South Africa: Analysing Long Term Implications of Government Policy

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Abstract

This paper, to our knowledge, is the first attempt at applying a dynamic intertemporal CGE methodology to study of impact of expansive fiscal policy in context of an African country. The paper is oriented towards constraints government faces in financing its expenditures. Hence, the model correctly takes into account different sources of income of government, its expenditures and its deficit. Furthermore, one knows that poor infrastructure in South Africa (and in Africa in general) is an impediment to economic growth. It is thus believed that taking into account the impact of improving infrastructure on productivity is an important South African characteristic. The main lesson from this exercise is that an expansive fiscal policy would have short run positive impact on GDP but would translate into a greater debt-to-GDP ratio. Using increased taxation to finance the additional spending would lessen this impact but would also negatively affect macroeconomic variables. Increased investment spending would improve long-term GDP, under any financing scheme, and would decrease debt-to-GDP ratio as well as deficit-to-GDP ratio. This outcome is driven by the positive impact infrastructure has on total factor productivity. Sensitivity analysis shows that these conclusions are qualitatively similar for a wide value of the elasticity of the total factor productivity to infrastructure. In fact, the conclusions hold even when comparing different financing schemes. The findings have immediate policy implications in various policy modelling areas, including long term fiscal policy design in countries seeking to grow their economies sustainably and create jobs.

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1. Introduction

Increases in government expenditure can benefit the economy by affecting the level of income and its distribution. This can influence people's wages and returns to capital thereby affecting saving and investment, thus potentially boosting economic growth. However, increased spending, ceteris paribus, will translate into a greater debt, which might not be sustainable in the long run. Indeed, if the government increases its spending, it might need to either reduce them in the future or increase taxes in order to get back to its original debt-to-Gross Domestic Product (GDP) ratio. To evaluate the impact of such policies, an intertemporal model is constructed and applied to South Africa. In such a model, firms and households have a forward-looking behaviour and thus take into account all future prices in their investment and consumption decisions. By taking this approach, major contributions to existing literature on the transmission mechanism of fiscal policy in African economies is made. To the best of our knowledge, no published study has empirically analyzed the macroeconomic effects of fiscal policy in the context of an open, middle-income sub-Saharan African economy like South Africa's using an integrated intertemporal model with such rich production disaggregation. It is believed that this approach can provide important insights on the fiscal constraints and their impact on the economy as a whole.

South Africa experienced a long period of economic decline in the last decades of apartheid (1985–1994). In the immediate post-apartheid period (1995–2003) economic growth rates improved and then picked up substantially from 2004 to 2007. However, in 2008 the global economic crisis resulted in a slowdown in economic growth. Economic growth (in real terms) has increased from 2.8% in 2010 to 3.1% in 2011 which much like for 2010 remains reflective of the ongoing economic recovery. This positive economic growth, however, masks a more complex reality, that of a tepid economic recovery associated with unemployment, poverty and inequality. Poverty remains high, especially among African and female-headed households, despite an unprecedented extension of government social grants that have helped to reduce absolute poverty. Poor educational and health outcomes are similarly skewed against the poor. These social realities, together with the realisation that dates for attaining the Millennium Development Goals are a mere three years away, have galvanised government to seek alternative ways of using public expenditures to grow the economy in order to address poverty and inequality. Ambitious social reforms are being proposed to tackle poverty, growth and inequality problems. The National Health Insurance promises to be the largest reform undertaken in the health sector since the end of apartheid. Government has adopted the New Growth Path (NGP) and National Development Plan (NDP) for South Africa, which aims to accelerate the creation of decent jobs and reduce inequality and poverty. Current as well as projected economic growth is sluggish and posing a real threat to the targets outlined in the NGP as well as the National Planning Commission's (NPC) Vision for 2030[1]. Furthermore, in order to improve South Africa's chances in achieving the goal of sustained and inclusive growth, and hence its job-creation targets, consistency needs to be achieved between NGP and NPC's Vision for 2030. Though both are essentially geared towards the same medium-term and long-term goals[2], the nuances in the details of policies (where available) as well as the discrepancies in numerical targets need to be ironed out for the sake of uniformity and to increase South Africa's chances of reaching those targets.

[1] Given the revision in the economic growth figure for 2011 as well as the estimates for economic growth over the medium term, it is apparent that South Africa will need a much higher economic growth than the 7% set out in the NGP document. This is further borne out by the current slow, positive growth rates not producing significant job increases. If National Treasury's estimates for 2012/13-2014/15 materialise, South Africa will need an average growth rate of 8-9% in the period 2015/16-2020/21. This figure is highly unlikely considering that emerging market economies are expected to grow at some 5-6% over the same period.

[2]Elimination of poverty and reduction of inequality. The specific targets for job creation and economic growth set in the two strategies are: NPC: 11 million jobs by 2030, which requires an annual growth rate of 5.4%; NGP: 5 million jobs by 2020, which requires an annual growth rate of about 7%. Naturally, because the horizons of the two strategies are different (and because these strategies were developed a year apart), final targets and the economic growth rates necessary to achieve them are different. However, this sends mixed messages to the economic role players and may possibly undermine the credibility of government (and even more so if the targets are not being met).

As government identifies options for public expenditure, the need for reliable assessments of the probable impact of such expenditure becomes critical. Although fiscal authorities intend reducing the high fiscal deficit induced by the 2007-2009 global economic crisis and public debt, intensified utilization of expansionary fiscal strategies in this way may jeopardise fiscal sustainability. A number of critical policy questions such as the composition of spending and how much does it matter whether the expanded spending are financed by reductions in government expenditure, or by increases in government's budget deficit or by increased taxation are raised? As Mountford and Uhlig (2009) note, these questions are critical not only to the science of economics, but also for the practice of fiscal policy alike. Hence, it is an opportune time to reflect on the current state and likely future of South African fiscal policy. This paper provides such reflection, focusing specifically on the impact of the composition of government spending and alternative financing arrangements on the economy in both the short and longer-term developmental sense and impact on the allocation of resources.

