Modelling Strategic Options for Agricultural Growth and Rural Development in South Africa

Margaret Chitiga, Ramos Mabugu and Ismael Fofana

1. Introduction

Although the government of South Africa has had some impressive achievements in the past two decades, it still has many challenges remaining. Specifically, the rural landscape still needs concerted efforts in order to fight poverty, inequality and unemployment, among others. It is important to note that the majority of the poor live in rural areas.

"In 2006, eight out of ten (80.8%) people living in rural areas were poor, which was double of that in urban areas (40.7%). By 2009, the proportion of poor people had increased to 83.0% in rural areas compared to 41.0% in urban areas. In 2011, more than two-thirds (68.8%) of rural dwellers were still living in poverty as compared with less than a third (30.9%) of residents in urban areas. The rate of reduction between the two settlement types from 2006 to 2011 was also different – there was a 15% reduction in poverty levels in rural areas, which was much lower than the 24% reduction in urban areas" (Stats SA, 2014: 33). A recent study by Daniels, *et al* 2013, shows that there is some evidence of de-agrarianisation in rural areas in the last few years. This is seen in a reduction in agriculture employment as well as a reduction in non-employment agriculture activities. At the same time, there is also evidence of increased reliance on government grants, Daniels, *et al* 2013. These developments are concerning and to be addressed swiftly if the government must reduce dependence of grants, migration of the unemployed to urban areas as well as further vulnerability of the rural poor. Therefore, the National Development Plan, vision 2030, makes clear the importance of rural development. Further, the Medium Term Strategic Framework (2014-2019) shows commitment to rural development.

The government aims to address rural development through a cross-sectoral and multi-occupational diversity of programmes. There is need to respond to constitutional and legislative imperatives to ensure that implementation of rural development strategies and programmes can be monitored. According to the Comprehensive Rural Development Programme (CRDP), the programme is to be implemented through a coordinated and integrated broad-based agrarian transformation, rural development infrastructure, and an improved land reform programme. Much is already known in terms of the role of that agriculture can play in a country's development, see for example, Dorward et al. (2008). Furthermore, while there is substantial evidence of the positive role of agriculture growth, especially small scale agriculture on poverty reduction, (see Christiaensen et al. 2011), there is no agreement that small scale agriculture growth is the only or best way to reduce poverty and inequality. Dercon and Gollin, 2014 specifically argue that the choice of whether government expenditure focus should be on agriculture policy or non-agriculture policies in a bid to reduce inclusive poverty, is highly dependent on effectiveness of the specific agriculture policies as well as the context in which they are applied.

Given the slowdown in the South African economy, it is important to prioritise budget items that will offer the most in terms of sustainable development. It is especially important to ask if the many programmes that have been introduced for rural development have been effective. This is because rural areas remain poverty stricken with low economic performance and contribution to

the economy. Thus the study aims at contributing to improve the IGFR efficiency for rural development through a better understanding of the issue of agricultural growth and rural development and their linkage to the national economy, on the one hand, and the prioritisation of public investments/spending and interventions, on the other hand. More specifically, the study assesses the impact of macroeconomic performances on agricultural growth and rural households' wellbeing.

One of our contributions in this paper is to the debate on the importance of the context in which agricultural policy is implemented. We advance the idea that improvement of the Inter-governmental Fiscal Relations (IGFR) efficiency will accelerate agricultural growth as well as rural development. This in turn is expected to reduce poverty and inequality. Through targeted and prioritised public interventions and investments in rural development, it is expected that IGFR efficiency will be achieved as well as better welfare outcomes in rural areas. This implies assessment of the agricultural interventions and investments, as well as the consistency of macro and non-agricultural policies (crowding in/out effects). A second contribution of this paper is to offer a practical way on how interventions and recommendations can contribute the most to growth and poverty alleviation in rural areas. Government is searching for new ways to unlock the economy's growth potential. Both rural and urban regions are key contributors to national growth and places where citizens and firms create and reap economic benefits. A third and major contribution of this paper is in the methodology used. We develop a dual economy Computable General Equilibrium (CGE) model with a focus on urban-rural labour mobility as well as commodity mobility between producers and consumers markets. The latter feature of imperfect local product markets, is a major innovation. After the model is calibrated over a10-year period, i.e. Reference scenario, four policy scenarios are tested. These are an exchange rate policy, a fiscal policy, an agricultural growth policy, and a nonagricultural growth policy. The rest of this paper is arranged as follows: the next section briefly reviews agricultural growth and rural development theories. Thereafter the model used is discussed. Simulation results and discussion follow that section, and finally the paper concludes.

