IOSR Journal of Economics and Finance (IOSR-JEF)
e-ISSN: 2321-5933, p-ISSN: 2321-5925.Volume 10, Issue 3 Ser. III (May. – June 2019), PP 57-65
www.iosrjournals.org

The Missing Link: Fiscal Sustainability Analysis in South Africa

Elvis Munyaradzi Ganyaupfu
Latitude Data (Pty) Ltd, Pretoria, South Africa
Corresponding Author: Elvis Munyaradzi Ganyaupfu

Abstract: *The main goal of this study was to evaluate whether South African government reacted to its debt positions in a sustainable manner afterintegrating the implicit exogenous short-run impact of monetary policy stance on primary balance and public debt positions over the period 1997q4 to 2016q3. The Vector Error Correction (VEC) model was applied to estimate the fiscal reaction function using EViews. Results indicate that fiscal policy was sustainable, while monetary policy stance had significant impacts on primary balance and public debt positions, which confirms that monetary policy contributes to ensuring fiscal sustainability in South Africa.*

Keywords: *fiscal sustainability, monetary policy stance, primary balance, public debt, VEC model*

Date of Submission: 06-06-2019 Date of acceptance: 21-06-2019

I. Introduction

The sources and trends of public debt are crucial indicators of the degree to which financial markets accommodate government as a borrowing agent, given the observed and perceived manner in which government manages its sovereign debt. Subsequent to the global financial crisis in 2008, South Africa's real gross domestic product (GDP) growth plunged from 3.6% in 2008 to -1.7% in 2009 before recovery to 2.9% in 2010, and drop to 1.2% in 2015 (International Monetary Fund (IMF), 2017). Sluggish growth in the country's output was attributed to labour market instabilities mainly in the mining, agriculture and manufacturing sectors, diminishing business and consumer confidence and weak growth in the nation's major European and North American trading partners (Kumo, Rielander & Omilola, 2014). Real output growth was moderately volatile over the period 2002 quarter 4 to 2016 quarter 4, with a decline in real GDP of -1% being recorded in 2009 quarter 4 adjacent to recovery. In an effort to support fiscal policy towards improving weak domestic aggregate demand and negative output gap in the economy,monetary policy retained interest rates low since the 2008 global financial crisis(Financial and Fiscal Commission, (FFC), 2014).

Over the period 1994/95 to 2016/17, the net loan debt-to-GDP ratio declined from 48.1% during 1996/97 to 22.9% during 2008/09, but constantly increased to 45.5% during 2016/17 (National Treasury, 2017). The cyclically adjusted balance (full employment budget balance)during the periods 2000-2005 and 2008-2016 averaged -0.9% and -3.1% respectively (IMF, 2017), indicating that the country's decomposed fiscal position was depressed over the period 2000 to 2016. In addition, the cyclically adjusted primary balance; calculated by subtracting net interest payments from cyclically adjusted balance, was in the surplus territory, and averaged 3.1% over the period 2000 to 2008 (IMF, 2017). The respective balance remained in the deficit zone, and averaged -0.8% between 2009 and 2014 (IMF, 2017).

This paper is organised as follows: Section 1 provides the introduction, while Section 2 presents literature and theoretical framework. Section 3 describes econometric methodology, Section 4 presents and analyses the results, and Section 5 provides concluding remarks.

II. Literature Review and Theoretical Framework

Several priorstudies on fiscal sustainability regard fiscalpolicy as purely exclusive from monetary policy, whileDahan (1998) and Gurkaynak (2015) maintain that fiscal sustainability cannot be regarded as a fiscal issue purely exclusive from monetary policy since monetary policy affects the budget deficit and debt through borrowing costs and seigniorage.Laurens and de la Piedra (1998) emphasise the need for coordination of monetary and fiscal policies derives from the link between fiscal deficit and its financing via bonds issuance and central bank credit to government. When output growth remains low relative to interest rates, debt usuallyexplodes. The central bankmight need to intervene by determining growth of monetary base independent ofdeficit financing needs (Goodhart, 2012). Government would need toreduce budget deficit to match available financing.

Though the instant impact of a monetary policy stance on budget deficit and debt may be small, the cumulative effect can be significant if there is at least one kind of nominal rigidity such that money remains non-neutral in the short run (Dahan, 1998). Impaired banking sector conditions cause low growth and increase fiscal risks, and furthercause fragile fiscal positions, and reduced investment and consumption (IMF, 2015). Hellebrandt, Posen and Tolle (2012) and Greenlaw, Hamilton, Hooper & Mishkin (2013) emphasise the importance of an accommodative monetary policy stance in ensuring fiscal sustainability.However, in respect of preceding studieson fiscal sustainability in South Africa, none of such empiricalstudies (Tshiswaka-Kashalala, 2006; Burger, Stuart, Jooste & Cuevas, 2011; Gabriel & Sangduan, 2010; Jibao, Schoeman & Naidoo, 2011; and Ganyaupfu, 2014) integrated and examined the impact of monetary policy stance onprimary balance and debt positions.

