanied by a decrease in the debt/GDP ratio.⁵ Thus, the reduction in the debt/GDP ratio of public corporations did not represent an improvement in their net worth either. Since 2009 the debt/GDP ratio of public corporations has been increasing. But unlike general government, this increase has not implied a deterioration in their net worth, as their fixed asset/GDP ratio has also been increasing (mainly because of the construction of the Medupi and Kusile power stations by Eskom).

Figure 4 - Debt and fixed assets of the public sector



⁵ Note that the debt figures for public corporations include only the debt of non-financial public corporations. Also including the debt of financial public corporations will mean a significant amount of double counting of debt as financial public corporations such as the Public Investment Corporation hold substantial amounts of debt issued by non-financial public corporations. Therefore, counting the debt of financial public corporations (the funds of which are used, among other things, to buy the debt of non-financial corporations) would cause a double count of public sector indebtedness. Also note that the balance sheets of public corporations report fixed assets, but the fixed assets reported in this paper derive from the national accounts so as to be comparable with the fixed assets of general government. The movements in the balance sheet version and the national accounts version of public sector fixed assets are broadly similar, although the level of the latter is higher due to the inclusion of capitalized interest payments.

Figure 4 displays the co-movement of the fixed capital/GDP and debt/GDP ratios of the entire public sector (i.e. general government plus public corporations). It shows that particularly since the 1990s a decrease (increase) in the one has accompanied a decrease (increase) in the other.⁶

A more formal analysis of the relationship between the debt/GDP ratio and the fixed capital/GDP ratio can also be undertaken. Equation (11) represents this net worth function, inspired by Easterly (1999) arguing that often the reduction in the debt burden is accomplished by allowing the asset/GDP ratio to deteriorate:

$$(K/Y)_t = \alpha_1 + \alpha_2(K/Y)_{t-1} + \alpha_3(D/Y)_t + \alpha_4(D/Y)_{t-1} + \varepsilon_t \quad (11)$$

Equation (11) regresses the fixed capital/output ratio on the current and lagged values of the debt/GDP ratio. The current value of the debt/GDP ratio is included because it is assumed that if a government is guided broadly by a policy to eliminate or contain dissaving, then it intends to incur debt primarily to finance capital formation.⁷ An increase in the current value of the debt/GDP ratio will then be associated with an increase in the current value of the fixed capital/GDP ratio.⁸ The lagged value of the debt/GDP ratio is included to capture the possibility that the government allowed the fixed capital/GDP ratio to decrease in reaction to an increase in the debt/GDP ratio in the previous period – in essence, it is the stock effect of the flow decisions of the government to allocate less funds to public investment (relative to GDP) in reaction to a higher debt/GDP ratio. As such, the inclusion of this term renders Equation (11) a fiscal reaction function. Lastly, a lag of the fixed capital/GDP ratio is also included to capture inertia in government behaviour. The parameter of this lag should be between zero and one. A Markov-switching model was again used for the estimation to allow for the possibility that government behaviour changed over time. A time trend was also included to capture additional movement in the fixed capital/GDP ratio not explained by changes in the debt/GDP ratio. As infrastructure mature a government might find no need to expand infrastructure

⁶ Even though these numbers do not result from a single budgetary process, the national government nevertheless keeps an eye on the debt position of public corporations. In addition, even though public corporations pay for the benefit, they benefit from national government guarantees of their debt (for which they pay a fee, however). National government policies such as GEAR and the NDP also contained stated objectives for public sector investment (in the case of the NDP the government plans to increase public sector investment from 7.5% to 10% of GDP) and simultaneously considered the level of domestic saving available to finance the investment. Hence, the national government does have broader public sector investment and saving objectives. As such, it is possible to compare the co-movement of the fixed capital/GDP and debt/GDP ratios of the entire public sector.

⁷ Cognisance is of course taken that the national government uses a unitary budget that pools all expenditure, and then borrows to the extent that the pooled expenditure exceeds revenue. However, if it pursues a policy to eliminate or contain dissaving, then it implicitly aims to only borrow to finance capital formation.

