Analysing the effects of fiscal policy shocks in the South African economy

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ABSTRACT

This paper analyses the effect of aggregate government spending and taxes on output for South Africa. In testing the size of the government multiplier, we use a calibrated DSGE model which we contrast with other empirical models. The empirical models are a structural vector error correction (SVEC) model and a nonlinear VAR to capture possible asymmetries and time variation of fiscal impulses. Given that South Africa is making greater strides towards a more comprehensive countercyclical fiscal policy framework, it is important to analyse and understand the effectiveness of fiscal policy. The impulse responses show that increases in government expenditure have a positive impact, albeit (at times) less than unity, on GDP in the short run. Over the long run, the impact of government expenditure on GDP is insignificant. Increases in taxes decreases GDP over the short run, while having negligible effects over longer horizons.

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1. Introduction

The effects of fiscal policy on output and consumption have been studied intensively. Since the 2008/09 financial crisis at a time when monetary policy remains constrained by the zero lower bound on policy rates, fiscal policy has received new vigour. It should be noted, however, that the discussion on government policies is one that has been around for a very long time. The financial crisis had many similar elements to the 1930 world recession. During the 2008/09 financial crisis monetary policy has set interest rates too low to stimulate the economy and thus the use of fiscal policy tools was required. Fortunately for policy makers the seminal contributions by Perotti (2002), Uhlig (2002), Blanchard and Perotti (1999) have made considerable strides in analysing fiscal trends on output and consumption which made fiscal policy intervention somewhat more digestible. However, the use of fiscal intervention has always been met with criticism. In particular, Barro (1981) and Lucas, argue that fiscal shocks do not stimulate aggregate demand, because individuals smooth consumption over time which implies that consumers are not liquidity constrained and have cash on hand for current period consumption. Whereas more recently, Ramey (2008) shows that fiscal policy is more than effective in stimulating aggregate demand. The assumption that consumers are not liquidity constrained, hence Ricardian, ensures that fiscal policy, tax cuts in principle, is ineffective in stimulating demand. There is also not a clear consensus on whether government expansions crowd out private investment. Many studies have looked at this question and empirical works have either been unable to reject or accept such propositions. Ricardian assumptions and crowding out effects have a huge bearing in studying the overall effectiveness of fiscal policy in stimulating demand.

Where most of these studies use specific methodologies (e.g. DSGE models or VARs), very few focus on the time variation of fiscal shocks. Time variation of fiscal shocks could for example explain what the impact of a continuous fiscal shock on the economy is. It could account for possible fiscal regimes; i.e. to understand how the economy responds to shocks when they are pro or countercyclical. Understanding the time variation of fiscal shocks might elucidate why so many studies find disagreeing results. This study attempts to answer these related questions.

Even if the impact of fiscal policy shocks is negligible on the economy, nothing seems to indicate that fiscal policy will be replaced by alternative policies. The social objective needs of the economy make fiscal policy integral in addressing certain economic shortcomings such as social security. Other important fiscal issues are the development and the possible implementation of fiscal rules to make the fiscus more countercyclical and stable. The 2011 Budget Review (Budget Review, 2011) makes reference to the possibility of employing a fiscal rule. An in depth discussion on fiscal rules fall beyond the scope of this study, but a discussion on its effects on fiscal decisions are merited. As will briefly be showed, a fiscal rule with an exact numeric target, such as a structural budget balance, implies one of two things - that discretionary fiscal policy is ineffective in stimulating demand and that only automatic stabilisers should work, or that the uncertainty in using fiscal policy levers cannot be priced in and thus the sole reliance falls on automatic stabilisers to smooth out shocks (again avoiding the use of discretionary fiscal adjustments). Thus, it is important to ask whether fiscal policy has been and can be effective in stimulating demand and if so, whether reducing discretionary fiscal policy is a bad policy? There are many factors that influence the effectiveness of fiscal policy on demand. It is by taking most of these factors into account that we attempt to address whether policy has been effective in creating demand. Discussions regarding the implementation of fiscal rules make the understanding of fiscal policy effects even more important. If South Africa were to implement a fiscal rule, it has to consider the impact of fiscal policy decisions on the economy first.

South Africa's share of government has increased since the 1970's, with several researchers arguing that fiscal policy was unsustainable in South Africa in the earlier and mid-1990s (Roux 1993; Van der Merwe 1994; Schoeman 1994; Cronje 1995), although more recently the government has achieved a substantial reduction in its budget deficit, from 6.8% of GDP in 1993 to a small surplus of 0.6% in 2008 (see Budget Review 2010). Apart from the evolution of government, a possible innovation from government could be the implementation of a fiscal rule. A section in the recent 2011 Budget Review talks about the case for a stronger countercyclical fiscal stance. There has been a large debate on whether the fiscal rule should have a single target or allowed to have some elements of discretion. Appendix B provides a detailed analysis of this debate. A fiscal rule by itself can ensure effective counter cyclical policy (Forni et al., 2004) when automatic stabilisers are large.

However, a fiscal rule that has a single target such as Chile's structural budget balance rule can often be too binding in times of adverse economic events. When truly adverse economic shocks hit the economy fiscal policy often deviates from a rule in order to meet other objectives. However, if strict evidence is presented that fiscal multipliers are indeed equal to zero, a single numeric fiscal rule should be sufficient. But, if fiscal multipliers are significantly larger than zero, then there is scope for a deviation from a strict numeric target.

Moreover, the size of fiscal multipliers, which can be defined as the ratio of the change of output to an exogenous shock in the fiscal deficit (Spilimbergo, 2009), can in the most simplistic case be calculated as: $\frac{\Delta Y_t}{\Delta G_t}$ where Y and G is GDP and aggregate government spending. However, the simple calculation often leads to rather bizarre outcomes such as multipliers equal to eight for South Africa (see Figure 1). In general, studies show that the size of multipliers depends on a number of issues such as the responsiveness of interest rates to fiscal policy changes, see Christiano et al. (2009) and Monacelli et al. (2009), the degree of openness of the economy, see for instance, Ilzetzki et al. (2009) and Faia et al. (2010) and multiplier size can largely depend on the models' properties, see for instance, Leeper et al. (2009) and Cogan et al. (2010).

There is no reason to suggest that the size of fiscal multipliers, as an a priori, should be constant over time. It is possible that with persistent government shocks the size of the multiplier can decrease. An example of this would be when government expands during economic contractions and continues to do so even when growth becomes buoyant. It might also matter from which deficit/surplus level an expansion takes place. Increasing government spending from an already high deficit will only increase the overall debt burden which has to be financed in the future. The risks associated with ever increasing debt levels and more specifically the ability of governments to finance these deficits was well illustrated with the 2011 European sovereign woes. Rating agencies that downgrade the quality of bonds can easily lead to massive outflows of capita which in essence means that fiscal authorities have to implement severe austerity measures which limits the effectiveness of fiscal policy in stimulating demand.

Different tax and spending tools of fiscal policy could also have different multiplier effects. In consolidating budgets or stimulating demand, it is important to know which of these tools would be most effective in meeting government's objective. It is important to distinguish between those fiscal tools that have longer lasting impacts to those whose impact dissipates quickly. These remarks put emphasis on the importance of adequately trying to understand the role that fiscal policy should play.