The paper proceeds as follows: Sections 2 and 3 outline key elements of the model, its options for financing fiscal policy, and its calibration to social accounting matrix data. Sections 4 explores a range of possible macroeconomic—and fiscal—impacts from expansive fiscal policy, giving simulation results and their sensitivity to alternative choices of key parameters. Section 5 offers concluding remarks.

2. Key Model Features

We present a multi-sector forward-looking dynamic general equilibrium model for South Africa. It largely draws from the family of PEP standard Computable General Equilibrium

(CGE) models developed by Decaluwé et al (2010)[3]. It is a neo-classical growth model in which the steady state growth rate of the economy is solely determined by the population growth rate augmented by Harrod-neutral technological progress. South Africa is considered a small-open economy producing tradable and non tradable goods that takes world prices and international interest rates as given. As will be discussed in the next section, the economy is disaggregated into 19 industries, producing 19 products.

The model is real in the sense that only relative prices affect real variables. The *numéraire* is the nominal exchange rate, or more specifically, the conversion factor between local and foreign exchange units. To disentangle the dynamics resulting from the exogenous growth of the population from the dynamics induced by policy shocks, all real variables are expressed in labour efficiency units.

Production

The representative firm in each industry combines labour, capital and intermediate inputs to produce composite commodities that can be sold either locally or exported. It has access to constant returns to scale technology and faces capital installation costs. It operates in a competitive environment in the good markets, as well as in factor markets. A nested structure is used to represent the production function of each activity. At the first level, output ($XST_{j,t}$) is a Leontief function of value-added input ($VA_{j,t}$) and of the aggregate of intermediate inputs ($CI_{j,t}$):

$$XST_{j,t} = \min\left[\frac{VA_{j,t}}{v_j}, \frac{CI_{j,t}}{io_j}\right]$$

[3] http://www.pep-net.org/programs/mpia/pep-standard-cge-models/

where v_j and io_j are parameters.

Labour ($LD_{j,t}$) is combined with capital ($KD_{j,t}$) using a CES function to produce value-added. Total factor productivity is influenced by the level of infrastructures (IND^{INF}) available in the economy. Hence,

$$VA_{j,t} = \left(KD_t^{INF}\right)^{\sigma^{INF}} B_j^{VA} \left[\beta_j^{VA} LD_{j,t}^{-\rho_j^{VA}} + \left(1-\beta_j^{VA}\right) KD_{j,t}^{-\rho_j^{VA}} \right]^{-\frac{1}{\rho_j^{VA}}}$$

where σ^{INF}, B_j^{VA}, β_j^{VA} and ρ_j^{VA} are parameters. σ^{INF} reflects the amplitude of the impact an increase in infrastructures would have on output (elasticity). The value of this elasticity was set to 0.3 (is taken from the literature[4]), which can be considered to be in line with South African literature cited above. The total stock of infrastructure at a given period depends on its depreciated level inherited from the previous period plus the new investment made by the government, IND^{INF}.

$$(1+n)\ KD_{t+1}^{INF} = (1-\delta)KD_t^{INF} + IND_t^{INF}$$

Finally, the aggregate of intermediate inputs is a Leontief function of the composite inputs ($DI_{i,j,t}$).

$$DI_{i,j,t} = aij_{i,j} CI_{j,t}$$

where $aij_{i,j}$ is a parameter.

Assume further that capital stock at each period is determined by the depreciated stock from the previous period plus investment $IND_{j,t}$, that is:

$$(1+n)\ KD_{j,t+1} = \left(1-\delta_j\right)KD_{j,t} + IND_{j,t}$$

where δ_j is the depreciation rate and n is the rate of growth of the labour force, adjusted to take into account technical progress[5].

[4] See Dissou and Didic (2011) and Calderón et al. (2009).
[5] The intertemporal model is thus defined per unit of effective worker.

The representative forward-looking firm maximizes the actualized value of profits net of investment expenditures:

$$\max \sum_{t=1}^{T}\left[\frac{1}{1+ir_t}\right]^t \left(r_{j,t}KD_{j,t} - PK_t IND^T_{j,t}\right)$$

Where profits are given by

$$r_{j,t}KD_{j,t} = PP_{j,t}XS_{j,t} - w_t(1+ttiw_{j,t})LD_{j,t} - \sum_i PC_{i,t}DI_{i,j,t} - ttik_{j,t}KD_{j,t}$$

with $ir_t, r_{j,t}, PP_{j,t}, w_t, ttiw_{j,t},, ttik_{j,t}$ and $PC_{i,t}$ being respectively the interest rate, the rate of return to capital, the price received by the firm for its aggregated output, the wage rate, taxes paid on the labour, taxes paid on capital and the price paid for input *i*.

Following Hayashi (1982), we consider a convex adjustment cost function, which is linear homogeneous in both of its arguments, i.e., investment and capital stock. In mathematical terms:

$$IND^T_{j,t} = \left(1 + \frac{\phi_j}{2}\frac{IND_{j,t}}{KD_{j,t}}\right)IND_{j,t}$$

where ϕ_j is the adjustment parameter.