2. Agricultural Growth and Rural Development: A Review

Economic transformation is a long process, from agriculture, to manufacture, and then to service. This is well anchored in the classic papers by Rostow (1960) and Kuznets (1966). The modern literature can be summarised as follows. There is an initial transition to modern economy and industrial transformation, (Goodfriend-McDermontt (1995), Hansen-Prescott (2002), Gollin-Parente-Rogerson (2002), Atkeson-Kehoe (2007), and Acemoglu-Guerrieri (2008)). This is followed by activation of the industrial transformation process (Wang & Xie, 2004). Thereafter there is industrial transformation and long-term growth implying transformation from agriculture to manufacture and to service, (Kongsamut-Rebelo-Xie, 2002). After these processes, there is transformation to a mass-consumption economy, (Matsuyama, 2002) including a shift from home to market and service society (Buera-Kaboski, 2009) and multi-sector structural transformation to meet various stylized facts (Herrendorf-Rogerson-Valentinyi, 2013). Recent quantitative analysis literature has used dynamic general equilibrium models to mimic some of these transition processes; e.g. Laitner (2000) on savings as a key driver of modernisation; Hansen and Prescott (2001) and Ngai and Pissaridis (2007) on the role of technology growth rates in structural change process; Gollin, Parente, and Rogerson (2002) on advancement in

agricultural productivity as essential for providing the means to allow labour to be reallocated to the modern sector.

There are also examples using non-balanced growth models. There are also examples using non-balanced growth models. For instance, subsistence consumption of agricultural goods can lead to a downward trend in agricultural employment (e.g. Kongsamut, Rebelo, and Xie, 2003); model with agricultural subsistence as an integral part with authors studying structural transformation and regional convergence in the United States (e.g. Casselli and Coleman, 2001); structural transformation based on cross-country differences in labour productivity (e.g. Duarte and Restuccia, 2010). Buera and Koboski (2009) examine whether sector-biased technological progress or non-homothetic preferences is as a result of agricultural subsistence. Buera and Koboski (2012) further elaborate that theme by arguing that scale technologies for mass production are important forces leading to industrialisation. For a comprehensive survey, the reader is referred to Herrendorf, Rogerson and Valentinyi (2013).

The pioneering work on surplus labour economies is by Lewis (1954), Fei and Ranis (1961, 1964) and Sen (1966) who analysed implications of surplus labour economies for labour-market performance and economic development. The term 'dual economy' refers to the existence of traditional and modern sectors within one economy (Lewis, 1954)[1]. The traditional sector typically uses traditional technology with low capital intensity. The sector also features low paid labour and productivity. The modern sector in contrast uses advanced technology and is relatively highly capital intensive, with high productive and paid labor. In the Lewis model, agriculture supplies labour and food to industry and its labour force in the economic development process. Labour migrates from agriculture to industry until the surplus of labour is exhausted, i.e. convergence in urban and rural wages. Following these seminal work, there has been an explosion of work focusing on implications of rural surplus labour in a dual economy. Perhaps the most influential amongst these are the papers by Todaro (1969) and Harris and Todaro (1970, (hereinafter referred to as HT). In the HT papers, urban unemployment and labour policies are examined under an institutionally fixed minimum wage (above its equilibrium level) in the urban areas. There are many extensions of HT as follows: Khan (1980) re-examined generalised HT models from a trade theory lens (Heckscher-Ohlin). Findings are that a uniform subsidy to labour with a differential subsidy to capital is optimal (in the sense of second-best). Batra and Naqvi (1987) evaluate gains from trade in a setup of urban unemployment and the optimal policy established is a uniform subsidy to labour together with free trade (no tax levied on goods). Beladi and Marjit (1996)'s setup features a rural sector that employs labour and an intermediate good but with no capital. In the urban area, capital and labour are employed by both the intermediate good and final good. A tariff on the final good in urban areas lowers capital rental and raises urban employment. This is provided the urban final good sector is capital intensive. Chang, Kaltanic and Loayza (2009) argue that a tariff reduction improves production efficiency but distorts labour markets in a simple HT setting. Another strand of the literature is in bringing in dynamics into the analysis. There are two variants, one by Drazen and Eckstein (1988) who construct a 2-period overlapping generations' framework. Land is a specific factor in the rural sector and capital is a specific factor in the urban sector. The decentralised equilibrium

[1] Lewis two-sector model assumptions are that (a) the traditional sector is agriculture and (b) the modern sector is industry.

in this setup is suboptimal. Glomm (1992) on the other hand proposes an infinite lifetime model that allows for rural-urban migration. Higher urban productivity is explained by lower costs of communication with higher population density. Unlike in the overlapping generations model (OLG) case, the decentralised equilibrium is found to be Pareto optimal.