The paper proceeds as follows. Section 2 summarises the models used in the paper, viz., a general equilibrium model of a closed economy that captures the features of the South African economy with the purpose of analyzing the effects of a fiscal rule-based policy, a structural vector error correction model and a nonlinear VAR. Section 3 discusses the data and reports the results and Section 5 presents some concluding remarks and offers some policy implications.

2. Methodology

We first sketch out a benchmark general equilibrium model of a closed economy. We then discuss the empirical models, viz., a structural vector error correction model (SVECM) and a time varying parameter structural vector autoregression (TVP-VAR) model. The SVECM departs from the traditional VAR model in that it not only enables us to identify both short and long restrictions but also allows us to consider the cointegrating space between the variables. We then elaborate on a small TVP-VAR that allows for nonlinear effects of fiscal spending and taxes.

2.1 A dynamic stochastic general equilibrium model with differentiated consumers

The effectiveness of a fiscal expansion is often difficult to measure. To this end, we build a general equilibrium model of a closed economy that captures the features of the South

African economy with the purpose of analyzing the effects of a fiscal rule-based policy. Some of these inherent features include a distinction between hand-to-mouth or rule of thumb consumers and Ricardian consumers. In particular, we analyse cases where the fiscal multiplier is not zero which then makes fiscal policy effective in stimulating demand and therefore could justify the use of discretionary policy and thus cautions limits put on fiscal policy such as a single numeric structural budget balance rule target. Thus, deviating from a strict fiscal rule when required could be substantiated.

A New Keynesian DSGE model in the line of Smets and Wouters (2003) and Gali et al. (2007) is used to benchmark the empirical model. Most of the features are standard. Emphasis falls on the consumer's utility function and the monetary and fiscal policy rules. The rest of model's features are the same as Smets and Wouters (2003) and some calibrated parameters are presented in Appendix A.

Households

Households are differentiated as Ricardian and rule-of-thumb households who consume their current income. Ricardian households seek to maximise their expected discounted utility over consumption good C_t^r and leisure $1 - N_t^r$:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{(C_t^r - hC_{t-1}^r)^{1-\eta_c}}{1-\eta_c} - \frac{(N_t^r)^{1+\eta_n}}{1+\eta_n} \right] \qquad (2.1.1)$$

Where β is the subjective discount factor, η_c is the coefficient of relative risk aversion of households or the inverse of the intertemporal elasticity of substitution,, η_n represents the inverse of the elasticity of work effort with respect to the real wage. The habit formation parameter h measures the importance of the reference level relative to current consumption.

In each period Ricardian households carry government bonds B_{t-1} from the previous period to the current period. Households receive the nominal profit or dividend payment D_t from the intermediate good firms. In addition, households receive their usual labour income $W_t N_t^r$

where W_t denotes the nominal wage. Households need to pay a lump sum tax T_t^r to the government. Therefore, the Ricardian households maximise (2.1.1) subject to the following constraint:

$$C_t^r + K_t + \frac{B_t^r}{P_t} \leq \frac{W_t}{P_t} N_t^r + \frac{B_{t-1}^r(1+i_{t-1})}{P_t} + \frac{D_t}{P_t} - \frac{T_t^r}{P_t} + (1-\delta)K_{t-1} \qquad (2.1.2)$$

After solving the standard first order conditions and log-linearizing around the steady state we have the consumption Euler equation, whereby when h=0, this equation reduces to the traditional forward-looking consumption equation:

$$c_t^r = \frac{h}{1+h} c_{t-1}^r + \frac{1}{1+h} E_t c_{t+1}^r - \frac{1-h}{(1+h)\eta_c} r_r \qquad (2.1.3)$$

The rule-of-thumb households do not smooth their consumption over time when income fluctuates and they do not intertemporally substitute when interest rates change and therefore have a binding borrowing constraint. This might be a consequence of a direct choice not to hold bonds or equities or capital, or it might be the consequence of not being able to do so. Their period utility is given by

$$U(C_t^o, L_t^o) \qquad (2.1.4)$$

subject to

$$P_t C_t^o = W_t P_t N_t^o - P_t T_t^o \qquad (2.1.5)$$

which equates consumption to labour income net of taxes.

Total consumption is aggregated as

$$C_t = \lambda C_t^r + (1-\lambda) C_t^0 \qquad (2.1.6)$$

where λ is the share of Ricardian households in the economy. This paper avoids a discussion on the Ricardian Equivalence Theorem of Barro (1974) which states that increases in government spending are exactly offset by private saving. Instead we relied on three methods

to gauge the overall size of λ. The first unsuccessful approach involves estimating simple reduced form equations as proposed by Gale et al. (2004). The equation is a simple consumption function with disposable income, government transfers, wealth and taxes as explanatory variables. The results of this equation seem at odds to a priori thinking – one would expect the largest part of SA consumers to be liquidity constrained and given the sheer unemployment rate (at around 25%) one would expect any given income to be consumed immediately. Another study by Mathfield (2006) invalidates the Ricardian Equivalence Theorem for South Africa. Thus we test how the model reacts to different values of λ. The rest of the model equations (log linearised) that relates to labour supply, investment and capital accumulation decisions and firms' price setting behaviour follow Smets and Wouters (2003).

Monetary Policy

The model is closed by assuming that the monetary authority follows a Taylor-type interest rate rule. That is, the monetary authority adjusts its instrument, the short-term interest rate, in response to deviations of output and inflation from their steady-state levels. The log-linearized Taylor rule is written as:

$$i_t = \varkappa_i i_{t-1} + (1 - \varkappa_i)(\varkappa_\pi \pi_t + \varkappa_y y_t) + \xi_{i,t} \qquad (2.1.7)$$

Fiscal rule

The government's budget constraint is given by

$$\frac{G_t}{P_t} + \frac{i_t B_{t-1}}{P_t} = \frac{T_t}{P_t} + \frac{B_t - B_{t-1}}{P_t} \qquad (2.1.8)$$

Government debt and expenditures are only defined as deviations from steady state. The fiscal rule is defined in the form of:

$$t_t = \varphi_b b_t + \varphi_g g_t \qquad (2.1.9)$$

where both φ_g and φ_b are positive. Government purchases (in deviations from steady state) are assumed to follow a first order autoregressive process:

$$g_t = \varrho g_{t-1} + \varepsilon_t \qquad (2.1.10)$$

where 0<ρ<1 and ε represents an i.i.d. government spending shock with a constant covariance.