To validate the relevance of monetary policy stance in assessing fiscal sustainability, Burnside (2004) usedthe government lifetime budget constraint as the crucial starting point, where net debt issuance should equal interest payments less primary balance and seigniorage; defined by the identity $D_t - D_{t-1} = I_t - B_t - (M_t - M_{t-1})$; where t denotes time in years, D_t represents the amount of government debt at the end of period t, I_t symbolises interest payments, $B_t$denotes primary balance (revenue less non-interest spending), and $M_t$represents local currency denominated monetary base at the end of time period t. In deriving the government's lifetime budget constraint.

Burnside (2004) makes assumptions that time is discrete, all public debt matures in time period t, debt is measured in real terms and interest rate is constant. The government lifetime budget constraint becomes $d_t = (1+r)d_{t-1} - b_t - \rho_t$, and further reduces to $d_{t-1} = (1+r)^{-1} d_t + (1+r)^{-1}(b_t + \rho_t)$; where d_t isthe end-of-period public debt-to-GDP ratio, $b_t$is the primary balance-to-GDP ratio, and $\rho_t = (M_t - M_{t-1})/P_t$ is real value of seigniorage. Updating $d_{t-1} = (1+r)^{-1} d_t + (1+r)^{-1}(b_t + \rho_t)$to time t yields $d_t = (1+r)^{-1} d_{t+1} + (1+r)^{-1}(b_{t+1} + \rho_{t+1})$; which when substituted into the RHS of $d_{t-1} = (1+r)^{-1} d_t + (1+r)^{-1}(b_t + \rho_t)$ yields $d_{t-1} = (1+r)^{-2} d_{t+1} + (1+r)^{-1}(b_{t+1} + \rho_{t+1}) + (1+r)^{-1}(b_t + \rho_t)$. Substituting d_{t+1} on the RHS of theadjacent preceding equation, and for $d_{t+2} \ldots$ recursively yields:

$$d_{t+1} = (1+r)^{-1(j+1)} d_{t+j} + \sum_{i=0}^{j} (1+r)^{-(i+1)} (b_{t+i} + \rho_{t+i}) \tag{2.1}$$

Equation (2.1) shows that the amount of debt held by government at period t+j is a function of the amount of initial debt stock held at period t-1, as well as the amount of primary surplus realised and seigniorage raised between periods t+j and t-1. The condition $\lim_{j \to \infty} (1+r)^{-(j+1)} d_{t+j} = 0$ has to be imposed in order to derive the government lifetime budget constraintdefined by the equation:

$$d_{t-1} = \sum_{i=0}^{\infty} (1+r)^{-(i+1)} (b_{t+i} + \rho_{t+i}) \tag{2.2}$$

Equation (2.2) shows that government finances its initial debt by raising seigniorage revenue and generating primary surpluses in future, whose present value equals initial public debt obligations (Burnside, 2004). From a fiscal-monetary policy coordination standpoint, when a set of fiscal and monetary policies maintained indefinitely puts the nation on a solvency path, that policy composite can be deemed sustainable. Fiscal sustainability analysis exercises musttherefore not focus merely on default, but also on potential impacts of changes in the policy mix required to prevent default; where the government lifetime budget constraint defined by $d_t = (1+r)d_{t-1} - b_t - \rho_t$ reduces to:

$$\underbrace{P_t(d_t - d_{t-1}) + (M_t - M_{t-1})}_{\text{government financing}} = \underbrace{P_t(rd_{t-1} - b_t)}_{\text{government financing requirement}} \tag{2.3}$$

The RHS of equation (2.3) denotes government's financing requirement, given by the nominal value of the sum of real interest payments and primary deficit. Similarly, the LHS of the equation denotes government's financing, which comprisesnet issuance of debt and net issuance of base money. In scenarios where fiscal authorities determine b_t, then rd_t can be predetermined. Taking into consideration the price stabilisation goal, fiscal authorities can choose b_t, while the central bank choosesM$_t$ and $d_t$consistent with equation (2.3). In scenarios where government issues debt to finance budget deficits, while money is never printed to finance deficits or monetise public debt $(M_t = M \forall t)$, the budget constraint becomes $d_{t-1} = \sum_{t=0}^{\infty}(1+r)^{-(t+1)} b_t$, and the present value of primary balance remains equal to the initial public debt stock. The scenario that $M_t = M \forall t$ implies that running a primary deficit at time t = 0; $b_0 > 0$ forces government to ensure future primary surpluses in present value terms such that $\sum_{t=0}^{\infty}(1+r)^{-(t+1)} b_t > 0$; which depicts a rigid monetary policy stance that requiresfuture fiscal policy to tighten if present fiscal stance gets loose over time.