In maximizing firm's value, managers determine the optimum paths for investment, labour and other intermediate inputs. Apart from investment decisions, the first-order conditions of the firm's intertemporal optimization problem are the standard ones encountered in static optimization problems. Firms use the production factor up to the point where its marginal product equals its price.

$$\frac{LD_{j,t}}{KD_{j,t}} = \left[\frac{\beta_j^{VA}}{1-\beta_j^{VA}}\frac{r_{j,t}(1+ttik_{j,t})}{w_t(1+ttiw_{j,t})}\right]^{\sigma_j^{VA}}$$

The optimum level of investment is determined so as to equalize the marginal cost of investment to the shadow price of capital, i.e., the marginal benefit q_j (evaluated in terms of change in firms' value) of changing the capital stock by a unit. The firm's marginal cost of investment includes not only the purchase price of capital goods, but also the additional capital installation costs that the firm must incur. Note that this behaviour refers solely to the business sectors, *bus*. In the public sectors, investment does not follow an optimization process but is rather determined exogenously by the government.

$$q_{bus,t} = PK_t \left(1 + \phi_{bus} \frac{IND_{bus,t}}{KD_{bus,t}} \right)$$

The marginal benefit of the investment takes into account the marginal impact of investment on profits of the current and future periods. Thus, this marginal benefit is the discounted sum of present and future marginal gain of physical capital. This marginal gain is the sum of the marginal product and the gain associated with the reduction in installation costs linked to the increase in the capital stock.

$$q_{bus,t+1}(1-\delta_{bus}) = q_{bus,t}(1+ir_t) - r_{bus,t+1}(1-ttik_{bus,t+1}) - PK_{t+1}\left[\frac{\phi_{bus}}{2}\frac{IND_{bus,t+1}}{KD_{bus,t+1}}\right]^2$$

It appears that firms' investment decisions can be affected through two main channels: the purchase price of capital goods and the marginal product of capital that depends mostly on the producer price received by the firm. On the one hand, an increase in the purchase price of capital goods has a negative impact on investment demand. On the other hand, an increase in the producer price has a positive impact on investment.

We assume that total private and public investment demand is a Cobb-Douglas composite of several commodities. The demand for each commodity entering this composite is a fixed share γ_i (in value) of total gross fixed capital formation (*GFCF*).

$$PC_{i,t} INV_{i,t} = \gamma_i^{INV} GFCF_t$$

It follows that average price of the capital goods is given by the following equation:

$$PK_t = \frac{1}{A^K} \prod_i \left[\frac{PC_{i,t}}{\gamma_i^{INV}} \right]^{\gamma_i^{INV}}$$

where A^K is a scale parameter.

Finally, total financial wealth at each period is given by:

$$Wealth_t^{TOT} = \sum_{bus} q_{bus,t} KD_{bus,t+1}$$

Households

Consider an economy populated by a finite number of infinitely-lived households. The representative household makes consumption and savings decisions, derives its current income from wages and profits paid by firms, and pays income tax. It maximizes an intertemporal utility function subject to a sequence of budget constraints and an intertemporal solvency constraint. The intertemporal utility function, which is additively separable, features a constant rate of time preference (ρ^H) and an instantaneous logarithmic utility function that is weakly separable and defined over aggregate consumption CTH_t.

$$\max u = \sum_{t=1}^{T} \left[\frac{1}{1+\rho^H} \right]^t \ln CTH_t$$

subject to:

$$SH_t = w_t LS_t + \lambda_{HH}^{RK} \sum_j r_{j,t} KD_{j,t} + \sum_{ag} TR_{HH,ag} + INT_t^{DOM} - TDH_t - \sum_{ag} TR_{ag,HH} - CTH_t$$

where SH_t represents savings, LS_t labour supply, λ_{hh}^{RK} the share of capital income received by households, INT_t^{DOM} domestic interest paid on the public debt, TDH_t income taxes and $TR_{HH,ag}$ and $TR_{ag,HH}$ transfers respectively received and paid by households from and to other agents.

By solving its optimization problem, the representative household determines the optimal paths for consumption expenditures. The first-order condition of this standard optimization problem is the consumption Euler equation, which specifies the trade-off between consumption in two consecutive periods. This trade-off depends on the ratio of real interest rate (in terms of consumption) and the discount factor. More precisely, an anticipated rise in the real interest rate relative to the rate of time preference induces households to substitute current consumption for future consumption.

$$CTH_{t+1}\left(1+\rho^{H}\right)=CTH_{t}\left(1+ir_{t}\right)$$

Based on the optimal path for aggregate consumption (or consumption expenditures), the representative household allocates in each period these expenditures among the available commodities (C_i). A Linear Expenditure System (LES) function is used as the aggregator function to specify the relation between aggregate consumption and the quantities of various commodities consumed by the representative household.

$$C_{i,t}PC_{i,t}=\overline{C_{i,t}^{MIN}}PC_{i,t}+\gamma_{i}^{LES}\left(CTH_{t}-\sum_{ij}\overline{C_{ij,t}^{MIN}}PC_{ij,t}\right)$$

where $\overline{C_{i,t}^{MIN}}$ represents the minimum consumption of commodity *i* and γ_{i}^{LES} the marginal share of commodity *i* in the household's consumption budget.