A final strand of the literature worth mentioning is that which uses rural-urban migration to explain equilibrium low-growth traps under information asymmetries. Examples include Bencivenga and Smith (1997) who argue that adverse selection of workers into urban areas perpetuates low growth. While Banerjee and Newman (1998) achieve a similar goal by considering the modern urban sector to have imperfect credit markets and associated higher agency costs. Lucas (2004) offers a variant to HT model. In his model rural/urban migration is modelled as a 'transition from a no-growth agricultural sector using traditional technology to an urban sector where there is persistent growth due to human capital accumulation'. Urban sector workers choose their time allocation between human capital accumulation and work. There is therefore a persistent wage differential between the urban and rural sectors which in essence reflects the return to human capital accumulation that workers must engage in when they migrate to the city.

In this paper we develop a dual economy CGE model with a focus on urban-rural labour mobility as well as commodity mobility between producers and consumers markets. The latter feature of imperfect local product markets, which is a major innovation, is important as it is the main driving force underlying the structural transformation and envisaged urbanisation process unlike in the Harris-Todaro model where it is the possibility of being unemployed as a result of urban wage rigidity that explains the differential. Thus, in our setup, agricultural goods are primarily rural-based and non-agricultural goods are urban-based. Similarly, agricultural goods producers and non-agricultural goods consumers are rural-based, while non-agricultural goods producers and agricultural goods consumers are urban-based. The price transmission between producers and consumers markets for agricultural and non-agricultural commodities are hence of major interest for rural development. During this transition process, migration cost reduction and Total Factor Productivity (TFP) changes are also important, accounting for a significant proportion of increased urbanisation. The next section focuses on developing the model in detail.

3.

4. Analytical Approach

The study uses the economic modelling technique to assess the options for agricultural growth and rural development in South Africa. This is initially done by using an Agriculture-focused Computable General Equilibrium (Ag-CGE) model built to account for the linkages between the agricultural sector and the rest of the economy.

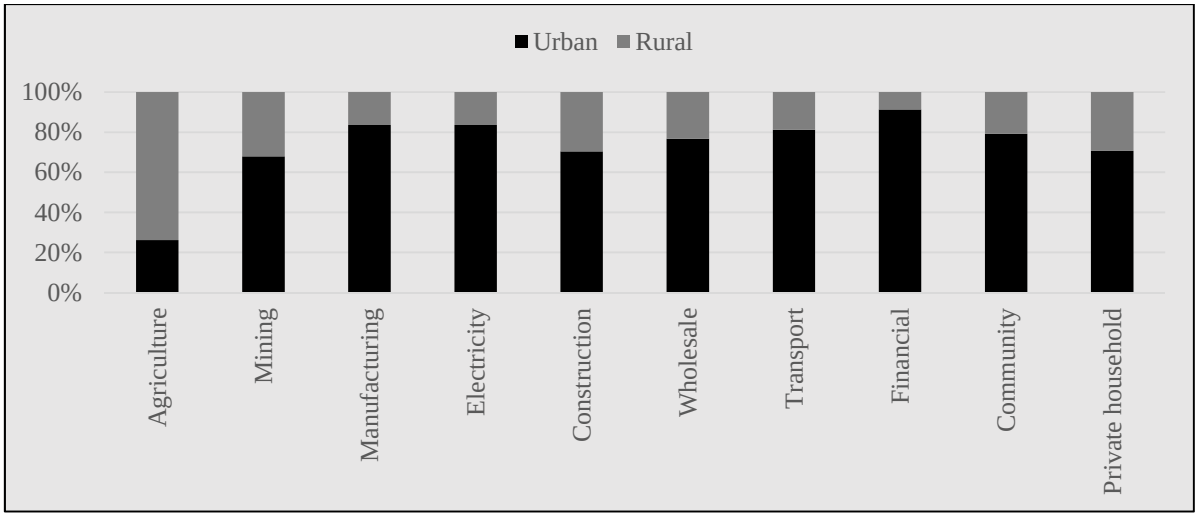
Agriculture-focused CGE Model (Ag-CGE)

A Standard CGE model archetype is used to build the Ag-CGE for South Africa. The model is made agriculture focused through the following features:

- Separate urban and rural labour markets for the nine provinces in South Africa, and by skill category, and including analyses of labor force growth, and rural-urban migration and remittances;
- Separate urban and rural representative household groups, including analyses of demographical growth, and food and nonfood demand patterns; and
- Imperfect integration of markets, i.e. separation between producer and consumer markets for locally produced goods, and including analyses of consumption of self-produced food, and consumption of marketed food.