⁸ It might be argued that fiscal policy making does not actually include considerations of this nature. A balance-sheet approach to fiscal policy, which has not yet taken root in South Africa, does however allow for the imputation of such fiscal analysis, if nothing else.

at the same pace as GDP, which will translate into a negative trend in the fixed capital/GDP ratio (e.g. if GDP grows by 10% over five years, a country does not necessarily need 10% more roads if the road network is already mature).

Because a component of general government fixed assets were reclassified as public corporation assets in 1989, the time series for these two subcomponents, running from 1989, are too short for regression purposes. However, adding the two subsectors eliminates the problem. Hence, the regression is estimated for the public sector and not for general government or public corporations separately. The sample period is 1981-2014.

Table 3 -Fixed capital/GDP reaction function

Switching	Regime 0	Regime 1
Constant	0.830 (0.009)	0.601 (0.001)
Fixed Capital/ Y_{t-1}	0.496 (0.012)	0.433 (0.003)
Debt/ Y_t	0.119 (0.457)	0.721 (0.000)
Debt/ Y_{t-1}	-0.142 (0.415)	-0.319 (0.009)
Sigma	0.029 [0.006]	0.014 [0.002]
Linear		
Trend	-0.007 (0.004)	
$p\{0 0\}$	0.925 [0.072]	
$p\{1 1\}$	0.796 [0.202]	
Mean value	1.189	
Linearity LR-test χ^2 (prob)	0.000	
Portmanteau (5): χ^2 (prob)	0.436	
ARCH(1,1) test	0.945	
Normality: χ^2 (prob)	0.233	
Transition probabilities	Regime 0,t	Regime 1,t
Regime 0, t+1	0.925	0.000
Regime 1,t+1	0.075	1.000
Regime classification	Regime 0 years avg.prob. 1982 - 1993 12 1.000 Total: 12 years (36.36%) with average duration of 12.00 years. Regime 1 years avg.prob. 1994 - 2014 21 0.980 Total: 21 years (63.64%) with average duration of 21.00 years.	

Values in () are p-values; values in [] are standard errors

Table 3 presents the results. The analysis identified two clear regimes, one prior to 1994 and the other since 1994. In the regime prior to 1994 debt does not explain movements in the fixed capital/GDP ratio (the parameters for both the current and lagged values of the debt/GDP ratio are statistically insignificant). However, in the period since 1994 all the variables have their expected sign. Debt mostly decreased from 1994 to 2008, and its fall was facilitated by a falling fixed capital/GDP ratio (low levels of investment thus required lower deficits, so that the lower debt/GDP ratio put downward pressure on the fixed capital/GDP ratio. With a long-run parameter for debt of 0.71 (i.e. $(0.721-0.319)/(1-0.433)$) every one percentage point decrease in the debt/GDP ratio led to a 0.71% decrease in the fixed capital/GDP ratio. With the debt/GDP ratio having decreased by 33.4%, the concomitant decrease in the capital/GDP ratio would

have been 23.7%. A further 18.5% decrease originated from the trend ($0.007/(1-0.433)$) multiplied by 15 years (1994-2008)). The reality that the fixed capital/GDP ratio decreased by 46% over this period, implies that just more than 50% of this drop is explained by the fall in the debt/GDP ratio. Since 2009, the process has been in reverse, with both the debt/GDP ratio and the fixed capital/GDP ratio of the public sector increasing (though some of this debt has registered in national government and has not been accompanied by a concomitant increase in national government fixed capital, which can be seen in the public sector debt/GDP ratio having increased faster than the public sector fixed capital/GDP ratio since 2009).

Thus, instead of stabilising and maintaining the debt/GDP ratio at 49%, the government opted to run larger primary surpluses than were needed to just stabilise the debt/GDP ratio. As a result the ratio decreased from the late 1990s to 2008. An alternative would have been to have maintained the debt/GDP ratio at its late 1990s value and rather have substituted capital for current expenditure. The latter option was not taken and therefore, as a result of the decision to reduce the debt/GDP ratio, the fixed capital/GDP ratio decreased.