In conditionswhere fiscal and monetary policies are coordinatedin pursuit of an inflation target (π^*), central bank can determinea growth rate of money stock consistent with the inflation target. Conversely, in theabsence of fiscal and monetary policies coordination, central bank would need to set the transactionary motive for money demand constant (Md^T= Md) to ensure that the real balance remains constant (M_t / P_t= q/v); where "q" denotes real GDP and "v" denotes a constant real value for money velocity. If the growth of money remains constant at some rate θ, the inflation rate can be set at π = θ, and the real value of seigniorage becomes constant at $\rho_t = \rho$ such that:

$$\rho = \frac{M_t - M_{t-1}}{P_t} = \frac{(1+\theta)M_t - M_{t-1} - M_{t-1}}{(1+\theta)P_{t-1}} = \frac{\theta}{1+\theta} m \tag{2.4}$$

To maintain stability in the general price level from the current period 0 to some future period T, the central bank sets the growth rate of money to some realistically lowest possible arbitrary value θ. However, if the central bank prints money to ensure government's solvency, the money growth rate might have to be set at constant θ', consistent with the lifetime budget constraint. To ensure policy coordination, government can set $b_t = b \forall t$ and $b < rd_{-1}$. Some seigniorage revenue might be required to satisfy the lifetime budget constraint at sometime period T+1 defined by:

$$d_T = \sum_{t=T+1}^{\infty}(1+r)^{-(t-T)}(b_t + \rho_t) \tag{2.5}$$

Since $\rho_t = \theta' m/(1+\theta')$ and $b_t = b \forall t$, equation (2.5) can be rewritten as $d_T = [(b+\theta' m)/(1+\theta')]/r$. Solving for θ' in the adjacent equation yields $\theta' = (rd_T - b) \div (m - (rd_T - b))$; indicatingthat higher levels of debt at timeperiod T can imply higher θ' since $(\Delta\theta' / \Delta d_T) = \left[rm \div (m - (rd_T - b))^2 \right] > 0$. The government lifetime budget constraint rolled from time period 0 to time period T becomes:

$$d_{-1} = (1+r)^{-(T+1)} d_T + \sum_{t=0}^{T}(1+r)^{-(t+1)}(b_t + \rho_t) \tag{2.6}$$

Rearranging equation (2.6), the government lifetime budget constraint at time period T yields:

$$d_T = (1+r)^{T+1} d_{-1} - \frac{(1+r)^{T+1}}{r}\left(b + m\frac{\theta}{(1+\theta)}\right) \Rightarrow \frac{\partial d_T}{\partial T} = \ln(1+r)(1+r)^{T+1}\left[d_{-1} - \frac{1}{r}\left(b + m\frac{\theta}{(1+\theta)}\right)\right] \tag{2.7}$$

The government can accumulate more debt when θ is lower. Equation (2.7) showsthat a tougher monetary policy stance (lower θ) over a long period (higher T) leads to increased debt stock (d_T). In order to maintainfiscal sustainability, fiscal authorities and the central bank should set paths of primary balance (b_t) and base money supply (M_t) consistent with the government's lifetime budget constraint defined by equation (2.2). Since the central bank cannot stabilise prices indefinitely without the support of fiscal policy, the goals of a stable general price level and a sustainable fiscal path can only be attained through coordination of fiscal and monetary policies (Burnside, 2004).

III. Econometric Methodology

Data and Sources

Time-series quarterly data for primary balance-to-GDP ratio (B/Y) and debt-to-GDP ratio (D/Y)for the period 1997q4 to 2016q3 was sourcedonline from South African Reserve Bank (SARB). Data for exogenous variables GDP growthand central bank policy rate (r)were sourced from the International Monetary Fund (IMF) International Financial Statistics (IFS) online portal. The GDP growthrate series was applied to compute the outputgap ($\hat{y}_t$) seriesusing the Hodrick-Prescott filter technique.

Stationarity Tests and Optimal Lag Order Selection

The Augmented Dickey-Fuller (ADF) criterion, which performs well even when a sample is small (Dickey & Fuller, 1979), was applied to test for univariate unit roots based on the autoregressive (AR(p)) process defined as $\Delta X_t = \pi + \beta X_{t-1} - \sum_{i=1}^{p-1} \alpha_i \Delta X_{t-i} + \varepsilon_t$; where $\varepsilon_t$denotes a white noise error term, and p signifies a class of autoregression. The optimal lag lengths wereselected based onLikelihood Ratio (LR) statistic, Akaike Information Criterion (AIC), Final Prediction Error (FPE), Schwarz Information Criterion (SIC) and Hannan-Quinn Information Criterion (HQIC).

Vector Auto-Regressive (VAR) Model

The unstructured VAR framework, which allows variables to interact without imposing theoretical structures on estimates, was used to model interrelations of a system of multivariate equations for B/Y and D/Y, and examine the joint dynamic behaviour amongsuch variables given by the matrix:

$$\begin{aligned} \left(\frac{B}{Y}\right)_t &= \alpha_{11} + \pi_{12}\left(\frac{B}{Y}\right)_{t-1} + \theta_{13}\left(\frac{D}{Y}\right)_{t-1} + \gamma_{12}(r_t) + \delta_{13}\left(\hat{y}_t\right) + \varepsilon_{11t} \\ \left(\frac{D}{Y}\right)_t &= \alpha_{21} + \pi_{22}\left(\frac{B}{Y}\right)_{t-1} + \theta_{23}\left(\frac{D}{Y}\right)_{t-1} + \gamma_{22}(r_t) + \delta_{23}\left(\hat{y}_t\right) + \varepsilon_{21t} \end{aligned} \tag{3.1}$$

The VAR(p) model (equation 3.1) is a seemingly unrelated regression (SUR) with lagged (B/Y) and (D/Y) as endogenous variables, while(r) and output gap ($\hat{y}_t$) are exogenous variables.