Government

The government's behaviour is simple. It collects direct and indirect taxes, receives and pays transfers, and consumes goods and services. It also pays interest (INT_{t}^{DOM} and INT_{t}^{ROW}) on the public domestic and foreign debt ($Debt_{t}^{DOM}$ and $Debt_{t}^{ROW}$ respectively), for which interests rates $\overline{ir}_{t}^{DOM}$, $\overline{ir}_{t}^{ROW}$ can differ and are exogenous.

$$INT_{t}^{DOM}=\overline{ir}_{t}^{DOM}Debt_{t}^{DOM}$$

$$INT_{t}^{ROW}=\overline{ir}_{t}^{ROW}Debt_{t}^{ROW}$$

The repartition between domestic and foreign borrowings is assumed to follow a fixed repartition although different closure could be assumed. The government finances the excess of its current and investment expenditures over its revenue by issuing bonds (SG).

$$SG_{t}=YG_{t}-\sum_{agng}TR_{agng,GVT,t}-\overline{G}_{t}-INT_{t}^{DOM}-INT_{t}^{ROW}-IT_{t}^{PUB}$$

A positive balance implies that the government would reimburse part of its debt, whereas a negative balance would increase it. Hence:

$$
\begin{aligned}
(1+n)\,Debt_{t+1}^{TOT} &= \left(1+\overline{ir}_t^{ROW}\right) Debt_t^{ROW} + \left(1+\overline{ir}_t^{DOM}\right) Debt_t^{DOM} - \left(SG_t + INT_t^{DOM} + INT_t^{ROW}\right) \\
&= Debt_t^{ROW} + Debt_t^{DOM} - SG_t
\end{aligned}
$$

A wide variety of taxes have been introduced in the model to allow taking into account many tax instruments. Although some of them are not used, given the SAM we had in hand, the users could easily implement new taxes in order to evaluate alternative financing options and their impacts on the South African economy.

3. Data Description

The data used is based on a 57 activity social accounting matrix (SAM) of 2005. However, in order for the model to solve numerically for a large period of time, we needed to aggregate the SAM. Indeed, an intertemporal model where agents have forward-looking behaviour, all periods need to be taken into account and solved simultaneously. Furthermore, such a model requires a large number of periods to allow for the economy to set back on a steady-state path when a shock is introduced. Hence, we aggregated the SAM into 19 activities and commodities. The correspondence between the 19 sectors in the aggregated SAM and the 57-activity SAM is shown in Table 1.

<Insert Table 1: Activities in the SAM about here>

In order to better appreciate the relative size of each sector in the South African economy, Figure 1 presents the contribution of grouped sectors to GDP whereas Table 2 presents the sectoral contribution. Although South Africa shows a rather diversified economy, one can note the large importance of the services sectors, which contribute to more than half of GDP, whereas agriculture only represents less than 3%.

<Insert Figure 1: Share of grouped sectors in GDP about here>

<Insert Table 2: Sectoral value added in GDP in 2005 about here>

The SAM displays four institutional accounts. Households receive payment for the factors of production they supply to the activities, and receive transfers from other agents. They use their income to consume, save, pay direct taxes and transfer to other agents. Figure 2 below shows the contribution of each source of revenue to total households' income.

<Insert Figure 2: Source of income for households: about here>

Firms' income is mainly composed of capital revenues, although they also receive minor transfers from other institutions. Firms distribute dividends to other agents, pay direct taxes and save. Note that firms' savings is a huge component financing total investment.

Government collects direct taxes (from households and firms) as well as indirect taxes (on products, taxes on production and import taxes). It also receives dividends from the firms and transfers from other agents. Figure 3 displays the relative importance of each sources of income. It highlights the reliance of public receipts on direct taxation.

<Insert Figure 3: Sources of income for government about here>

4. Simulations and Results

Two simulations were run, both increasing government expenditures by the same percentage up to 2020: Simulation 1 increases current expenditures, while simulation 2 increases investment expenditure. Both simulations assume that government expenditures will go back to their Business As Usual (BAU) values thereafter. Three different financing mechanisms are envisaged. The first assumption is that government cannot run a greater deficit and therefore taxes would have to be increased in order to compensate for this new spending. Two different types of taxes are alternatively set as endogenous to keep the deficit constant: tax rate on households' income and taxes on commodities. As a third experiment, all taxes are kept constant and government is allowed to increase its deficit. In other words, the public administration finances its additional expenditures through increased debt.

Table 3 shows the impact of increased current public spending under these three financing mechanisms for three years (2011, 2015 and 2025). It shows that, in order to finance its additional expenditures, government would need to raise actual income tax by 2.65 percentage points in the short run, but this increase would be temporary as income tax rates would slowly go back to their original levels, as public expenditures revert to their BAU values. If government chooses to finance new spending through indirect taxation, an additional tax of 1% on all commodities will be necessary to keep the deficit constant. As in the direct taxation scenario, this new tax would no longer be necessary in the longer run, for the same reasons.

Under all these financing mechanisms, the impacts on macroeconomic variables are rather small. In the short run, real GDP stays about the same as in the BAU, but impacts on investment are bigger, thus affecting the long-run value of GDP. This impact on investment is greater under the income tax and the debt financing mechanisms because of the greater effect on savings from households and public deficit respectively. Although an indirect tax affects investment less in the short run, its impact is more even across periods, thus leading to a similar decrease in real GDP in the longer run.

<Insert Table 3. Simulation 1: Impact of increased current public expenditures on macroeconomic variables (deviation from BAU in %) about here>

Figures 4 and 5 show the debt-to-GDP ratio and the deficit-to-GDP ratio respectively, over the next 60 years for Simulation 1. Although the impacts of the three financing mechanisms are about the same for the macroeconomic variables, these two ratios do vary quite differently. Indeed, in all cases the ratios would be greater than they would have been without the increased current spending. However, the impact is very much more important if the government chooses to finance its extra spending through increased debt. In the very long run, the debt-to-GDP ratio is 1.5% greater than it would have been and close to 1% for the deficit-to-GDP ratio. In other words, increased government spending for a short period of time will have a long-lasting impact on these two indicators.