5. Which road back to fiscal sustainability?

Using Equation (6) one can calculate the level to which, *ceteris paribus*, the debt/GDP ratio will converge. One can also plot the movement over time to that convergence level using Equation (5) together with the debt dynamics equation defined in Equation (1b). This approach requires an assumption about the long-run values for the real interest rate, r , and the real economic growth rate, g . Calculating convergence levels differs from the fan-chart approach followed in Burger *et al.* (2012) and Saxegaard (2014). The fan-chart models depend on estimates of variables such as the real economic growth rate and the real interest rate, where such variables are subject to stochastic shocks. Thus, one can estimate the probability that the actual debt level will exceed or fall short of the expected debt level by any given percentage (for instance, if the expected debt/GDP ratio is say 43%, then one can establish that there is a 20% probability that the debt/GDP ratio will exceed, say, 50%).

In contrast, the approach used in Equation (6) is not just a point estimate for the next year or in ten years, but rather implies that the behavioural parameters captured in estimating Equation (5) indicate particular levels at which the debt/GDP ratio will converge should the future behaviour of the government be similar to the historical pattern of behaviour captured by the regression analysis. Thus, given the assumption that the government's past pattern of behaviour will continue into the future, the debt/GDP ratio will return to the convergent level in the medium to longer term even if the variables are subjected to transitory stochastic shocks (shocks imply a probability that the actual debt/GDP ratio will

exceed or fall short of the expected value). Therefore, a shock that causes the debt/GDP ratio to exceed its expected level by say, 2020, will disappear once the debt/GDP ratio returns to its long-run convergence path. Focusing on the long-term convergence level of the debt/GDP ratio instead of where shocks to output and interest rates might leave the debt/GDP ratio in the short to medium run, also concurs with Pisani-Ferry (2015). Warning about the effects of relying too much on volatile estimates of the output gap in forecasting the deficit, Pisani-Ferry stated that: “For actual GDP, ... frequent and large forecast revisions are inevitable. Potential GDP, however, is supposed to be more stable.... But relentless attempts at accuracy easily result in noise ... Yet volatility in the assessment of potential growth prevents politicians from “owning” the already abstruse structural deficit and causes volatility in the policies based on this assessment, paradoxically resulting in a shortening of decision-makers’ time horizon. The focus of policy discussions should not be the latest potential GDP revision, but whether a country is on track to ensure public finance sustainability.” That track is the path towards the convergence level defined by Equation (6).

Table 4 – Debt/GDP convergence levels

	α_1	α_2	α_3	α^*	D/Y
Regime 0	-0.021	0.564	0.082	0.01	0.274
Regime 1	-0.021	0.564	0.028	0.01	0.922
Regime 0	-0.021	0.564	0.082	0	0.259
Regime 1	-0.021	0.564	0.028	0	0.776
Regime 0	-0.021	0.564	0.082	-0.01	0.246
Regime 1	-0.021	0.564	0.028	-0.01	0.670
Regime 0	-0.021	0.564	0.053	0.01	0.439
Regime 0	-0.021	0.564	0.053	0	0.402
Regime 0	-0.021	0.564	0.053	-0.01	0.372
Regime 1	-0.021	0.564	0	0	∞

Table 4 shows the calculations done with Equation (6), using the parameters for the two regimes estimated for the primary balance/GDP ratio above. Should the real interest rate exceed the real growth rate so that $\alpha^* = 0.01$, Regime 0 of the primary balance/GDP Markov-switching regression implies a low debt regime, while Regime 1 implies the high debt regime. In the case of Regime 0 the debt/GDP ratio is expected to converge on 27.4%, while in the case of the high debt regime it is expected to converge on 92%. Note that the low debt regime (Regime 0) is also the regime in which the primary balance/GDP ratio reacts to the debt/GDP ratio, while in the high debt regime (Regime 1), it does not react. Table 5 also presents the cases for when $\alpha^* = 0$ and $\alpha^* = -0.01$. For the low debt regime these scenarios imply slightly lower debt/GDP ratios (25.9% and 24.6%), while for the high debt regimes the debt/GDP ratio is significantly lower, but nevertheless still high (77.6% and 67%).