Cointegration Test

The Johansen's procedure (Johansen, 1988), which applies VAR(p) as a starting point, was used to test for presence of a cointegrating between B/Y and D/Y in form of a vector $X_t$defined as:

$$X_t = \Phi_1 X_{t-1} + \Phi_2 X_{t-2} + \ldots\ldots + \Phi_p X_{t-p} + u_t \tag{3.2}$$

where: X_t is a 2x1 vector of I(1) B/Y and D/Y series, u_t is a 2x1 vector of innovations, Φ_1 through Φ_p denotes 2x2 coefficient matrices, and the impact matrix Φ is the degree of system cointegration.

The test was conducted usingthe Maximum Eigenvalue and Trace likelihood ratio (LR) statistics.

The Maximum Eigenvalue statistic tested the null hypothesis (H_0) that the number ofcointegrating vectors equals r_0 versus the alternative hypothesis (H_1) that the number of cointegrating vectors equals $r_0 + 1$ based on the function $\lambda_{max}(r_0, r_0 + 1) = -T \ln(1 - \lambda_{r_0+1})$; where λ_{max} is the maximum eigenvalue, T denotes the sample size, and λ denotes the canonical correlation.The Trace statistictested theH_0 that the number of cointegrating vectors $\leq r_0$ versus the H_1 that the number of cointegrating vectors $> r_0$ based on the function $\lambda_{trace} = -T \sum_{i=r_0+1}^{n} \ln(1-\lambda)$; where T is the sample size, n isthe maximum number of cointegrating vectors, and λisthe largest canonical correlation.

Vector Error Correction (VEC) Model

The fiscal reaction function $(B/Y)_t = \alpha + \beta(B/Y)_{t-1} + \tau(D/Y)_{t-1} + \varepsilon_t$ was estimated to assesswhether or not the intertemporal budget constraint condition was satisfied. Econometric estimation was conducted using the Vector Error Correction (VEC) model comprising a system of equations:

$$\Delta\left(\frac{B}{Y}\right)_t = \alpha_{11} + \pi_{12}\left[\left(\frac{B}{Y}\right)_{t-1} - \theta_{12}\left(\frac{D}{Y}\right)_{t-1} - \theta_{13}\right] + \varphi_{11}\,\Delta\left(\frac{B}{Y}\right)_{t-1} + \varphi_{12}\,\Delta\left(\frac{D}{Y}\right)_{t-1} + \gamma_4(r_t) + \delta_5\left(\hat{y}_t\right) + \varepsilon_{11t}$$

(3.3)

$$\Delta\left(\frac{D}{Y}\right)_t = \alpha_{21} + \pi_{13}\left[\left(\frac{B}{Y}\right)_{t-1} - \theta_{12}\left(\frac{D}{Y}\right)_{t-1} - \theta_{13}\right] + \varphi_{21}\,\Delta\left(\frac{B}{Y}\right)_{t-1} + \varphi_{22}\,\Delta\left(\frac{D}{Y}\right)_{t-1} + \gamma_4(r_t) + \delta_5\left(\hat{y}_t\right) + \varepsilon_{21t}$$
(3.4)

The one period lagged B/Y in equation (3.3)captures inertia in the behaviour of government. Parameters $(B/Y)_{t-1} - \theta_{12}(D/Y)_{t-1} - \theta_{13}$ in both equations (3.3) and (3.4) denote the deviation from the long-run equilibrium.The parameter π_{12} in equation (3.3) denotes the error correction term (ECT), which measures the fiscal reaction to publicdebt positions or deviations from the long-run equilibrium defined by the function $(B/Y)_{t-1} = \theta_{12}(D/Y)_{t-1} - \theta_{13}$.

The central bank policy rate (r) variablewas integrated into the short-run components of equations (3.3) and (3.4) to capture the impact of monetary policy stance on primary balance and debt positions. Given the government's efforts to pursue short-run demand stabilisation, output gap ($\hat{y}_t$) was exogenously in the short-run dynamics of equations (3.3) and (3.4) to capture the reaction of fiscal policy to business cycles.Based the structure of the VEC model, estimation of the fiscal reaction function was conducted based on the reduced form defined by equation (3.5):

$$\Delta Z_t = \varpi\, Z_{t-1} + \sum_{t=i}^{k} \xi_i\, \Delta Z_{t-1} + \sum_{t=j}^{n} \Phi_j\, X_{t-j} + c_t + \varepsilon_{kt} \qquad (3.5)$$