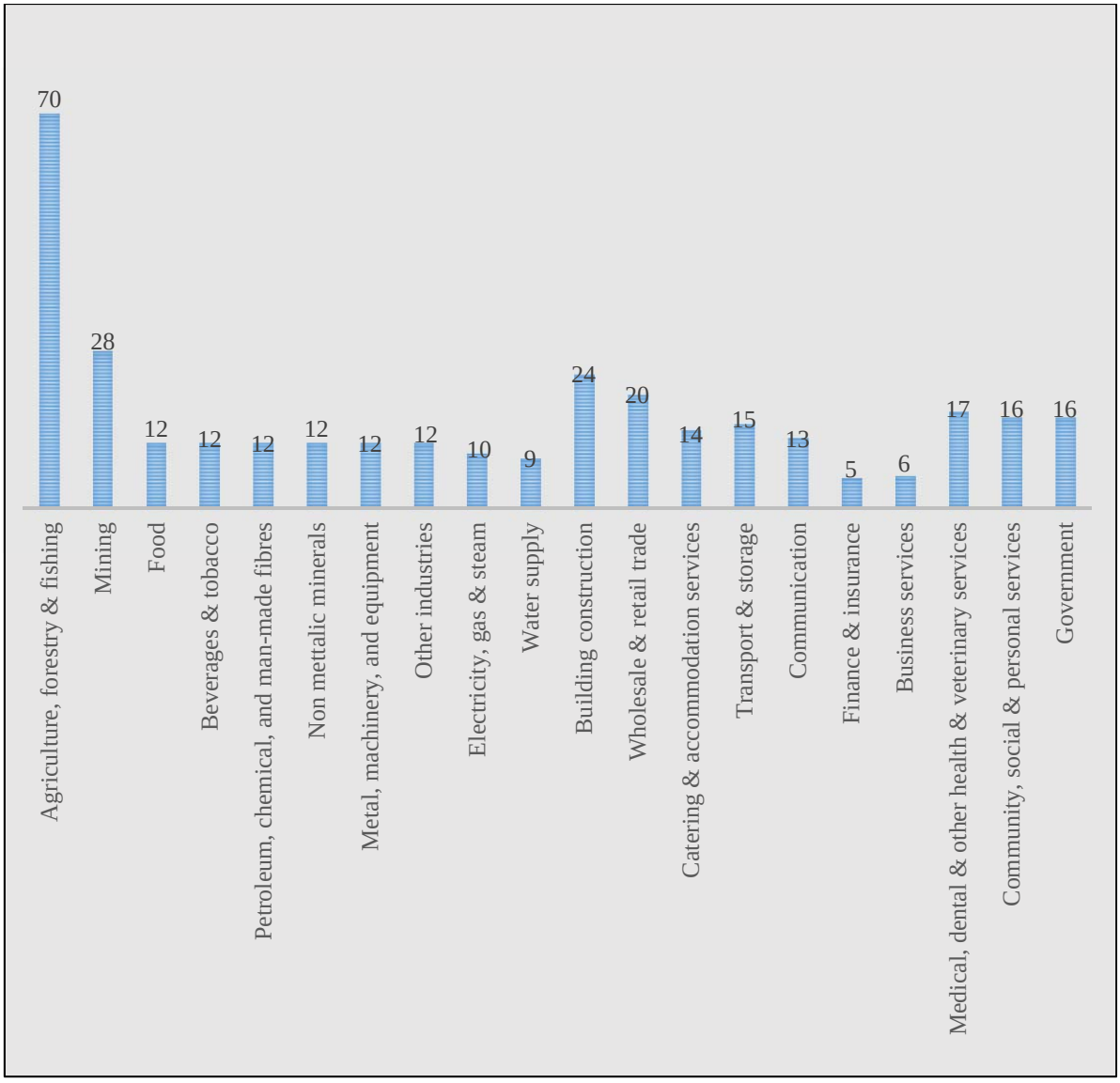
The model features thirty industries or activities, including one industry for “Agriculture, forestry & fishing”. The latter is predominantly rural-based, according to the employment and income distribution linkages with rural populations (Graphs 1 and 2).