Figure 5 -Debt/GDP ratio's converging paths according to the two regimes

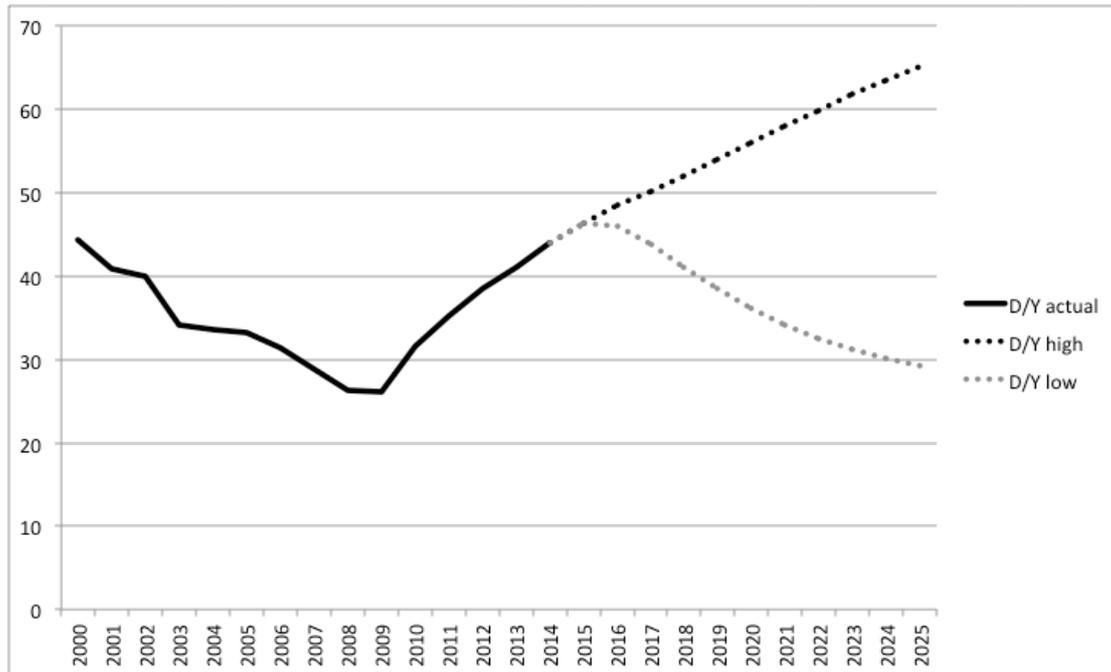


Figure 6 -Primary balance/GDP ratio's converging paths according to the two regimes