where Z_t represents a 3x1 vector comprising I(1) endogenous variables (B/Y) and (D/Y), and a constant; X_t denotes a 2x1 vector consisting of I(1) exogenous variables (r and $\hat{y}_t$); $\xi_i$symbolises 2x2 short-run coefficient matrices; Φ_j signifies a 2x1 vector comprising coefficients of exogenous variables; $c_t$is a vector comprising constants; and ε_{kt} denotes IDD error terms. The parameter ϖ was decomposed into τ and $\vartheta^{/}$ matrices; yielding:

$$\varpi\, Z_{t-1} = \tau\,\vartheta^{/}\, Z_{t-1} = \begin{bmatrix}\tau_{11}\\ \tau_{21}\end{bmatrix}\begin{bmatrix}1 & -\vartheta_{12} & -\vartheta_{13}\end{bmatrix}\begin{bmatrix}(B/Y)_{t-1}\\ (D/Y)_{t-1}\\ 1\end{bmatrix} \qquad (3.6)$$

whereτ denotes a 2x1 matrix of two variables with ≥ 1 cointegrating relationship(s) that contain the long-run equilibrium adjustment parameter, and $\vartheta^{/}$ represents a 1x3 matrix containing long run parameters, including a constant.

IV. Results and Analysis

Stationarity Results

Table 1: ADF stationarity tests statistics in first differences

Series	Model	Lag length	α=1%	α=5%	α =10%	t-statistic τ_c, τ_{tc}, τ_n
B/Y	Constant	6	-3.530	-2.904	-2.589	-3.496^{**}
	Trend and Constant	6	-4.098	-3.477	-3.166	-3.462^{*}
	None	6	-2.599	-1.945	-1.613	-3.449^{***}
D/Y	Constant	7	-3.531	-2.905	-2.590	-1.073
	Trend and Constant	7	-4.100	-3.478	-3.166	-2.211
	None	7	-2.599	-1.945	-1.613	-1.133
r	Constant	11	-3.538	-2.908	-2.591	-4.614^{***}
	Trend and Constant	11	-4.110	-3.482	-3.169	-4.984^{***}
	None	11	-2.602	-1.946	-1.613	-4.110^{***}
ŷ	Constant	8	-3.533	-2.906	-2.590	-3.181^{**}
	Trend and Constant	8	-4.103	-3.479	-3.167	-3.147
	None	8	-2.600	-1.945	-1.613	-3.209^{***}

$^{[***]\,(**)\,*}$ represent significance at 1 percent, (5) percent levels and [10] percent levels; respectively
τ_c, τ_{tc}, τ_n and $Ø_c$, $Ø_{tc}$, $Ø_n$ represent ADF and PP test results computed using constant, trend and constant, and none; respectively

Results for unit root tests in first differences show that primary balance-to-GDP ratio (B/Y), central bank policy rate (r) and output gap (ŷ) were stationary at 1% level of significance based on the model with no constant. The debt-to-GDP ratio (D/Y) remained non-stationary at 10% significance level, hence a second difference to the series was applied upon which the unit root hypothesis was rejected at 5 percent significance level. The results of the optimal lag length selected are presented in the Appendix 1.

Cointegration Results

Table2: Cointegration Test with Linear Deterministic Trend-Lag Interval: 1 to 1

Null hypothesis (H_0) vs. Alternative hypothesis (H_1)	r = 0 vs. r = 1	r ≤ 1 vs. r = 2
Trace statistic	49.656*	1.073
Critical value (p-value)	15.494(0.000)	3.841(0.300)
Maximum-Eigen statistic	48.583*	1.073
Critical value(p-value)	14.264(0.000)	3.841(0.300)

*denotes rejection of the null hypothesis at 5% significance level

The Johansen Trace and Maximum-Eigen test statistics indicate existence of 1 cointegrating equation at 5% significance level based on the computed Trace statistic (= 49.65697) greater than the critical value (= 15.49471; $p < 0.05$) and Max-Eigen statistic (= 48.58367) larger than the analogous computed critical value (= 14.26460; $p < 0.05$). The presence of a cointegrating equation forthe series B/Y and D/Yvalidated the rationale totest for the historical sustainability of fiscal policy using the VEC model.

VAR Representation of Vector Error Correction (VEC) Model Estimates

Table 31: VEC Model – Substituted Parameters†

Primary balance-to-GDP ratio equation

$$d(B/Y) = \underset{\{-6.095\}}{-0.696} * \left[(B/Y(-1)) + \underset{\{2.441\}}{1.627} * d(D/Y(-1)) + 0.854 \right] \underset{\{-1.449\}}{-0.176} * d(B/Y(-1)) \underset{\{-4.210\}}{-1.377} * d(D/Y(-1),2) \underset{\{-3.87}{-10.1}$$

$$+ \underset{\{3.868\}}{4.744} * r(-2) + \underset{\{2.859\}}{0.748} * y\_gap(-2) \qquad \text{(eqn 3}$$