<Insert Figure 4. Simulation 1: Impact of increased public current expenditure on debt-to-GDP ratio (BAU=1) about here>

<Insert Figure 5. Simulation 1 – Impact of increased public current expenditure on deficit-to-GDP ratio (BAU=1) about here>

It is worth mentioning that increased public spending in education and health would probably have a positive impact on the productivity of the factors of production. A more educated and healthy work force is likely to be more productive. However, in its current version, the model does not attempt to capture this impact. Evidence on concerning the relationship between current public expenditures and economic growth is mixed from the South African literature. While Alm and Embaye (2010) find evidence in support of Wagner's law, a study by Ansari et al (1997) finds evidence for the Keynesian hypothesis. Ziramba (2008) on the other hand finds that there is bidirectional causality, thus providing no evidence for either the Keynesian or the Wagnerian hypotheses for South Africa. Thus, as our paper consider rather small increases in public spending for a short period of time, does not take into account of linkages between current public spending and productivity. Further econometric work on how public spending affects productivity would be required in order to take this aspect into account. In other words, the results presented here could be considered the worst case scenario, as any positive impact on productivity would generate a positive impact on GDP and other economic variables. Furthermore, assuming all else is held constant, a positive impact on GDP would translate into smaller debt-to-GDP and deficit-to-GDP ratios.

In Simulation 2, the government increases its investment spending (see Table 4). Although the amplitude of the shock is the same as in Simulation 1, current expenditures represent a greater part of public expenditures. It is thus not surprising to see that the required rise in taxes (direct or indirect) is much less than the one presented in Table 3. Similarly, impacts on real GDP in the short run are negligible. However, as these expenditures finance investment, thus increasing total infrastructure and output, the GDP is positively affected in the medium and longer run. In fact, under a rigid deficit, taxes would eventually go down in the future as a result of greater production in the economy.

<Insert Table 4. Simulation 2: Impact of increased public investment (2011–2015) on macroeconomic variables (deviation from BAU in %) about here>

Figures 6 and 7 display different trends for the debt-to-GDP and deficit-to-GDP ratios to those seen in Simulation 1. In fact, as the GDP grows over time, a constant deficit translates into an improvement of both ratios over time. More surprisingly, this improvement is the greatest under the debt-financed scenario. In fact, keeping the same tax rates throughout the model horizon (2011–2059) would increase government revenues in the longer run and thus allow for a smaller deficit in the future.

<Insert Figure 6. Simulation 2: Impact of increased public investment on debt-to-GDP ratio (BAU=1) about here>

<Insert Figure 7. Simulation 2: Impact of increased public investment on deficit-to-GDP ratio (BAU=1) about here>

To test the robustness of the model to the elasticity values, Simulation 2 was run under the three different financing mechanisms using the lowest (0.1) and the highest (0.6) values of elasticities obtained from the South African econometric literature (Abedian and Van Seventer, 1995; Ayogu, 2005; Bogetic and Fedderke, 2005). Figures 8 and 9 present the impact of increased public investment on real GDP and debt-to-GDP ratio respectively. The results are qualitatively similar, whatever the value of the elasticity of the total factor productivity to infrastructure. In fact, the conclusions discussed above still hold when comparing the different financing schemes. As might be expected, the magnitude is somewhat different, but the impacts differ in a range of less than 1% and thus are not significant.

<Insert Figure 8. Simulation 2: Impact of increased public investment on GDP (BAU=100) about here>

5. Conclusion

This paper builds and uses an intertemporal CGE model for South Africa with elaborated government features. Simulations have focussed on the intertemporal impact of increased current and investment spending. Results show that an expansive fiscal policy would have short run positive impact on GDP but would translate into a greater debt to GDP ratio. Financing increased spending through taxation, direct or indirect, would mitigate this impact but would also have negative short run impact on macroeconomic variables. Increased investment spending would improve long run GDP, under any financing scheme, and would decrease debt-to-GDP ratio as well as deficit-to-GDP ratio. The lessons are not only valuable for South Africa but for developing countries where considerable attention is being given to the use of expansive fiscal policy for economic growth and the creation of jobs. These conclusions are driven by the positive impact infrastructure has on total factor productivity. Without this feature, increased public investment would have almost no impact on the South African economy. Although the positive impact of infrastructure on growth is well documented, less is known about the impact current expenditures on education and health on total factor productivity. More conclusive econometric work for South Africa on how this spending affect economic growth would allow a better modelling of public spending and thus a better understanding of their impact on the economy.

The paper is oriented towards constraints the government faces in financing its expenditures. Hence, the model correctly takes into account the different sources of income of the South African government, its expenditures and its deficit. Furthermore, one knows that the poor infrastructure in South Africa (and in Africa in general) is an impediment to economic growth. It is thus believed that taking into account the impact of improving infrastructure on productivity is an important South African characteristic. Admittedly, the labor market faces a lot of rigidities in South Africa. The intertemporal model presented here is more suited to the analysis of fiscal constraints than it is for labor market issues that have been discussed in other modeling frameworks. As well, other particularities of the South African economy could have been included in our modeling (education, health, inequalities, poverty, imperfect competition on some markets, and so on). All of them would have impacted the results. Indeed, most of these were included in other works from the authors but in sequential dynamic models or microsimulation models (see for example Mabugu et al (2010, 2012); Chitiga et al (2010, 2011); Maisonnave et al (2009); Mabugu and Chitiga (2009) among others).