Graph 1: Urban-Rural Employment Structure by Sector, Hours Worked



Source: Authors calculation from 2013 Labour Force Survey (2016).

Graph 2: Rural labor income intensity by industry (%)



Source: Authors calculations from 2013 Labour Force Survey (2016).

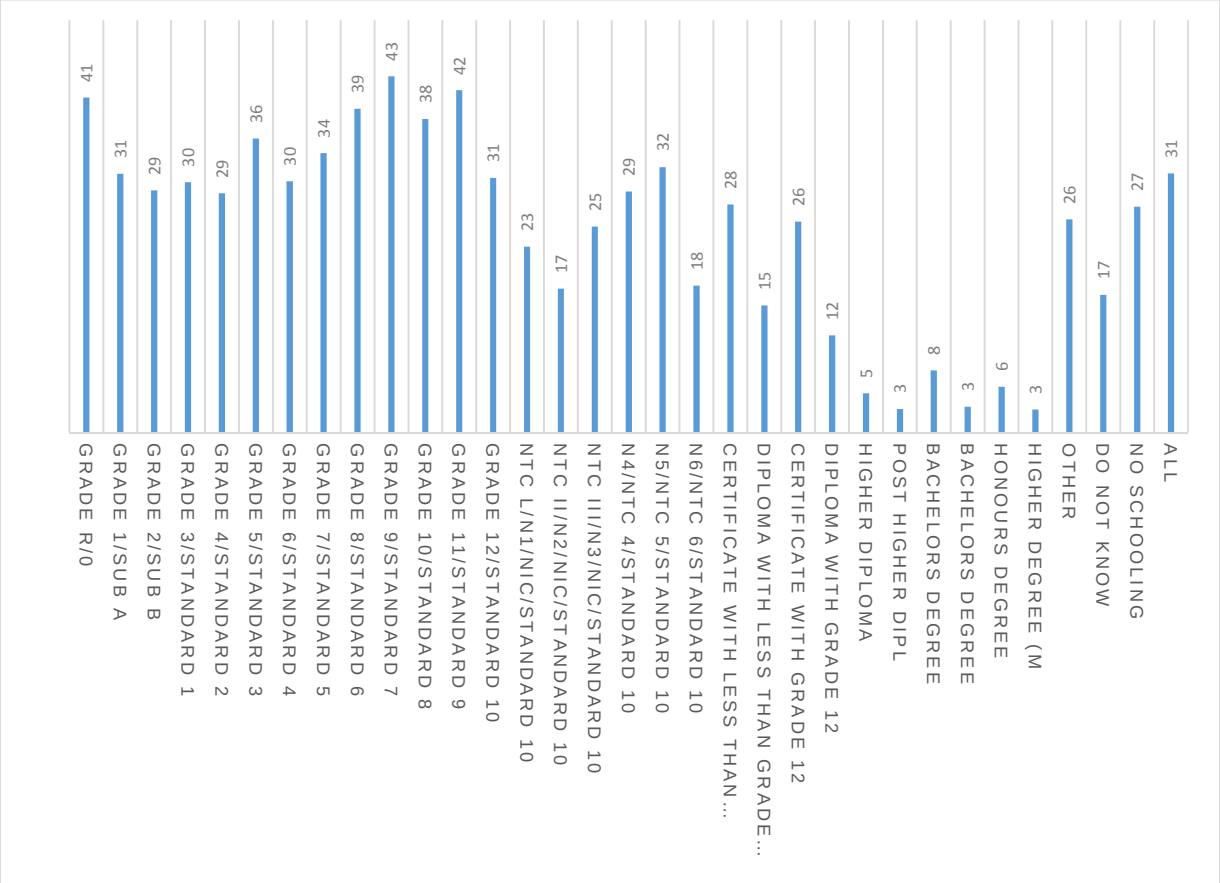
The macroeconomic closure rules of the model are presented next.Commodity markets follow the neoclassical market-clearance rule as local prices equilibrate supply and demand. We assume that the capital market follows the neoclassical market-clearance rule with the real interest rate equilibrating supply and demand. The external current account is equilibrated through a flexible exchange rate and the government fiscal balance is a fixed share of GDP. Saving is driven by investment. Finally, perfect competition is assumed in skilled labor markets while and imperfect competition is assumed in unskilled labor markets with an appearance of unemployment.