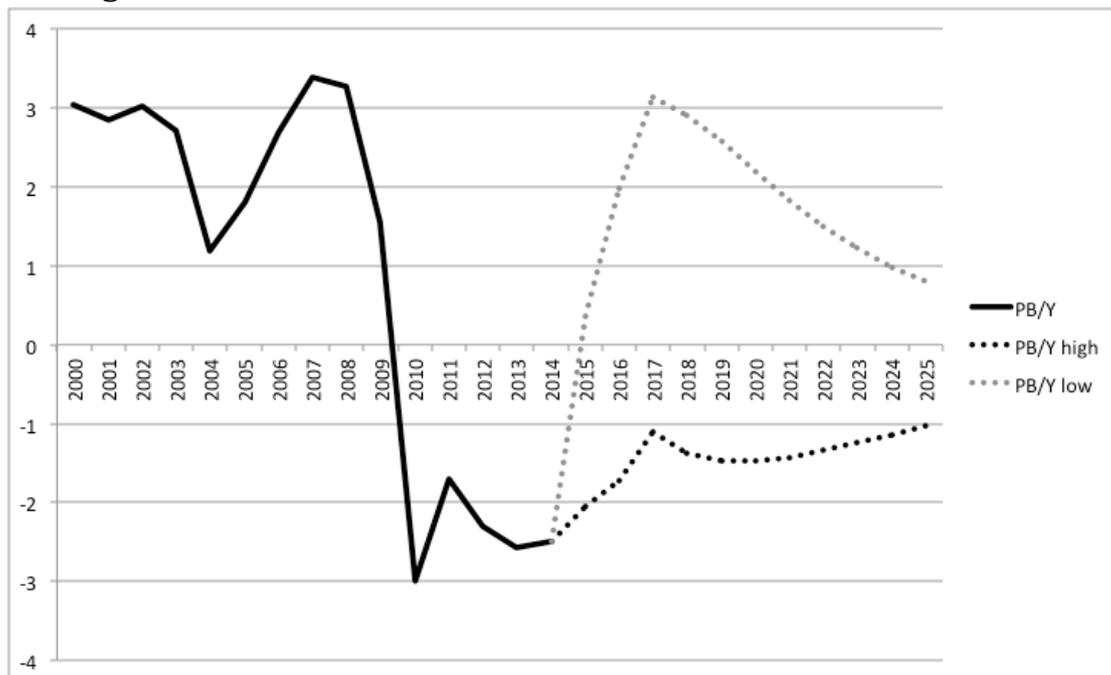


Figure 7 – Debt/GDP ratio’s converging paths: A regime that stabilises the debt/GDP ratio (but not reduce it)

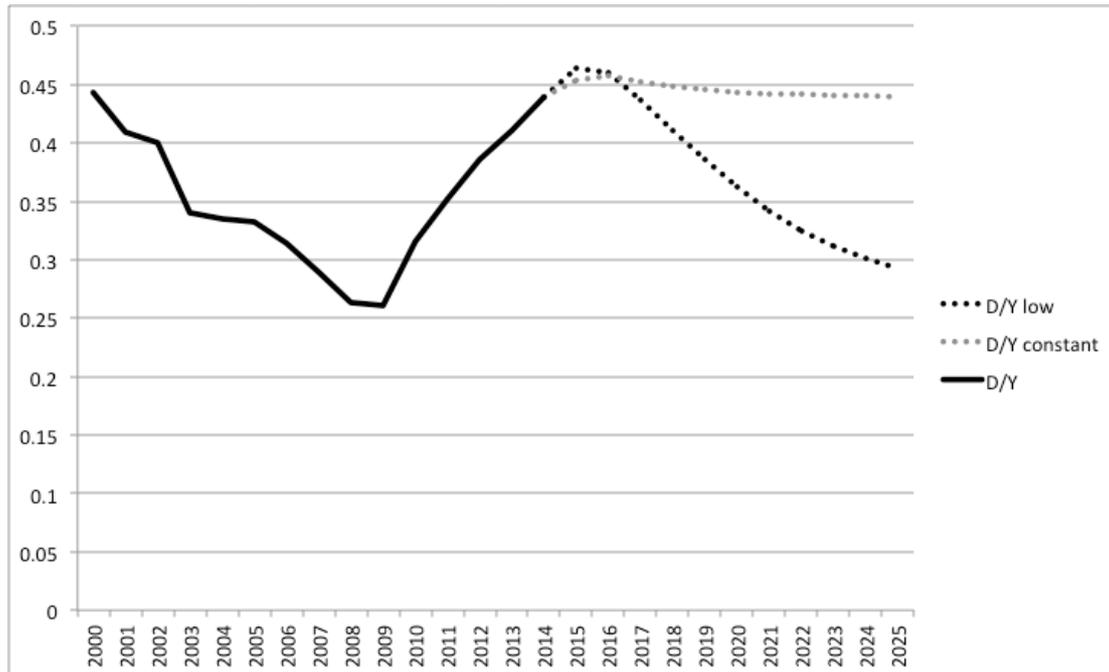
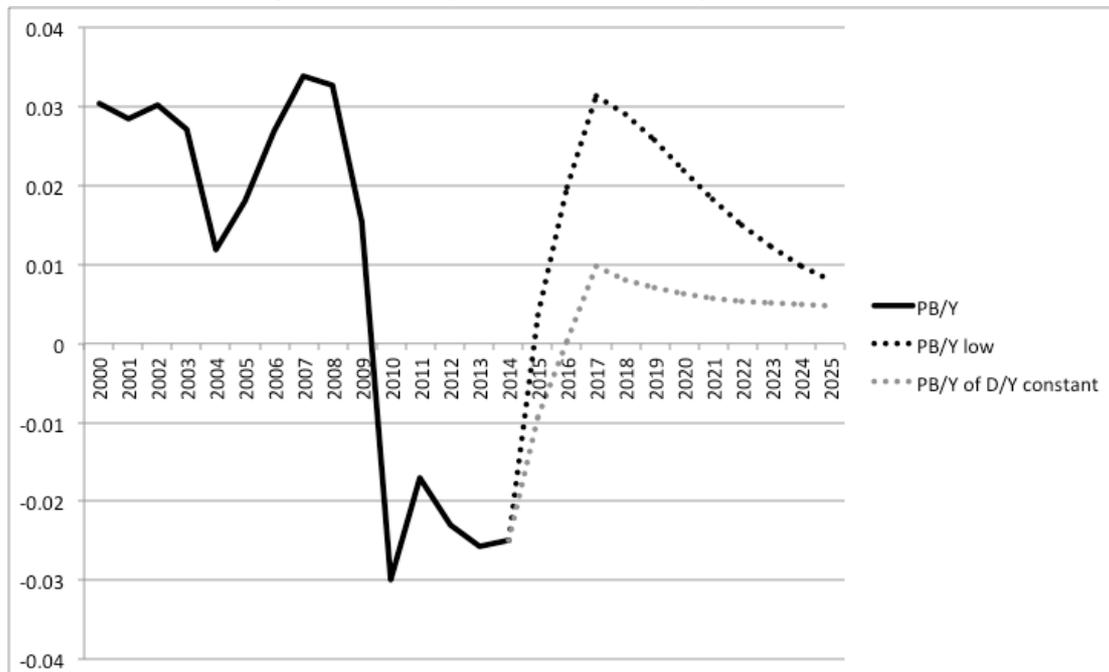