2.2 A structural vector error correction model (SVECM)

The data generating process of the variables can be expressed as a VECM with cointegrating rank (r) in the form of:

$$\Delta y_t = \alpha\beta' y_{t-1} + \Gamma_1 \Delta y_{t-1} + ... + \Gamma_{p-1} \Delta y_{t-p+1} + u_t \qquad (2.2.1)$$

All the symbols have their usual meaning where y_t is a K dimensional vector of observable variables, α is a $K \times r$ matrix of loading coefficients, β is the $K \times r$ cointegrating matrix, Γ_j is a $K \times K$ short-run coefficients matrix for $j = 1, ..., p-1$, and u_t is a white noise error vector with $u_t \sim N(0, \Sigma_u)$.We can re-write equation (2.2.1) in the Beveridge-Nelson MA representation:

$$y_t = \Xi \sum_{i=1}^{t} u_i + \sum_{j=0}^{\infty} \Xi_j^* u_{t-j} + y_0^* \qquad (2.2.2)$$

Where Ξ_j^* is absolutely summable so that the infinite sum is well defined and y_0^* contains all the initial values. This means that Ξ_j^* converges to 0 as j tends to infinity. The long run effects of shocks are thus captured by the common trends term $\Xi \sum_{i=1}^{t} u_i$. To identify the structural innovations we are looking for a matrix B that satisfies $u_t = B\varepsilon_t$ with $\varepsilon_t \sim (0, I_k)$. Substituting this relationship in the common trends term gives $\Xi B \sum_{i=1}^{t} \varepsilon_i$ .Thus the long run effects of the structural shocks are given by ΞB. Given that B has to be non-singular, there can at most be r zero columns in the long run matrix. Thus r can have transitory shocks while $K - r$ must have permanent shocks. For the local identification of the structural shocks in B

we need $K(K-1)/2$ restrictions. Assuming that there are r shocks with transitory effects, and $K(K-r)$ restrictions from the cointegrating structure of the model, which leaves us with $1/2K(K-1)-r(K-1)$ restrictions for just-identifying the structural innovations. $r(r-1)/2$ contemporaneous restrictions are necessary to disentangle the transitory shocks and $K(K-r)((K-r)-1)/2$ to identify the permanent shocks. This gives us a total of $1/2K(K-1)-r(K-r)$ restrictions. It is important to identify these restrictions locally; $r(r-1)/2$ restrictions need to be imposed on B directly.

The Johansen test for cointegration suggests that there is at most three cointegrating relationships (see table 3 in the appendix A). The lag length criterion was not chosen to satisfy certain information criteria. Rather, a top-down approach is employed to eliminate any unnecessary parameters (Lütkepohl, 2005). Table 1 below show the estimates of a stabilisation rule and a solvency rule. Legrenzi et al. (2005) show that when the long run relationship between taxes and government expenditure has an estimate of 1, then government is generally solvent.

The variables in the base case VECM are ordered as inflations, taxes, GDP, imputed interest rate and government expenditure [π_t, T_t, Y_t, i_t, G_t], we impose the following restrictions:

$$B=\begin{bmatrix} * & * & * & * & * \\ * & * & * & 0 & * \\ * & * & * & * & * \\ * & * & * & * & * \\ * & 0 & 0 & 0 & * \end{bmatrix},\ \Xi B=\begin{bmatrix} * & 0 & * & 0 & 0 \\ * & 0 & * & 0 & 0 \\ * & 0 & * & 0 & 0 \\ * & 0 & * & 0 & 0 \\ * & 0 & * & 0 & 0 \end{bmatrix}$$

The three zero columns in the long run matrix is identified from the cointegrating analysis. This means that there is no long run effect from our policy variables (G, T, and i) on any of the variables in the system. Four more restrictions are necessary to just identify the model since r(K-r)=6 linearly independent restriction in the long run matrix, ½K(K-1)-r(K-r)=4 restrictions are still to be defined. We impose zero contemporaneous restrictions for (T, Y and i) on G and a zero contemporaneous restriction for T on i which is in line with Perotti (2002).

The open economy SVECM is the base case economy version augmented with a UIP condition. The variables are ordered as [π_t, T_t, Y_t, i_t, $i_{tforeing}$, FX_t, G_t] where FX is the real effective exchange rate. The following restrictions are imposed:

$$B = \begin{bmatrix} * & * & * & * & * & * & * \\ * & * & * & 0 & 0 & * & * \\ * & * & * & * & 0 & * & * \\ * & * & * & * & * & * & * \\ * & * & * & * & * & 0 & * \\ * & 0 & * & * & * & * & * \\ * & 0 & 0 & 0 & 0 & 0 & * \end{bmatrix}, \; \Xi B = \begin{bmatrix} * & 0 & * & 0 & 0 & * & 0 \\ * & 0 & * & 0 & 0 & * & 0 \\ * & 0 & * & 0 & 0 & * & 0 \\ * & 0 & * & 0 & 0 & * & 0 \\ * & 0 & * & 0 & 0 & * & 0 \\ * & 0 & * & 0 & 0 & * & 0 \\ * & 0 & * & 0 & 0 & * & 0 \end{bmatrix}$$

The restrictions again imply that the policy shocks do not have a long run impact on any of the variables. Again zero contemporaneous restrictions are imposed for government shocks as in the closed economy version. Both domestic and foreign interest rates do not affect taxes contemporaneously and the exchange rate has no contemporaneous impact on foreign interest rates.

The different schools of thought (in particular Keynesians and New Classics) are pretty much in agreement in terms of the sign of the impact of a government shock on output (Fatas et al. (2001). However, the stark differences between the different schools arise in the analysis of consumption. The SVECM is augmented with consumption to analyse the overall effects of a government shock on consumption. As in Fatas et al. (2001) we also use different types of government expenditures to trace the effects on output. The vector of variables are [π_t, T_t, Y_t, i_t, C_t, GX_t], where GX is either total government consumption, government non wage consumption and government investment.

2.3 A time varying parameter (nonlinear) vector autoregression (TVP-VAR)

Given the time varying nature of fiscal policy, it is natural to ask how the evolution of fiscal policy has affected output. Time varying impulses allows us to study the evolution of fiscal shocks to the economy which could possibly assist us in understanding the circumstances under which fiscal policy seems to be most effective. The estimation of time varying impulses also allows us to analyse whether fiscal policy makers are improving in making

fiscal decisions and whether households expect an expanding government today will increase future taxes. For this purpose, the paper estimates a time varying structural VAR, where time variation comes from both the parameters and the variance covariance matrix of the model's innovations. This reflects simultaneous relations among variables of the model and heteroscedasticity of the innovations (Primiceri, 2005). To accomplish this, a Monte Carlo Marlov Chain algorithm is used to estimate the coefficients and the multivariate stochastic volatility.

Estimating time variation is a pretty well developed field (see Sims (1993), Stock and Watson (1996) and Cogley and Sargent (2001)). However, these studies impose restrictions on the variance covariance matrix that is supposed to evolve over time. Most of these models are limited to reduced form models that is usable only for data description and forecasting (Primiceri, 2005). With drifting coefficients one essentially also captures the learning process. The drifting coefficients are meant to capture possible nonlinearities or time variation in the lag structure of the model. The multivariate stochastic volatility is meant to capture possible heteroscedasticity of the shocks and nonlinearities in the simultaneous relations among the variables of the model.