a. Labour Markets

The model features ninety categories of worker and labour markets with urban-rural linkage. These are distinguished by province, settlement type and skills as detailed below. There are 9 provinces which are Western Cape, Eastern Cape, Northern Cape, Free State, KwaZulu-Natal,

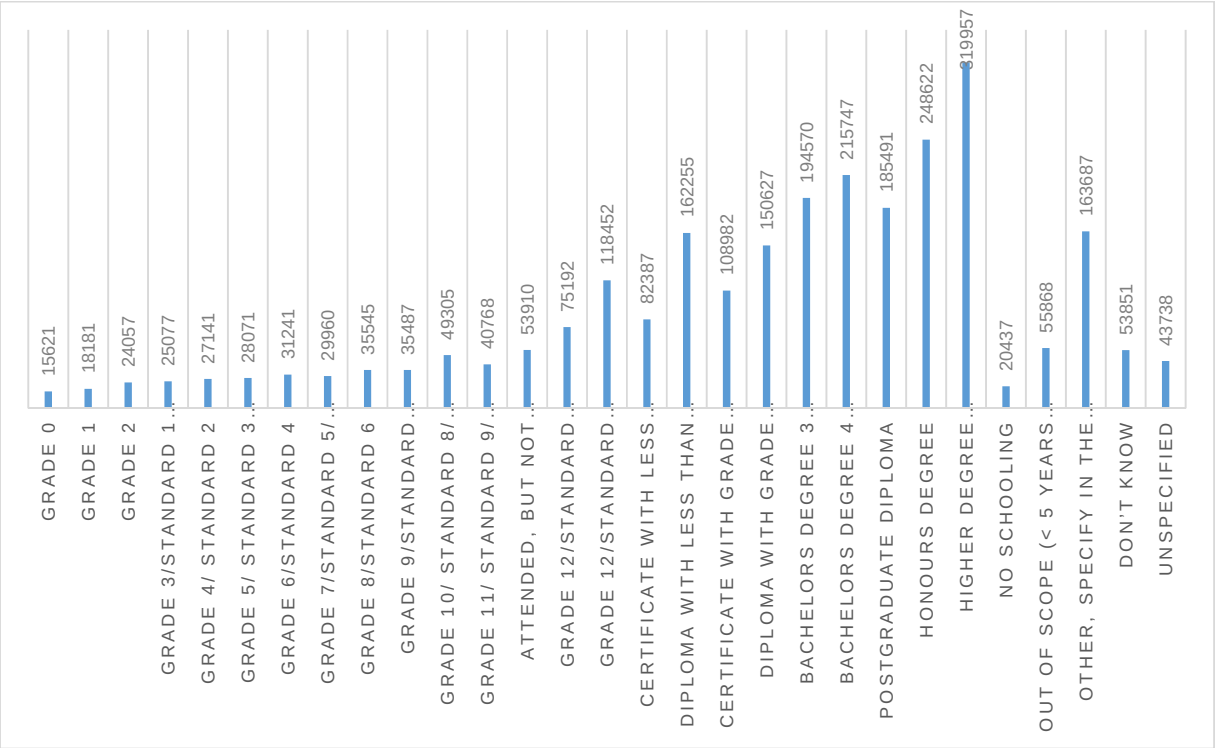
North West, Gauteng, Mpumalanga, and Limpopo. There are 2 settlement types which are urban (formal & informal) and rural (traditional & rural). 5 skill categories are included and are based on the highest education level achieved, i.e. Unskilled: No schooling and less than Grade 1, Lower skilled: grade 2 to 7, Medium skilled: Grade 12, Skilled: Certificate and diploma, High Skilled: Degree and Postgraduate diploma. Evidence from South Africa informs that high skilled labor markets show lower unemployment rates and pay higher wages and salaries (Graph 3 and 4) and unemployment rate is higher in rural areas as compared to urban areas (Graph 5). Table 1 show a heavy reliance of rural household groups on unskilled and low skilled labour income for all regions.