Figure 8 – Primary balance/GDP ratio’s converging paths: A regime that stabilises the debt/GDP ratio (but not reduce it)



Figures 5 and 6 accompany the scenario where $\alpha^* = 0.01$ and show the path for the debt/GDP and primary balance/GDP ratios up to 2025. Because the consolidation path of debt under the low debt regime might be construed as severe (it implies moving from a primary deficit of 2.5% to a primary surplus of 3% in a matter of two to three years), Table 5 also presents an alternative scenario in which the reaction of the primary balance/GDP ratio to the debt/GDP

ratio is smaller and intends to merely stabilise the debt/GDP ratio at roughly its level at the time of writing. Instead of a reaction parameter of 0.082 observed in Regime 0, it decreases to 0.053. The debt/GDP ratio then converges on 44% (with $\alpha^* = 0.01$), instead of 27.4%. Figures 7 and 8 compare the debt/GDP and primary balance/GDP ratios for the low debt scenario to those of the scenario in which the reaction is smaller. Lastly, the value for debt/GDP in the high debt regime is not statistically significantly different from zero. Hence, Table 5 also reports that the debt/GDP ratio will explode (move to infinity in finite time) if the primary balance does not react to the debt/GDP ratio.

6. Conclusion – the sustainability of fiscal policy

The analysis above shows that the government has been in a high debt regime since 2010, with the primary balance being unresponsive to the debt/GDP ratio. What approach should the government take to re-establishing fiscal sustainability and, more specifically, should the approach be similar to the one it followed from the late 1990s to 2009?

The analysis indicates that the low debt regime of the late-1990s to 2009 was accompanied by a reduction in the fixed capital/GDP ratio. Therefore, even though the reduction in debt/GDP ratio ensured fiscal sustainability, it did not coincide with an improvement in the government's balance sheet. International literature for OECD, emerging and developing countries indicate that cutting current expenditure is preferable to cutting capital expenditure as a strategy for reducing fiscal deficits.

