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Impact of fiscal policy in an intertemporal CGE model for South Africa

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ABSTRACT

This paper uses an intertemporal computable general equilibrium model to investigate the consequences of an expansive fiscal policy designed to accelerate economic growth in South Africa. A key contribution is made to existing literature on the transmission mechanism of fiscal policy in African economies. 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 using an integrated intertemporal model with such disaggregated production structure. The paper shows that an expansive fiscal policy would have a temporary impact on gross domestic product (GDP) but would translate into higher debt relative to GDP. 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 wide values of the elasticity of the total factor productivity to infrastructure. In fact, the conclusions hold even when comparing different financing schemes.

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 behavior 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 recovery and ensuing fiscal consolidation has evolved better than expected. This good performance, 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 realization that dates for attaining the Millennium Development Goals are a mere four years away, have galvanized the 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. The government has adopted the New Growth Path for South Africa, which aims to accelerate the creation of decent jobs and reduce inequality and poverty. As government

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identifies options for public expenditure, the need for reliable assessments of the probable impact of such expenditure becomes critical. Although fiscal authorities intend on 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 jeopardize 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 long-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. Section 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).[2] 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 the 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 labor efficiency units.

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 Chitiga et al., 2010a; 2012; Mabugu and Chitiga-Mabugu, 2009; Chitiga et al., 2010b; Mabugu et al., 2012; Chitiga et al., 2009, among others).

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

2.1. Production

The representative firm in each industry combines labor, 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 ($CI_{j,t}$):

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

where v_j and io_j are parameters.

Labor ($LD_{j,t}$) 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 (taken from the literature[3]), which can be considered to be in line with the 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 labor force, adjusted to take into account technical progress.[4]

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

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

where profits are given by

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

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 labor, taxes paid on capital and the price paid for input i.

[3] See Dissou and Didic (unpublished manuscript) and Calderón et al. (2009).

[4] The intertemporal model is thus defined per unit of effective worker.