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Table 1: Activities in the SAM

Sectors	Correspondence
Agriculture, forestry and fishing	Agriculture, forestry and fishing
Mining	Coal, gold, uranium ore and other mining
Food and beverages	Food, beverages and tobacco
Textiles	Textiles, wearing apparel, leather and leather products and footwear
Wood and paper	Wood and wood products, paper and paper products, and printing, publishing and recorded media
Petrochemicals	Coke and refined petroleum products, basic chemicals, other chemicals and man-made fibres, rubber and plastic products
Metals	Basic iron and steel, basic non-ferrous metals, metal products excluding machinery
Machinery and equipment	Machinery and equipment, electrical machinery, television, radio and communication equipment, professional and scientific equipment, motor vehicles, parts and accessories, other transport equipment
Other industries	Glass and glass products, non-metallic minerals, furniture, and other industries
Electricity, gas and steam	Electricity, gas and steam
Water supply	Water supply
Building construction	Building construction
Wholesale and retail trade	Wholesale and retail trade
Catering and accommodation services	Catering and accommodation services
Transportation	Railway transport, road transport, transport via pipeline, water transport, air transport, and transport support services
Other services	Communication, finance and insurance, business services, medical, dental and other health and veterinary services, and community, social and personal services
Government – education	Primary education, secondary education, and tertiary education
Government: Health	Health
Government – other	General administration, defence, law and order, social and economic

Table 2: Sectoral value added in GDP in 2005

SECTORS	share of VA in GDP
Agriculture, forestry & fishing	2.7%
Mining	7.0%
Food and beverages	3.1%
Textiles	0.8%
Wood and paper	1.6%
Petrochemicals	4.5%
Metals	3.5%
Machinery and equipment	3.5%
Other industries	2.4%
Electricity, gas and steam	0.5%
Water supply	0.2%
Building construction	0.1%
Wholesale & retail trade	13.5%
Catering & accommodation services	1.1%
Transportation	3.2%
Other services	30.7%
Government: education	5.9%
Government: health	2.1%
Government: other	7.3%

Table 3. Simulation 1: Impact of increased current public expenditures on macroeconomic variables (deviation from BAU in %)

	Direct tax financing			Indirect tax financing			Debt financing		
	2011	2015	2025	2011	2015	2025	2011	2015	2025
GDP	1.18%	0.07%	-0.10%	-0.54%	-0.42%	-0.23%	1.14%	0.04%	-0.12%
GDP deflator	1.19%	0.38%	0.11%	-0.56%	0.15%	0.16%	1.15%	0.35%	0.10%
Real GDP	-0.01%	-0.31%	-0.20%	0.02%	-0.57%	-0.39%	-0.01%	-0.32%	-0.21%
Real consumption	-1.07%	-0.71%	-0.24%	-1.65%	-0.81%	-0.40%	-1.09%	-0.74%	-0.27%
Real investment	-5.56%	-0.77%	-0.05%	-2.54%	-1.27%	-0.28%	-5.69%	-0.81%	-0.07%
Debt	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.97%	2.08%
Gov. expenditures	5.92%	1.22%	0.03%	6.23%	1.36%	0.07%	5.91%	1.43%	0.25%
Increase in tax rate	2.65%	0.63%	0.06%	1.01%	0.26%	0.04%	n.a.	n.a.	n.a.

Table 4. Simulation 2: Impact of increased public investment (2011–2015) on macroeconomic variables (deviation from BAU in %)

	Direct tax financing			Indirect tax financing			Debt financing		
	2011	2015	2025	2011	2015	2025	2011	2015	2025
GDP	0.02%	0.15%	0.17%	-0.22%	0.16%	0.26%	0.02%	0.15%	0.17%
GDP deflator	0.02%	-0.34%	-0.27%	-0.22%	-0.33%	-0.25%	0.02%	-0.34%	-0.27%
Real GDP	0.00%	0.49%	0.44%	0.00%	0.49%	0.51%	0.00%	0.49%	0.44%
Real consumption	0.07%	0.30%	0.37%	-0.09%	0.23%	0.37%	0.07%	0.30%	0.38%
Real investment	-0.21%	0.89%	0.51%	0.46%	1.12%	0.79%	-0.25%	0.88%	0.51%
Debt	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.17%	-0.15%
Gov. expenditures	0.73%	0.07%	-0.07%	0.76%	0.06%	-0.10%	0.73%	0.08%	-0.08%
Increase in tax rate	0.34%	-0.03%	-0.11%	0.13%	-0.01%	-0.04%	n.a.	n.a.	n.a.