The basic modelling structure follows Primiceri (2005). Start with the following model:

$$y_t = c_t + B_{1,t} y_{t-1} + \cdots + B_{k,t} y_{t-k} + u_t \qquad (2.3.1$$

where y is an n x 1 vector of observed endogenous variables, c is an n x 1 vector of time varying coefficients that multiply constant terms, B is an n x n matrix of time varying coefficients and u are heteroskedastic unobservable shocks with variance covariance matrix Ω. The triangular reduction of Ω is defined by:

$$A_t \Omega_t A_t^{'} = \Sigma_t \Sigma_t^{'} \qquad (2.3.2)$$

where A is the lower triangular matrix

$$A_t = \begin{bmatrix} 1 & 0 & \cdots & 0 \\ \alpha_{21,t} & 1 & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ \alpha_{n1,t} & \cdots & \alpha_{nn\ 1,t} & 1 \end{bmatrix}$$

And Σ_t is the diagonal matrix

$$\Sigma_t = \begin{bmatrix} \sigma_{1,t} & 0 & \cdots & 0 \\ 0 & \sigma_{2,t} & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ 0 & \cdots & 0 & \sigma_{n,t} \end{bmatrix}$$

It follows that

$$y_t = c_t + B_{1,t} y_{t-1} + \cdots + B_{k,t} y_{t-k} + A_t^{\ 1} \Sigma_t \varepsilon_t \qquad (2.3.3)$$

Stacking in a vector B all the right hand side coefficients can be rewritten as:

$$\begin{aligned} y_t &= X_t' B_t + A_t^{-1} \Sigma_t \varepsilon_t \\ X_t' &= I_n \otimes [1, y_{t-1}', ..., y_{t-k}'], \end{aligned} \qquad (2.3.4)$$

The dynamics of the model's time varying properties are specified as Random walks:

$$\begin{aligned} B_1 &= B_{t-1} + \upsilon_t, \\ \alpha_t &= \alpha_{t-1} + \zeta_t, \\ log(\sigma_t) &= log(\sigma_{t-1}) + \eta_t \end{aligned} \qquad (2.3.5)$$

The innovations are assumed to be jointly normally distributed. To reduce the number of parameters in the model, we restrict the model to include only three variables – output, interest rates and government expenditure. This is in line with the model of Du Plessis et al

(2007). Bayesian inference is used to restrict the number of parameters. The first seven years are used to calibrate the prior distributions.

3. Results

In this section, we first discuss the theoretical results of the DSGE model and we compare its findings with the empirical specifications discussed in the previous section. More specifically, we estimate the effects of government spending and tax shocks in the structural vector error correction model (SVECM). Then we introduce some time variation in the impulse responses by estimating the small nonlinear VAR which enables us to distinguish between the impact of shocks in different regimes and periods.

For the empirical models of sections 2.2 and 2.3, we use South African seasonally adjusted data for the period 1970:Q1-2010Q4. The data used are general government expenditure and taxes per capita, GDP per capita, an imputed measure of interest rates on debt, inflation measured as the annual change in the consumer price index and household consumption. All the data are in quarterly format and logs are used except for inflation and interest rates (a full description of sources and data transformations are shown in Table 2 in the appendix A). Augmented Dickey-Fuller tests show that all the variables are I(1) (see Table 3 in the Appendix A).

3.1 Dynamic Stochastic General Equilibrium model

The DSGE model is calibrated to South African data[2]. Since there is no direct measure for the share of Ricardian versus rule of thumb households for South Africans, the share is changed to observe how both output and consumption changes.

Figures 3 shows the impact responses of consumption, interest rates and output to a one per cent unit change in the innovation of government spending in equation (2.1.10) given three

[2] Some parameter values are standard and are taken from the literature (e.g. Liu and Gupta, 2007)

assumptions regarding the share of rule of thumb households (shares equal 0.8, 0.5 and 0.1, respectively). In the presence of a small share of Ricardian households, aggregate consumption increases due to the large response in rule of thumb households. The consequence of the strong increase in consumption is associated with larger interest rate increases that are also more persistent. Growth's response is close to unity which implies that fiscal policy has the potential to effectively stimulate demand. However, doing a counter factual analysis such as decreasing the share of rule of thumb consumers causes aggregate consumption to decline. Inflation and interest rates are also less responsive with the low share scenario. Output responses decline as the shares decline.

The results clearly show the importance of liquidity constrained consumers in analysing fiscal shocks. With South Africa being a developing country with a large share of the population in poverty, it is important to keep the economy afloat in the midst of adverse economic shocks. The empirical results seem to indicate that South Africa has indeed a large share of liquidity constrained consumers that are unable/unwilling to save given extra income. Since it is difficult to measure the share of Ricardian consumers, the empirical approaches that follow from sections 2.2 and 2.3, uses aggregate consumption to ascertain the impact of fiscal responses.

3.2 Structural vector error correction (SVECM) model

The first set of results report the baseline SVECM. Figure 4 shows the baseline scenario that an increase in government expenditure increases GDP per capita by more than one per cent.[3] The maximum impact is reached after three quarters. Over the long run, the effect of an increase in expenditure on GDP per capita is virtually zero.

Conversely, Figure 5 shows that an increase in taxes clearly distorts GDP per capita. The impact on GDP reaches a maximum over four quarter. These results also need to be

[3] To obtain the fiscal responses as in figure 3-7 we rescaled the impulses on growth by dividing it by the mean of the standard deviation of the shocked variable's own impulse and multiplied it by the inverse of the ratio of the observed variable that you wanted to shock and the variable affected: $\frac{\partial \varepsilon_{t,y,j}}{\frac{\sum_{i=0}^{n}(\partial \varepsilon_{t,j,j}\ )-E(\partial \varepsilon_{t,j,j}\ )}{n-1}^{2}}\frac{1}{\frac{y_{t,j}}{G_t}}$. The major advantage of this transformation is that the responses of output to the fiscal shocks can be interpreted as (non-accumulated) multipliers. We use bootstrap methods to obtain the standard errors or confident bands. We extract the confidence bands using 20 and 80 percent quintiles.

interpreted with some caution; the effects of say an increase in progressive personal income tax on GDP might not have large social costs as the lower ends of the income distribution is unaffected, but will still impact GDP negatively. The impact of an increase in company taxes might see investment opportunities shift to different countries.

[INSERT FIGURE 4]

[INSERT FIGURE 5]

The second set of results is drawn from the extended SVECM that includes total household consumption. An important result is the impact of government expenditure on interest rates. Often, when monetary policy does not accompany a fiscal expansion, a fiscal expansion raises interest rates which could crowd out investment. Studies such as Gupta et al.(2009) show this effect albeit on high frequency data. An increase in government expenditure increases interest rates by a maximum 0.35 percentage points. This result is consistent with the DSGE model.

[INSERT FIGURE 6]

The effect on output is still similar to the base line case as well as the DSGE model. Aggregate consumption increases by a maximum 0.7 when government spending increases but reduces by 0.9 given a total tax shock. These results seem to suggest that households in South Africa are generally not Ricardian.