Public debt-to-GDP ratio equation

$$d(D/Y, 2) = \underset{\{4.982\}}{0.218} * \left[(B/Y(-1)) + \underset{\{2.441\}}{1.627} * d(D/Y(-1)) + 0.854 \right] \underset{\{-4.272\}}{-0.199} * d(B/Y(-1)) \underset{\{-1.803\}}{-0.226} * d(D/Y(-1),2) + \underset{\{3.0}{3.1}$$

$$\underset{\{-3.105\}}{-1.463} * r(-2) \underset{\{-1.519\}}{-0.152} * y\_gap(-2) \qquad \text{(eqn 3}$$

†Figures in {} represent computed t-statistics for the respective estimated coefficients

The long-run component of the cointegrating equation computed based on the first-step Johansen procedure shows a significant and positive relationship between public debt and primary balance on which the vector was normalised. Results indicatethat for every 1% increase in public debt-to-GDP ratio, the primary balance-to-GDP ratio increased by an average of 1.62% over the period 1999q1 to 2016q2. The cointegrating vector results reveal strong evidence of a significant positive and systematic reaction of primary balance to variations in public debt.Resultsshow evidence of consistency of South African government's behaviour with the inter-temporal budget constraint.

Concomitantly, estimates of the second segmentwere computed based on the second-step of VAR in first and/or second differences, including the error correction term estimated from the first-step Johansen method. The respective term shows speed of adjustment at which a deviation by primary balance and public debt from the long-run equilibrium path steadily corrects towards convergence to their long-run relationship through a sequence of partial short-run adjustments. The short-run dynamics of the primary balance equation indicate that about 0.69% of the temporary deviation from long-run equilibrium relationship between primary balance and public debt was corrected through reductions in primary balance during the first quarter after occurrence of the deviation.

The monetary policy stance, overlooked by past empirical studies on fiscal sustainability in South Africa,hadsignificant impacts on primary balance and public debt positions. Results show that an increase in central bank policy rate by 1 percentage point led to about 4.7% upsurge in primary balance-to-GDP ratio while public debt decreased by about 1.5% of GDP during the sample period 1999q1-2016q2. Since budget deficits are largely financed through borrowing from the domestic market, results suggest that monetary policy significantlyinfluences government fiscal behaviour with regards to manner in which public borrowing and primary balance positions are maintained.

The short-run dynamics estimates show that output gap had a statistically substantial impact on primary balance, while the impact was insignificant on public debt. Although insignificant, the negative coefficient in the debt ratio equation shows that positive output gap marginally reduced public debt. The significant positive output gap coefficient in the primary balance ratio equation shows that positive output gap levels significantly led to increases in the primary balance ratio. Findings show evidence of counter-cyclicality behaviour of fiscal policy, hence the fiscal policy had an automatic stabilisation effect on debt accumulation.Figure 1confirms the cyclicality of discretionary fiscal policy based on variations between primary balance and output gap levels.