Figure 9: Share of grouped sectors in GDP

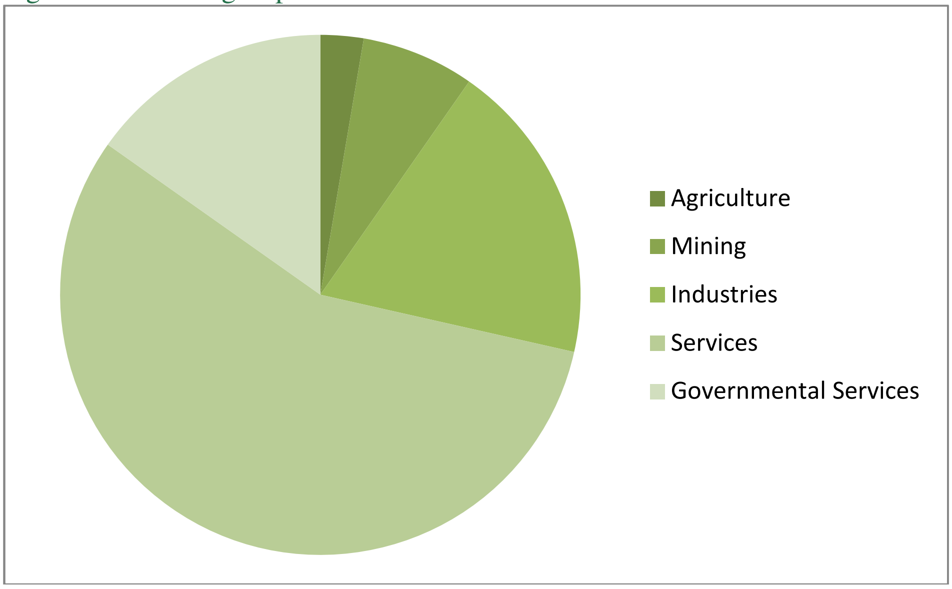

Figure 10: Source of income for households

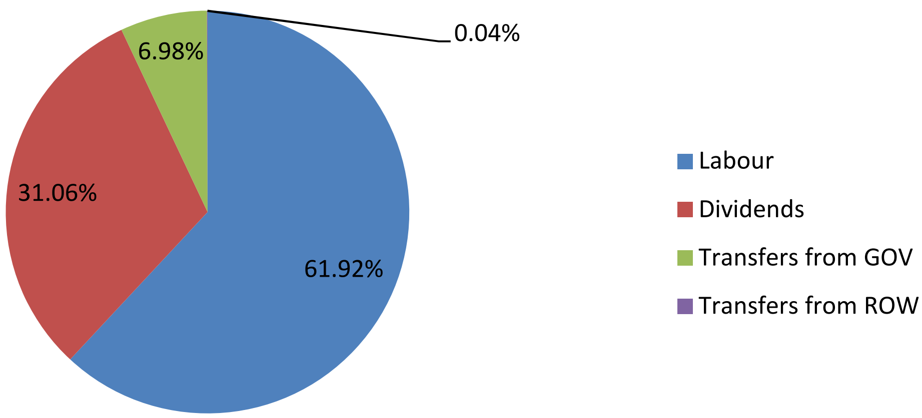

Figure 11: Sources of income for government

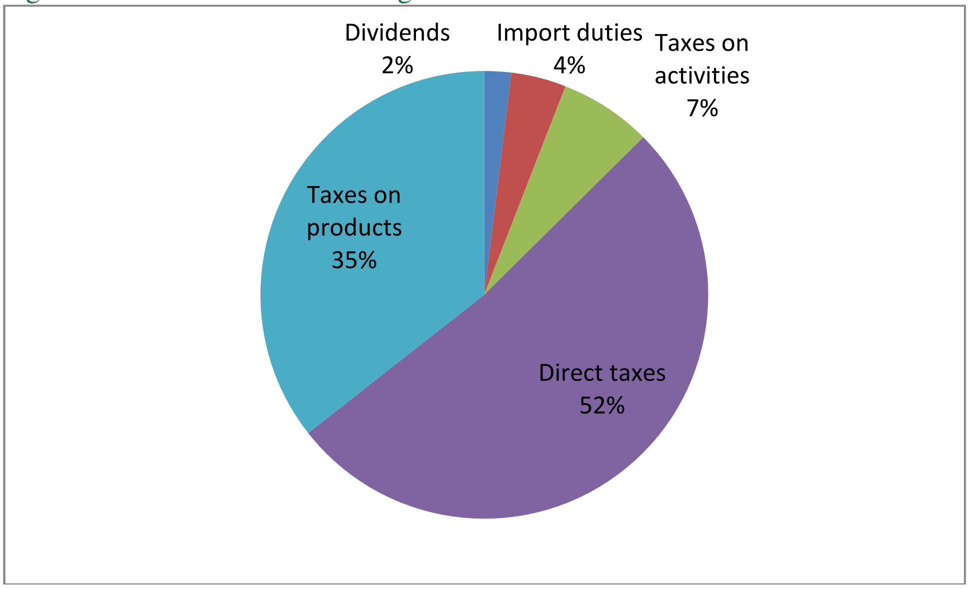

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Figure 12. Simulation 1: Impact of increased public current expenditure on debt-to-GDP ratio (BAU=1)

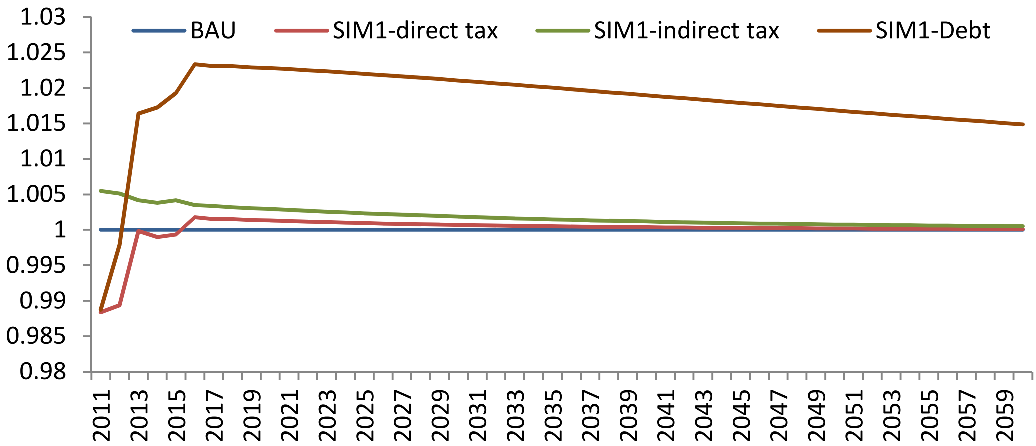

Figure 13. Simulation 1 – Impact of increased public current expenditure on deficit-to-GDP ratio (BAU=1)