[INSERT FIGURE 6]

Just to address other issues, we use the empirical model multipliers changes in the case where the model includes open economy dynamics such as an uncovered interest parity condition. An opening up of the economy effectively reduces the size of the fiscal multiplier. A quick and dirty calculation of the fiscal multipliers that include tax rates, the marginal propensity to consume and the marginal propensity to import can be calculated as: $\Delta Y = \Delta G * \frac{1}{1 - MPC * (1 - \tau) + MPI}$. This identity shows that the marginal propensity to import reduces the effect government has on stimulating the domestic economy (which could explain the smaller multiplier when compared to the baseline case). This simple identity shows that the

fiscal multiplier is close to 0.77 when we assume a MPC of 0.97, a MPI of 0.99 and a tax rate of 0.3. The maximum impact is now only reached five quarters from impact and goes only as high as 0.6 per cent (see Figure 7). The response of per capita GDP remains similar to a tax shock.

When an increase in government expenditure is associated with an increase in the demand for foreign goods then the real exchange rate will depreciate which is in line with the Mundell-Flemming framework. However, it should be noted that proper counter-cyclical fiscal policy should have close to no direct effect on the exchange rate (Clarida et al. 1999). When there is an output gap and inflation is low, government expansion should have little impact on exchange rates and rather perceptions on sustainable fiscal policy could see an inflow of bonds which could depreciate the currency.

[INSERT FIGURE 7]

Finally, for robustness reasons total government expenditure is replaced by government consumption, government consumption on non wages and government investments. Figure 8 show that government investment has the largest impact on output and consumption. This should not be surprising as it is assumed that government investment can compliment private investment in the form of private public partnerships.

[INSERT FIGURE 8]

3.3 Time varying parameter (nonlinear) vector autoregression (TVP-VAR)

The results from the time varying VAR tell an interesting story. Figure 9 shows the impact of fiscal shocks for various periods (1994, 1999, 2007, 2008 and 2009). Prior to 2000 South Africa mainly had a procyclical fiscal stance (Du Plessis et al., 2007). The pre 2000 period had multipliers slightly less than one and took five quarters to have a maximum impact on the economy. The periods in which the multipliers were the strongest was in the build up to the crisis, 2007 and 2008. During these years South Africa run budget surpluses not seen since 1990. An expansionary fiscal shock during this period also had longer and far reaching

effects (the area under the curve is higher). However, any additional increase in fiscal expenditure onwards would have contributed less to stimulating demand and its impact on the economy would have been significantly shorter than other periods. Some plausible explanations for this could be that households become more aware of a growing fiscal deficit and hence higher debt and debt service costs that they start to save more. In essence, it could very well be that non-Ricardian households become slightly more Ricardian as fiscal shocks continue. Or, households' habits don't change where questions about whether the additional income is structurally higher or that households' are not accustomed to changing consumption behaviour and hence saves more. Another explanation is that the degree of crowding out is nonlinear and time varying. When continued fiscal shocks hit the economy and replace firms' investment decisions then crowding out effects grow over time which limits the extent to which firms can reinvest in the economy.

These results, especially the 2009 impact, seem to suggest: (1) that fiscal policy can only be used for a short period of time to stimulate aggregate demand and (2) that fiscal policy should be mindful of not overextending the duration of deficits or continuously increasing it.

4. Conclusion

The size of fiscal multipliers is sensitive to many factors; the methodology, the identifying restrictions, structural changes in fiscal policy and the effectiveness of fiscal policy implementation. This study is the first one to analyse fiscal policy in a macroeconomic environment for the South African economy. Using different methodologies, this study shows that fiscal policy is indeed effective in stimulating both output and consumption. A closed economy typically yields larger multipliers which are in line with empirical findings, whereas an open economy reduces the multiplier. For South Africa, the multiplier is larger than one in countercyclical policy periods, indicating effective expenditure. However, the multiplier becomes less effective in periods where fiscal policy is procyclical. It clearly matters how liquid households are; the more they are able to save additional income, the lower the impact of a government shock to the economy. The time varying impulse responses

show that government shocks have been effective in stimulating demand, however, persistent increases seem to reduce the effectiveness of spending.

Relating the multipliers to the implementation of a fiscal rule, specifically a structural budget balance rule, it should be mindful of the fact that it limits discretionary spending. Fiscal policy has contributed significantly in stimulating demand during the recent 2008/09 fiscal crisis. A target would have limited the extent to which fiscal levers could have been used during this period. Given that a large portion of South Africans are generally poor, good fiscal guidance can shield both individuals and companies from negative economic shocks. However, fiscal policy should continue to be conducted in a prudent countercyclical fashion; saving in good times and spending in bad times. A suggestion for future research would be to study the impact of fiscal shocks when deviating from a fiscal rule.

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6. Appendix A: Tables and Figures

Table 1: Fiscal rules

Stabilisation	**Solvency**
$Y_t=0.973G_t$	$T_t=1.147G_t$

Table 2: Data description

Variables	Source:	Transformation
GDP	South Africa Reserve Bank	
Population estimates	Quantec	Linear interpolation
Interest rate	South Africa Reserve Bank	DSC/debt*100
Inflation	Statistics South Africa	Y-O-Y growth of CPI
General government expenditure	South Africa Reserve Bank	
General government taxes	South Africa Reserve Bank	
Household consumption	South Africa Reserve Bank	

Table 3: Stationarity tests

Variables	ADF-levels (P-values)	ADF-difference(P-values)
GDP	0.91	0.000
Population estimates	0.68	0.484
Repo rate	0.17	0.000
Inflation	0.16	0.000
General government expenditure	0.79	0.000
General government taxes	0.69	0.000

Table 4**: Johansen's cointegrating analysis**

Rank	**LR**	**P-values**

0	243.3	0.000
1	111.0	0.000
2	51.51	0.005
3	15.9	0.507
4	4.9	0.612

Table 5: Calibrated parameters

Habit formation (H)	0.7
Fraction of R-O-T households	0.2 , 0.5, 0.8
Steady state ratio of G expenditure to output	0.26
Steady state ratio of G expenditure to G debt	4.33
Steady state ratio of taxes to G expenditure	3.33
Φ_b	0.4
Φ_g	0.1
ρ_g	0.9