Figure1: Fiscal Policy Cyclicality

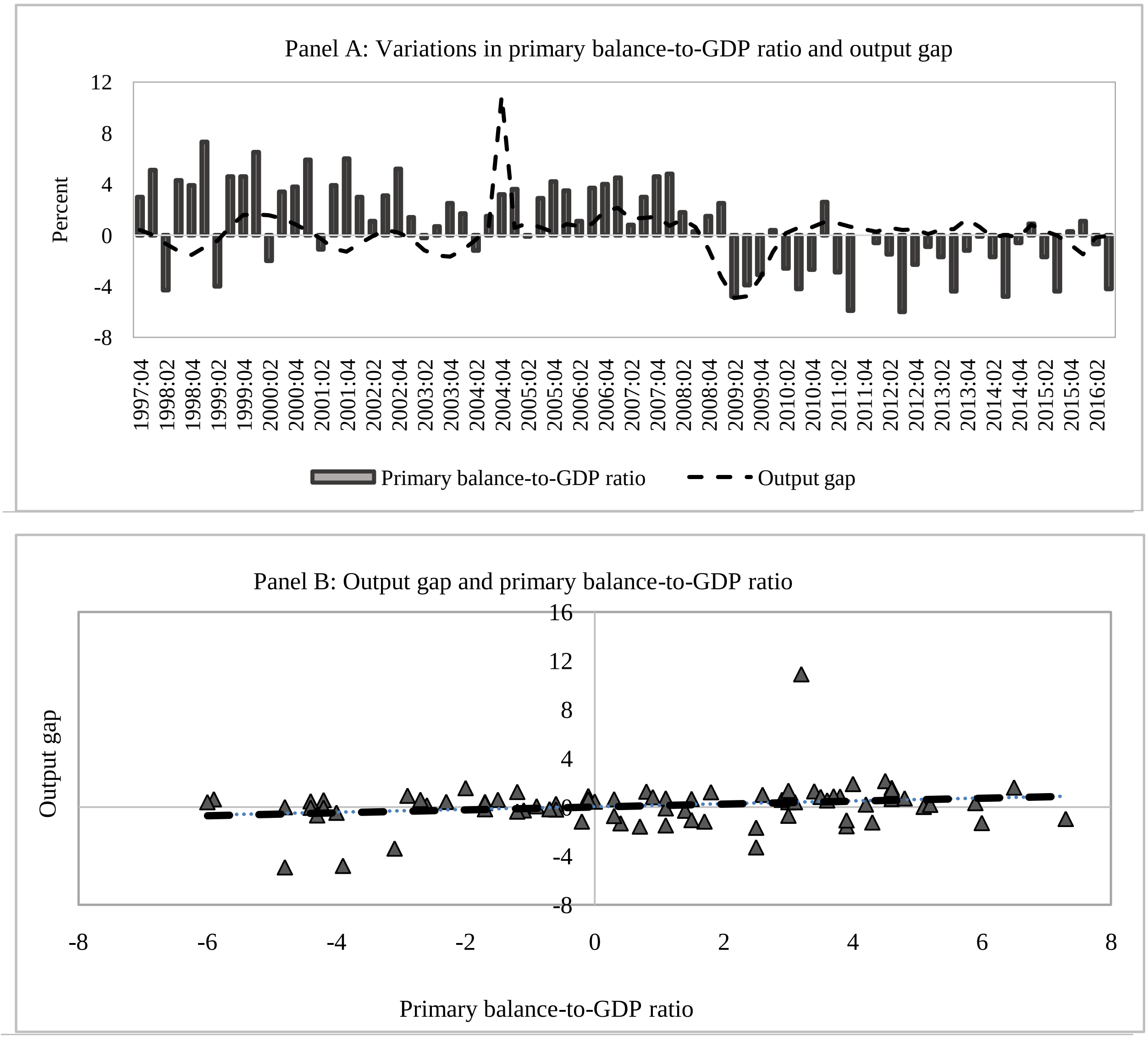

Figure 1validates the cyclicality of fiscal policy over the period 1997q4 to 2016q3 as shown by fluctuations and scatter plot between primary balance ratio and output gap levels.Fiscal policy is deemed counter-cyclical if primary deficit decreases (surplus increases) in periods with positive output gaps or if primary surplus decreases (deficit increases) in periods with negative output gaps. The South African economyexperienced down swings in productivityduring 1997q4 to 2004q3, volatile primary surplus during19947q4 to 2009q1, and volatile primary deficitsduring 2009q1 to 2016q3. The positive correlation coefficient equal to 0.217 between primary balance ratio and output gap confirms that discretionary fiscal policy was counter-cyclical over the sample period.

VEC Stability Results

Table 4: Roots of AR Characteristic Polynomial†

Root	Modulus
1.000	1.000
-0.738	0.738
0.141 - 0.546i	0.564
0.141 + 0.546i	0.564
† VEC specification imposes 1-unit root(s)	

Figure 2: Inverse Roots of AR Characteristic Polynomial

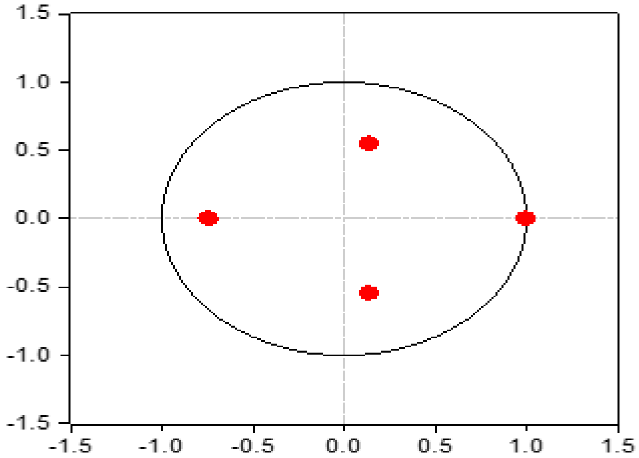

Table 4 show that all roots have modulus less than one and lie inside the unit circle, depicted in Figure 2. The presence of 1-unit root satisfied the condition that when a VEC model was estimated from a single cointegrating relation with two variables, the characteristic polynomial should have 1 root equal to a unity. Thus, the moduli less than one inside the unit circle satisfies the stability condition.

VEC Residual Diagnostic Results

Table5: VEC Residual Estimates

H_1	H_0	Test	Statistic	df	Prob
Serial correlation	No serial correlation	LM-(χ^2)	3.289	4	0.510
Multivariate normality	Normally distributed error term	JB-Joint	5.456	4	0.065
Heteroscedasticity	No heteroscedasticity	χ^2	33.960	30	0.282

The estimated VEC model satisfiedthe residual tests on serial correlation and heteroscedasticity. The computed Lagrangian Multiplier statistic (=3.28 (p>0.5)) was consistent with null hypothesis of no serial correlation while, the residual normality test conducted using the Cholesky (Lutkepohl) Orthogonalization method shows that residuals were multivariate normal at 5% significance level.