Therefore, the government at the time of writing needs to decide whether it wants to reduce the public debt/GDP ratio to its pre-crisis level (27% of GDP), or merely stabilise the ratio at its post-crisis level (roughly 44% of GDP). At the heart of this choice is the requirement to balance the need to finance much-needed public infrastructure with the need to return to a low debt/GDP ratio (say 27%) to create room for countercyclical fiscal policy in future recessions. Public corporations face a similar choice between reducing indebtedness and maintaining higher debt/GDP levels to finance much-needed infrastructure. Whichever option the government selects will mean a much tighter budget constraint with respect to current expenditure.

Given the constraint that infrastructure shortages (e.g. the electricity shortage) places on economic growth currently, the benefits of stabilising the ratio at roughly 44% and simultaneously expanding public infrastructure, probably outweighs the need to create room for future countercyclical fiscal policy. The same applies to public corporations. Unfortunately many, if not most public corporations lately face serious management problems that undermine their effective operations. The same goes for a number of provincial and local government departments and entities. If these problems are not resolved, they

will unfortunately seriously undermine the return on the expanding public sector investment.

Bibliography

- Adam, C.S. and D.L. Bevan. 2003. Staying the course: Maintaining fiscal control in developing countries. *Brookings Trade Forum* (2003): 167-214.
- Afonso, A., P. Claeys and M.R. Sousa. 2009. Fiscal regime shifts in Portugal. *School of Economics and Management (ISEG) Working Paper Series WP 41/2009/DE/UECE*, Lisbon: Technical University of Lisbon.
- Alesina, A., and S. Ardagna. 1998. Tales of fiscal adjustment. *Economic Policy*, 13(27): 487-545.
- Alesina, A. and S. Ardagna. 2010. Large changes in fiscal policy: taxes versus spending. In *Tax Policy and the Economy* (volume 24) (edited by J.R. Brown). Cambridge & Chicago: National Bureau of Economic Research & University of Chicago Press: 35-68.
- Alesina, A. and S. Ardagna. 2013. The design of fiscal adjustments. In *Tax Policy and the Economy* (volume 27) (edited by J.R. Brown). Cambridge & Chicago: National Bureau of Economic Research & University of Chicago Press: 19-68.
- Alesina, A. and R. Perotti. 1997. Fiscal adjustments in OECD countries: composition and macroeconomic effects. *IMF Staff Papers*, 44(2): 210-248.
- Ardagna, S. 2004. Fiscal stabilizations: when do they work and why? *European Economic Review*, 48(5): 1047-1074.
- Baldacci, E., B. Clements, S. Gupta and C. Mulas-Granados. 2004. Persistence of fiscal adjustments and expenditure composition in low-income countries. In *Helping countries develop: the role of fiscal policy* (edited by S. Gupta, B. Clements and G. Inchauste). Washington, D.C.: The International Monetary Fund: 48-66.
- Baldacci, E., B. Clements, S. Gupta and C. Mulas-Granados. 2006. The phasing of fiscal adjustments: what works in emerging market economies? *Review of Development Economics*, 10(4): 612-631.
- Bispham, J.A. 1987. Rising public sector indebtedness: some more unpleasant arithmetic. In *Private saving and public debt* (edited by M.J. Boskin, J.S. Flemming and S. Gorini). Oxford: Basil Blackwell: 40-71.
- Bohn, H. 1995. The sustainability of budget deficits in a stochastic economy. *Journal of Money, Credit and Banking*, 27(1): 257-271.
- Bohn, H. 1998. The behaviour of US public debt and deficits. *Quarterly Journal of Economics*, 113(3): 949-963.
- Bohn, H. 2007. Are stationary and cointegration restrictions really necessary for the intertemporal budget constraint? *Journal of Monetary Economics*, 54: 1837-1847.