Figure 1: Simple multiplier calculation

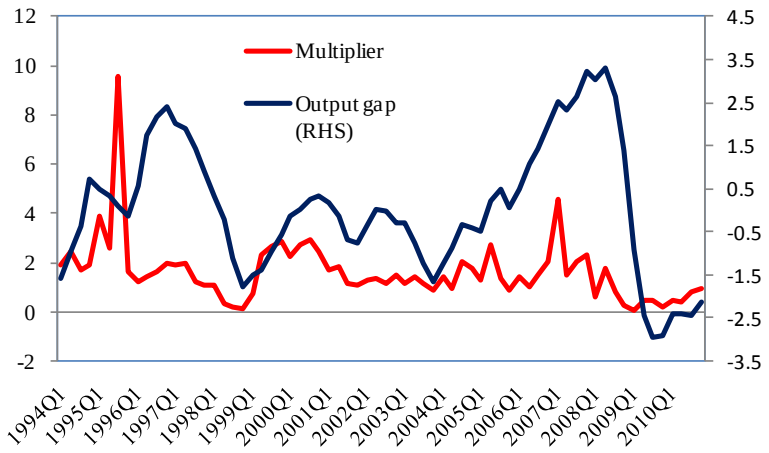


Figure 2: Government expenditure

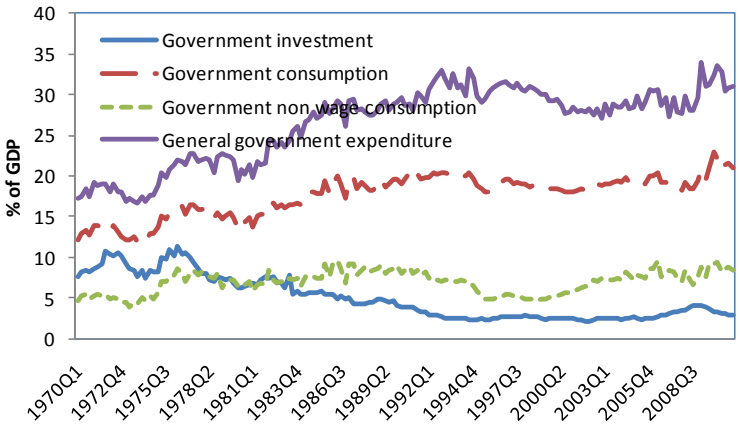


Figure 3: Different rule of thumb consumers

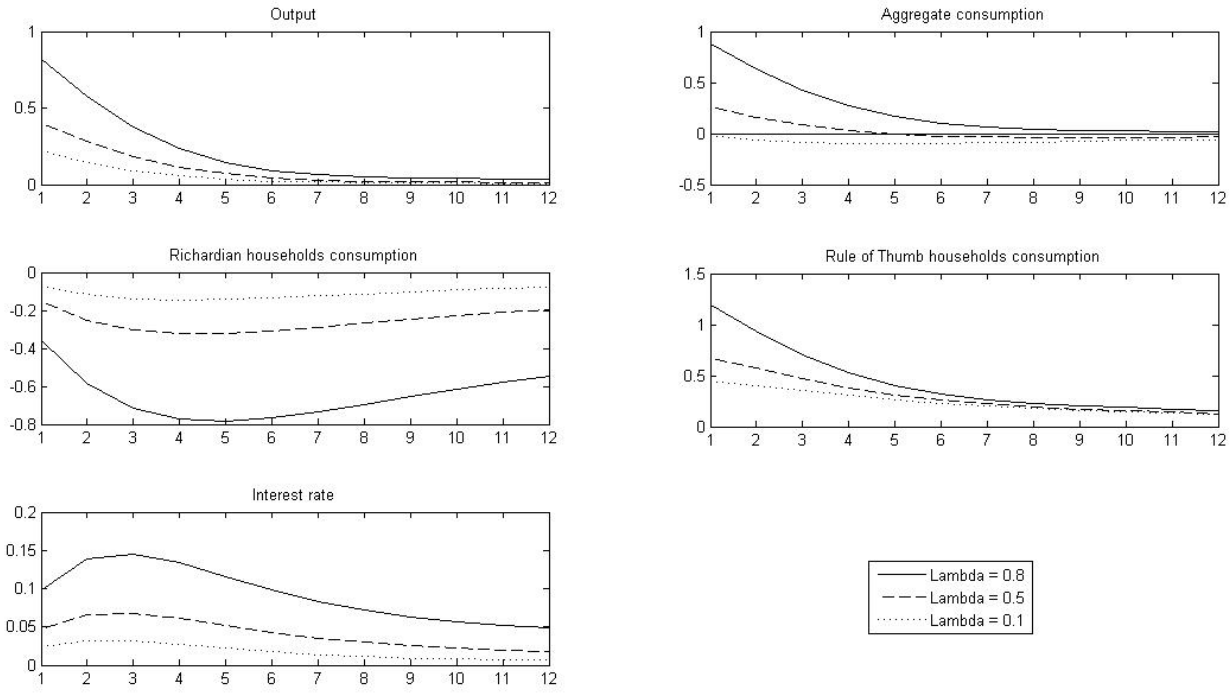


Figure 4: Baseline SVECM: Government expenditure and tax shocks shock

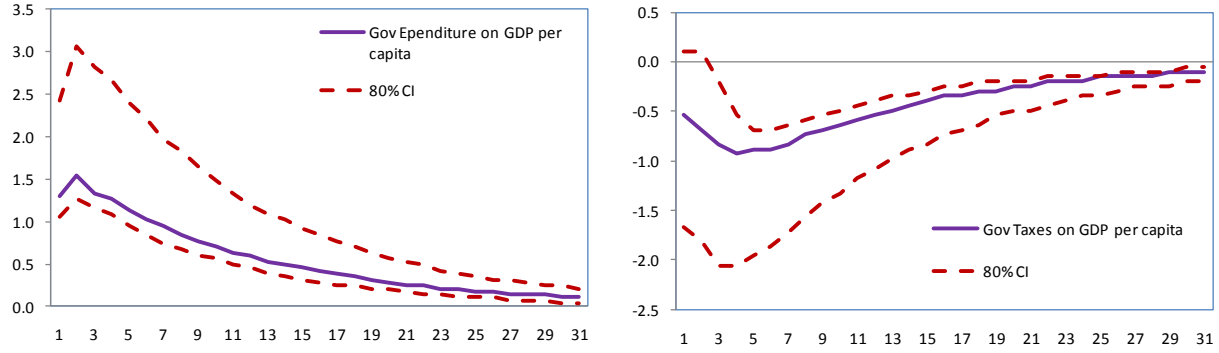


Figure 5: Baseline SVECM: Total general tax shock