Graph 3: Unemployment rates by skill category, including discouraged job seekers



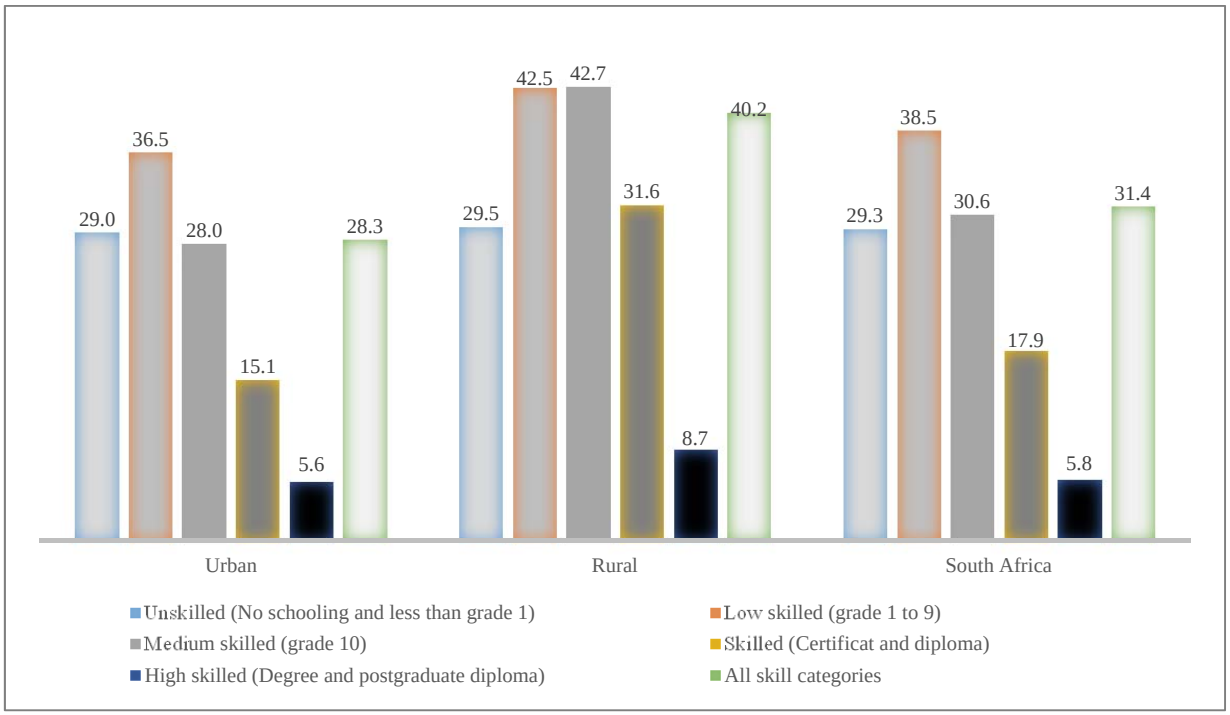
Source: Authors calculations from 2013 LFS (2016)

Graph 4: Average Salaries and Wages by Level of Education (SA Rand)



Source: Authors calculations from 2013 LFS (2016)

Graph 5: Unemployment rates by skill category, including discouraged job seeker



Source: Authors calculations from 2013 Labor Force Survey (2016)

Table 1: Distribution of Labor Income by Level of Education, Region, and Area (%)

Skill Category	Western Cape		Eastern Cape		Northern Cape		Free State		KwaZulu-Natal	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
No schooling and less than grade 1	1.3	7.5	1.7	7.5	3.4	10.1	2.8	3.5	1.7	7.5
Standard 1 to 9	40.8	60.7	47.8	67.4	41.8	65.3	44.4	68.1	37.7	58.5
Standard 10	36.9	23.9	32.3	16.2	36.6	13.8	32.6	16.8	41.4	24.9
Certificate and diploma	9.2	3.8	10.2	5.9	8.7	6.4	11.0	6.8	10.5	6.8
Degree and Postgraduate diploma	11.8	4.0	8.1	3.0	9.5	4.5	9.2	4.8	8.6	2.3
All categories	100	100	100	100	100	100	100	100	100	100

Source: Authors calculations from the 2011 Income and Expenditure Survey (2016).