V. Conclusion

This study analyzed fiscal sustainability and integratedthe link between fiscal policy and monetary policy stance in the fiscal reaction function. Results show evidence of fiscal policysustainability, while monetary policy stance demonstratedsignificant impacts on primary balance and public debt positions over the period1997q4 to 2016q3.The finding that a tight monetary policy stance led to improved primary balance and reduced public debtpositions validates the need for harmonization and consistent policy mix between fiscal and monetary policiestoensure fiscal sustainability andachieve economic growth by maintainingprice stabilityand managing pressure on interest rates.

References

[1]. Burger, P., Stuart, I., Jooste, C. and Cuevas, A. (2011). Fiscal sustainability and the fiscal reaction function for SouthAfrica. IMF Working Paper WP/11/69, IMF.

[2]. Burnside, C. (2004). *Assessing New Approaches to Fiscal Sustainability Analysis*. Duke University and NBER.

[3]. Dahan, M. (1998). The Fiscal Effects of Monetary Policy. Monetary and Exchange AffairsDepartment, IMF Working Paper. IMF, Washington, D. C.

[4]. Dickey, D. A. and Fuller, W. A. (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of American Statistical Association*,74(366):437–431.
[5]. Financial and Fiscal Commission (2014). Budget Consolidation in South Africa: Balancing Growth and Socioeconomic Rights. Submission for the 2014/15 Division of Revenue.
[6]. Gabriel, V. J. and Sangduan, P. (2010). Assessing Fiscal Sustainability Subject to Policy Changes: A Markov Switching Cointegration Approach. Department of Economics, University ofSurrey, UK and NIPE-UM.
[7]. Ganyaupfu, E. M. (2014). Fiscal Sustainability in South Africa: Recent Evidence. *Journal of Social Economics*, 1(4):159-167.
[8]. Goodhart, C. (2012). Monetary Policy and Public Debt. Financial Stability Review No. 16, Banquede France, London School of Economics, Financial Markets Group.
[9]. Greenlaw, D., Hamilton, J. D., Hooper, P. and Mishkin, F. S. (2013). Crunch Time: Fiscal Crisisand the Role of Monetary Policy. Working Paper, National Bureau of Economic Research.
[10]. Gurkaynak, R. S. (2015). Monetary Policy Responsibility for Fiscal Sustainability. BilkentUniversity/CEPR/CFS/CESIfo, Research Institute of Economy, Trade and Industry.
[11]. Hellebrandt, T., Posen, A. S. and Toll, M. (2012). Does Monetary Cooperation or ConfrontationLead to Successful Fiscal Consolidation? Policy Brief. Peterson Institute for InternationalEconomics.
[12]. International Monetary Fund (2015). From Banking to Sovereign Stress: Implications for PublicDebt. IMF Working Paper. IMF, Washington D. C.
[13]. International Monetary Fund (2017). Prices, Production, Labour & Population. International Financial Statistics (IFS).
[14]. Jibao, S. S., Schoeman, N. J. and Naidoo, R. (2011). Fiscal Regime Changes and the Sustainability of Fiscal Imbalance in South Africa: A Smooth Transition Error-Correction Approach. *South African Journal of Economic and Management Science*, 15(2): 112-127.
[15]. Johansen, S. (1988). Statistical Analysis of Cointegration Vectors, *Journal of Economic Dynamics and Control*, 12(2-3): 231-254.
[16]. Kumo, W. L., Rielander, J., and Omilola, B. (2014). South Africa 2014, African Economic Outlook. AfDB, OECD and UNDP.
[17]. Laurens, B. and de la Piedra, E. G. (1998). Coordination of Monetary and Fiscal Policies. Monetary and Exchange Affairs Department, IMF Working Paper. IMF, Washington D. C.
[18]. National Treasury (2017). Budget Review 2017. Republic of South Africa.
[19]. South African Reserve Bank (2017). Historic Macroeconomic Timeseries Information.
[20]. Tshiswaka-Kashalala, G. (2006). Is Fiscal Policy Sustainable in South Africa? An Application of the Econometric Approach. Working Paper: 2006-14. Department of Economics,University of Pretoria.

Appendix

Appendix 1: VAR Optimum Lag Length Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-219.3167	NA	2.589133	6.626963	6.822801	6.704560
1	-215.9140	6.305080	2.636116	6.644529	6.970927	6.773858
2	-208.2165	13.81025	2.366680	6.535778	6.992736	6.716839
3	-204.6251	6.232059	2.399277	6.547797	7.135314	6.780589
4	-164.8684	**66.65103***	**0.840388***	**5.496128***	**6.214204***	**5.780652***
5	-161.0411	6.191206	0.847877	5.501208	6.349843	5.837463
6	-157.9167	4.870321	0.874548	5.526962	6.506157	5.914949

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; and HQ: Hannan-Quinn information criterion

Source: Author's Computations using EViews

Elvis Munyaradzi Ganyaupfu. "The Missing Link: Fiscal Sustainability Analysis in South Africa." IOSR Journal of Economics and Finance (IOSR-JEF) , vol. 10, no. 3, 2019, pp. 57-65.