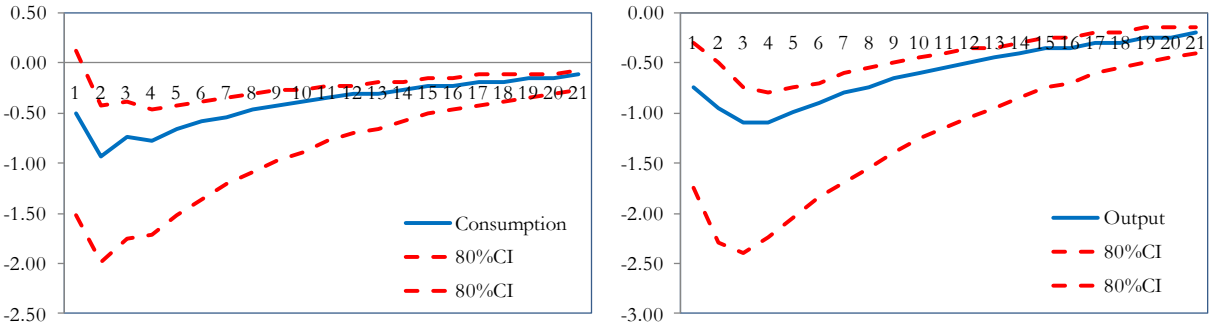


Figure 6: Consumption in the SVECM: Government expenditure shock

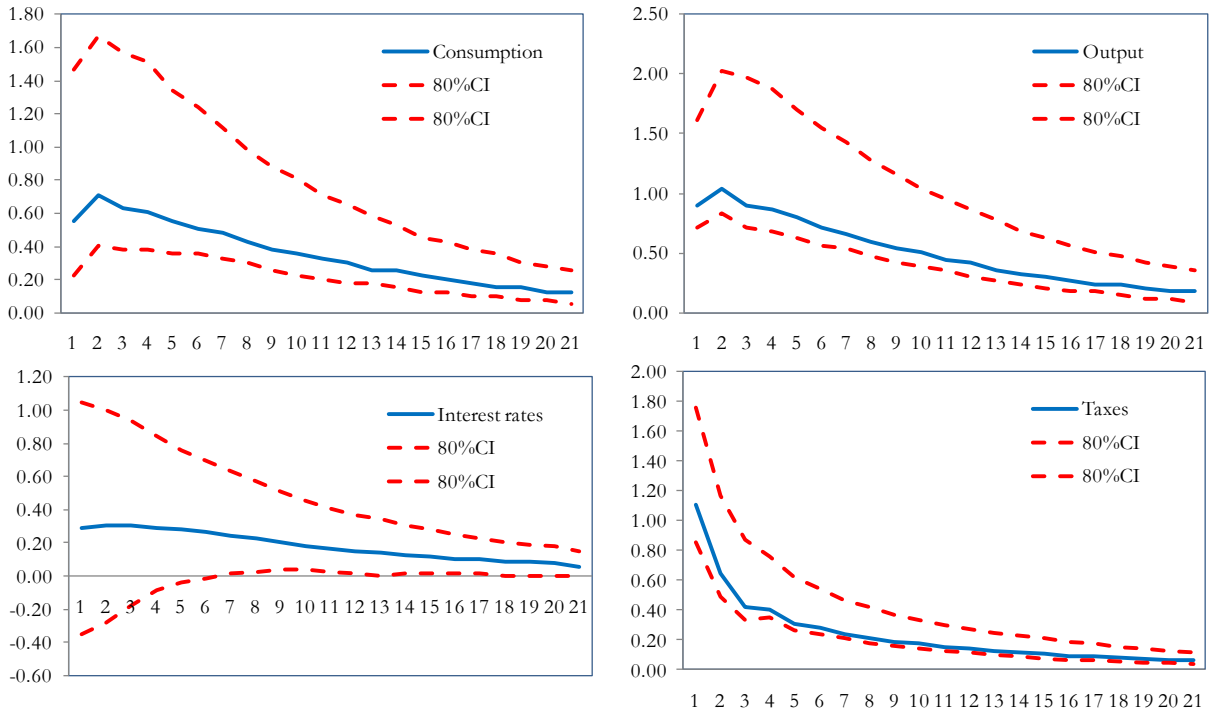


Figure 7: Output responses in an open economy

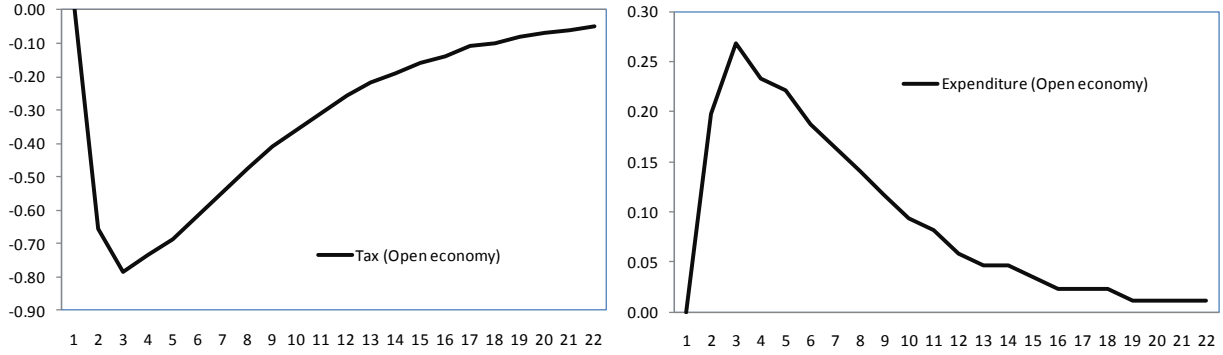


Figure 8: Alternative government shocks

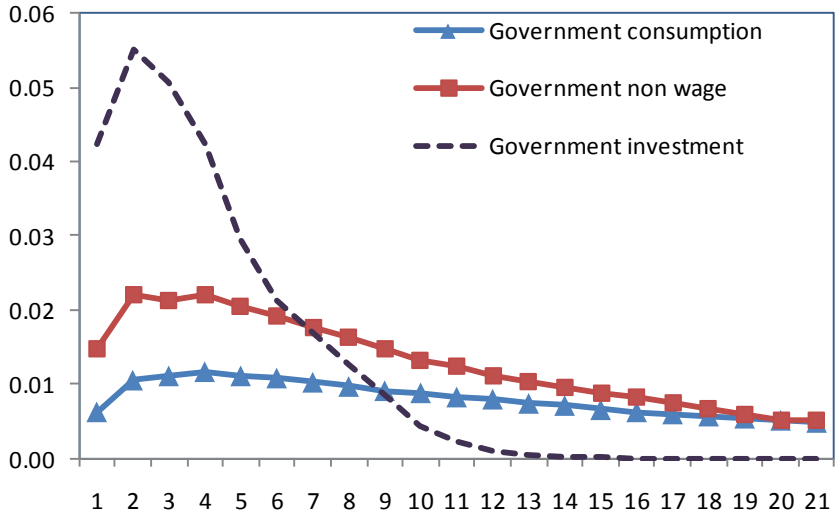
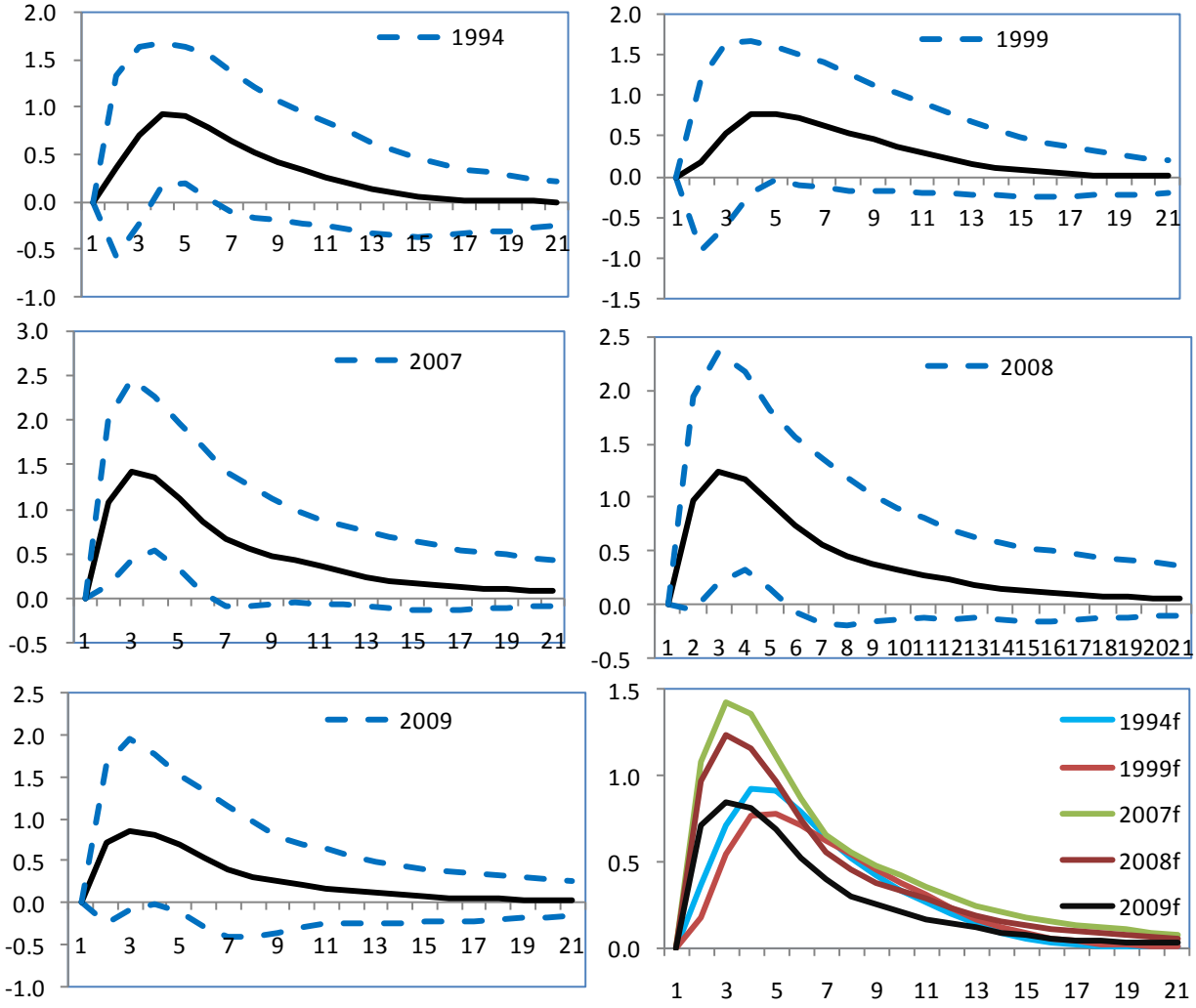