- Bohn, H. 2010. The economic consequences of rising US government debt: privileges at risk. Unpublished paper. Santa Barbara: University of California at Santa Barbara. Available at: <http://www.econ.ucsb.edu/~bohn/papers/BohnDebtConsequences.pdf>.
- Burger, P. and M. Marinkov. 2012. Fiscal rules and regime-dependent fiscal reaction functions: the South African case. *OECD Journal on Budgeting*, 2012(1): 79-107.
- Burger, P., I. Stuart, C. Jooste and A. Cuevas. 2012. Fiscal sustainability and the fiscal reaction function for South Africa: assessment of the past and future policy applications. *South African Journal of Economics*, 80(2): 209-227.
- Claeys, P. 2005. Policy mix and debt sustainability: evidence from fiscal policy rules. *CESifo Working Paper No. 1406*. Munich: Centre for Economic Studies, Ifo Institute and the CESifo GmbH.
- De Mello, L. 2005. Estimating a fiscal reaction function: the case of debt sustainability in Brazil. *OECD Economics Department Working Papers No. 423*. Paris: Organisation for Economic Cooperation and Development.
- Easterly, W. 1999. When is fiscal adjustment an illusion? *Economic Policy*, 14(28): 57-76.
- Favero, C., and M. Marcellino. 2005. Modelling and forecasting fiscal variables for the Euro area. *Oxford Bulletin of Economics and Statistics*, 67 (Supplement [2005]): 755-783.
- Franses, P.H. and D. van Dijk. 2000. *Non-linear time series models in empirical finance*. New York: Cambridge University Press.
- Guichard, S., M. Kennedy, E. Wurzel and C. André. 2007. What promotes fiscal consolidation: OECD country experiences. *Economics Department Working Paper No. 553*. Paris: Organisation for Economic Cooperation and Development.
- Gupta, S., E. Baldacci, B. Clements and E.R. Tiongson. 2003. What sustains fiscal consolidations in emerging market countries? *Working Paper No. 03/224*. Washington, D.C.: The International Monetary Fund.
- Gupta, S., B. Clements, E. Baldacci and C. Mulas-Granados. 2004. The persistence of fiscal adjustments in developing countries. *Applied Economics Letters*, 11: 209-212.
- Hamilton, J.D. 1996. Specification testing in Markov-switching time-series models. *Journal of Econometrics*, 70: 127-57.
- Hamilton, J.D. 1989. A new approach to the econometric analysis of nonstationary time-series and the business cycle. *Journal of Econometrics*, 57(2): 357-84.
- Leeper, E. 1991. Equilibria under 'active' and 'passive' monetary and fiscal policies. *Journal of Monetary Economics*, 27: 129-147.
- Lusinyan, L. and J. Thornton. 2009. The sustainability of South African fiscal policy: An historical perspective. *Applied Economics*, 41(7): 859-868.
- McDermott, J. and R. Wescott. 1996. An empirical analysis of fiscal adjustments.

- IMF Staff Papers*, 43(4): 723-753.
- Milesi-Ferretti, G.M. and K. Moriyama. 2006. Fiscal adjustment in EU countries: a balance sheet approach. *Journal of Banking and Finance*, 30: 3281–3298.
- National Treasury. 2009. *Budget review 2009*. Pretoria: National Treasury.
- National Treasury. 2012. *Budget review 2012*. Pretoria: National Treasury.
- National Treasury. 2014. *Medium-term budget policy statement 2014*. Pretoria: National Treasury.
- National Treasury. 2015. *Budget review 2015*. Pretoria: National Treasury.
- Pisani-Ferry, J. 2015. Unnecessary instability. Project Syndicate. 31 March 2015. <http://www.project-syndicate.org/print/potential-output-fiscal-policy-by-jean-pisani-ferry-2015-03>.
- Saxegaard, M. 2014. Safe debt and uncertainty in emerging markets: an application to South Africa. *IMF Working Paper WP/14/231*. Washington, D.C.: The International Monetary Fund.
- Von Hagen, J. and R. Strauch. 2001. Fiscal consolidations: quality, economic conditions, and success. *Public Choice*, 109(3–4): 327–346.