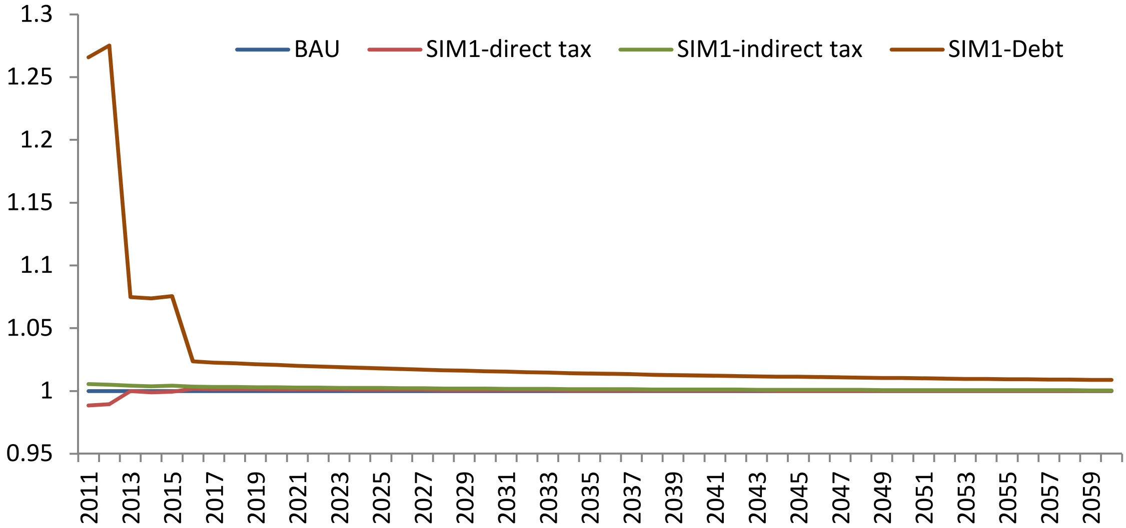

Figure 14. Simulation 2: Impact of increased public investment on debt-to-GDP ratio (BAU=1)

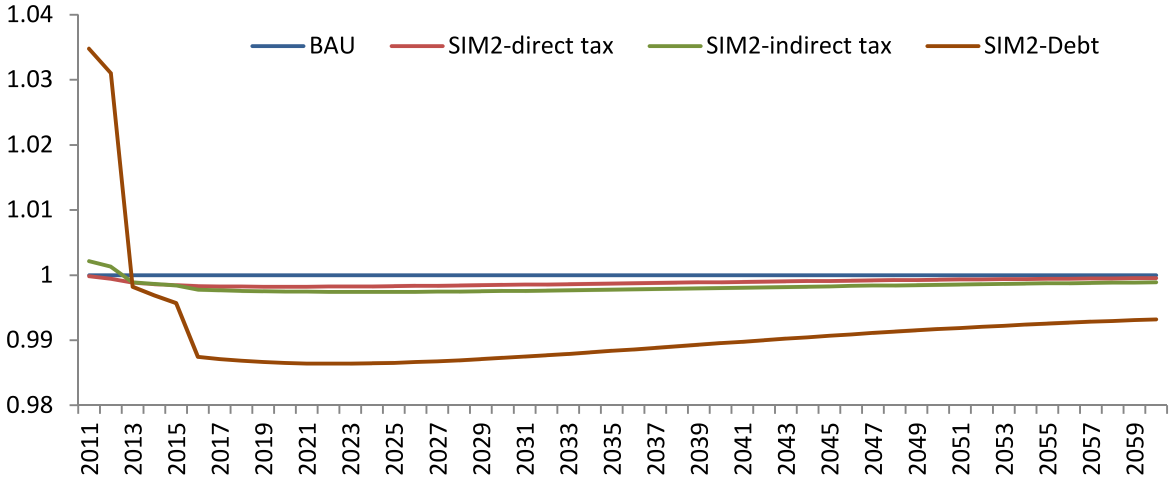

Figure 15. Simulation 2: Impact of increased public investment on deficit-to-GDP ratio (BAU=1)

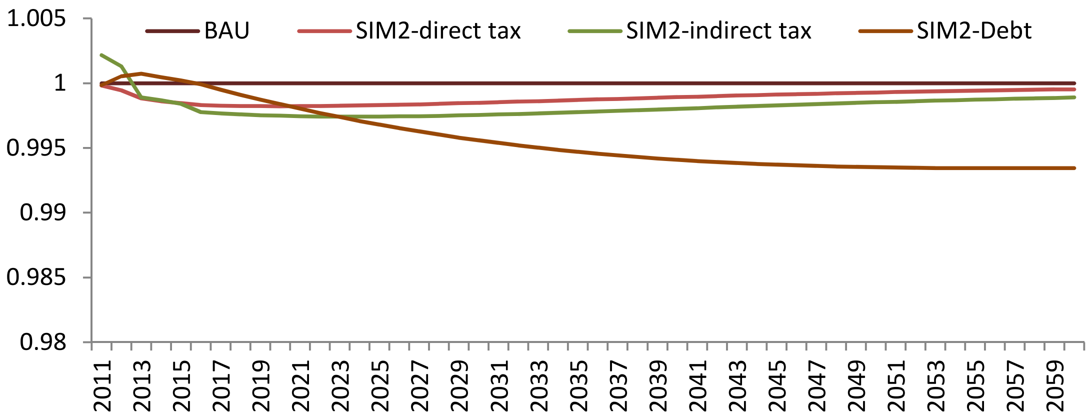

Figure 16. Simulation 2: Impact of increased public investment on GDP (BAU=100)