Figure 9: Nonlinear Time Varying impulse responses



7. Appendix B: The debate on fiscal rules

South Africa's share of government has increased since the 70's. This has happened in accordance to an increasing role and responsibility it took up in order to meet certain social needs and to fill in gaps. Figure 6 shows the evolution of government expenditure as a share of GDP from 1970 to 2011. During the 70's higher government expenditure resulted from higher outlays on public services, defence and debt service costs (Black et al., 2004). The 80's and 90's were characterised with increases in social security, education and health. Black et al. (2004) ascribes the increase in the wage bill due to an increase in the prominence of labour intensive and supply intensive functions in safety and security and education. The share on government investment to GDP has also decreased as more emphasis was put on government expenditure on welfare.

Apart from the evolution of government, a possible innovation from government could be the implementation of a fiscal rule. A section in the recent 2011 Budget Review talks about the case for a stronger countercyclical fiscal stance. If South African Treasury were to impose a rule it will have many consequences on the economy, some positive and some negative. A common fiscal rule is the structural budget balance rule which puts a limit on discretionary spending and allows automatic stabilisers to operate fully. If government were to impose a specific numerical target that does not vary with the cycle, one is effectively cutting discretionary government choices. Two simple equations illustrate this point (Debrun and Kapoor (2010)):

$$B_t = SBB_t + \alpha\tilde{y} \qquad (1)$$

$$SBB_t = \beta - \lambda\tilde{y} \qquad (2)$$

Where the budget balance (B) equals the structural budget balance (SBB) plus the automatic stabilisers (alpha measures the size of the automatic stabilisers given the output gap y). The SBB equals some constant and the degree of discretionary policy (lambda measures the extent to which discretionary fiscal choices are made given movements in the output gap); this is not implied by your equation above, that is, SBB does not include any cyclical component from equation (1). Assuming that government imposes a target on the SBB that is

fixed, will allow the budget to only change by changes in automatic stabilisers (which mainly come from revenue changes). This implies that government either believes the multiplier is zero or is avoiding the risk of making a bad budget decision. Thus, before imposing such limits on fiscal policy, government should study the size of the fiscal multiplier. If the multiplier is small and close to zero, then having such a target could be justified. However, if the multiplier is significantly larger than zero, then imposing such a rule would be difficult to substantiate.

[INSERT FIGURE 2 HERE]

The lessons learned from the previous section could guide our a priori expectations on the size of multipliers for South Africa, and these are summarised in Table 1. South Africa has accommodative characteristics of the above criteria in most cases except for having a closed economy. Also, automatic stabilisers have grown over the last decade and especially during the commodity boom.

Table 6: Is the stimulus large for SA?

Leakages	
Spending>Tax cuts	✓
MPC large	✓
Targeted	<>
Myopic	✓
MPI	<>
Small automatic stabilisers	<>
Large output gap	✓
Accommodative monetary policy	
Interest rates not responding to fiscus	✓
Fixed exchange rate	X
Sustainability	
Debt dynamics and servicing	✓

South Africa has not introduced significant tax cuts to stimulate demand during the 2008/09 recession but has implemented measures to increase its expenditure. Although consumer spending decreases during recessions, the propensity to consume was still large and close to one. Although fiscal policy expanded, it was not necessarily targeted. Large increases in expenditure came from a higher public wage bill (an extra allocation of R6.5 billion to cover the compensation of employees in 2010/11 (2011 Budget Review)) which are inflationary and do not necessarily increase GDP.

The size of automatic stabilisers has increased since 2000 when the government made clear strategies to reduce public debt and implement timely and counter cyclical policy. The 2011 Budget Review discusses the possibility of imposing a fiscal rule. A fiscal rule by itself can ensure effective counter cyclical policy (Forni et al., 2004) when automatic stabilisers are large. However, a fiscal rule that has a single target such as Chile's structural budget balance rule can often be too binding in times of adverse economic events. When truly adverse economic shocks hit the economy fiscal policy often deviates from a rule in order to meet other objectives. However, if strict evidence is presented that fiscal multipliers are indeed equal to zero, a single numeric fiscal rule should be sufficient. But, if fiscal multipliers are significantly larger than zero, then there is scope for a deviation from a strict numeric target. Interest rates were low during the financial crisis when the output gap was big and inflation low. Thus, the fiscal expansion was accommodated by monetary policy which did not crowd out private investment.

There also exists a trade-off between having a flexible exchange rate and sustainable fiscal policy. Under fixed exchange rates monetary policy responds by increasing the money supply to prevent an appreciation when fiscal policy expands. This provides an additional demand push to the economy. The South African government had a reasonably stable fiscal policy when it entered the recession with debt levels close to 20 per cent and having a small budget surplus. The prudent fiscal policy resulted in an increase in foreign capital inflows which appreciated the currency.