Table 1: Distribution of Labor Income by Level of Education, Region, and Area, cont.' (%)

Skill Category	North West		Gauteng		Mpumalanga		Limpopo		South Africa	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
No schooling and less than grade 1	4.4	8.1	1.9	6.5	3.2	8.8	2.3	10.8	2.0	8.5
Standard 1 to 9	43.3	59.1	34.1	44.0	41.2	57.0	36.0	60.1	38.4	60.0
Standard 10	37.6	25.6	37.9	30.6	38.1	24.8	32.3	19.5	37.4	22.1
Certificate and diploma	8.9	5.6	14.4	10.0	10.8	7.8	15.4	7.4	11.9	6.8
Degree and Postgraduate diploma	5.8	1.6	11.6	9.0	6.7	1.7	14.2	2.1	10.3	2.6
All categories	100	100	100	100	100	100	100	100	100	100

Source: Authors calculations from the 2011 Income and Expenditure Survey (2016).

The treatment of labor market reflects empirical evidences in South Africa as shown in Graphs 1 and 2 as well as that advanced by Kingdon and Knight, 2004 and 2007. Thus, imperfect labor market is assumed for unskilled, low skilled, semi-skilled, and skilled labor markets (Graph 1). This is implemented through a wage curve specification (Blanchflower and Oswald, 1995). On the other hand, a competitive market-clearance rule applies for high skilled labor markets, that is, full employment, (Graph 1). For each skill category, workers are perfectly mobile across industries within each of the nine provinces as well as between locations, i.e. urban versus rural.

b. *Rural-Urban Migration and Remittances*

The model specifies an exogenous setting of labor mobility between rural and urban areas, as well as across provinces for each skill category. An exogenous change in the share of labor income spent in the original location (remittances) is also specified. As labor migrates from the original to the final location, labor remittances flow from the final to the original location. We assume urban-rural migration and remittances are affected by both economic and noneconomic drivers. Levies on labor income are redistributed across household categories using initial distributional shares of labor income. The rates are ranked between 0 when labor income is fully spend in the final location, and 1 when labor income is fully spend in the initial location. While economic factors are well handled in our framework, the latter has a limitation when it comes to include noneconomic factors. This latter reason has guided the choice of exogenous specifications.

c. Commodity Markets

We assume an imperfect integration of local product markets. There is a separation between producers and consumers markets, while both markets are linked through local trade. We

explicitly model local trade activities along with other market activities. Commodity-based local traders or activities use private services to move commodities from producers to consumers markets. Trade service is provided by three industries: "*Wholesale & retail trade*", "*Transport & storage*", and "*Finance & insurance*". The model features a profit maximising representative trader.

d. Household categories

The model features eighteen representative household categories by province and urban or rural settlement type.

Data

The model is calibrated using an agricultural-focused Social Accounting Matrix (Ag-SAM). The Ag-SAM is developed from the 2013 SUT, the 2011 income and expenditure survey, as well as the 2013 labour force survey. The 2013 Ag-SAM has several features. There are thirty industries or activities, including one account for "Agriculture, forestry & fishing". There are thirty commodities including one account for "Agriculture, forestry & fishing". Ninety labor categories, are modelled based on nine provinces, two settlement types (i.e. urban and rural), and five education levels. One capital factor account is modeled. There are four tax accounts which are taxes on production, subsidies on production, taxes and levies on products, and current taxes on income and wealth. The model further includes twenty-one institutional accounts, including eighteen household categories. Lastly, there are two capital accounts which are fixed capital formation, and changes in inventories. The next sections are devoted to the discussion of the simulations and the results. The reference scenario is discussed first, then the four scenarios, an exchange rate policy, a fiscal policy, an agricultural growth policy, and a nonagricultural growth policy are discussed in turn.

5. Simulation Scenarios and Results

4.1 The Reference Scenario

The Reference scenario is characterised by the below set of hypotheses. First, for the *change in urban and rural labor forces, and rural-urban migration* we assume exogenous growth rates of rural and urban labor forces based South Africa's demography between 2000 and 2011. Second, for *urban-rural remittances we e*xogenously set them at 50% and it is worth mentioning that we found no major changes in results with alternative sharing rules. *Third, the household minimum consumption of goods and services growth rate* is exogenously set based on South Africa's demography between 2000 and 2011. Forth, for *fiscal policy* we assume a balanced government budget, balanced through compensatory tax on households income. Lastly, for *saving-investment* we assume that savings are investment driven, and balanced through households saving.

South Africa's demography between 2000 and 2011 (Table 2) shows an increase in urban population (at an annual average growth rate of 2.2%) except for Limpopo (-0.4%); and a decrease in rural population (at an annual average growth rate of -0.1%), except KwaZulu-Natal (1.7%), Mpumalanga (0.0%), and Limpopo (0.5%).

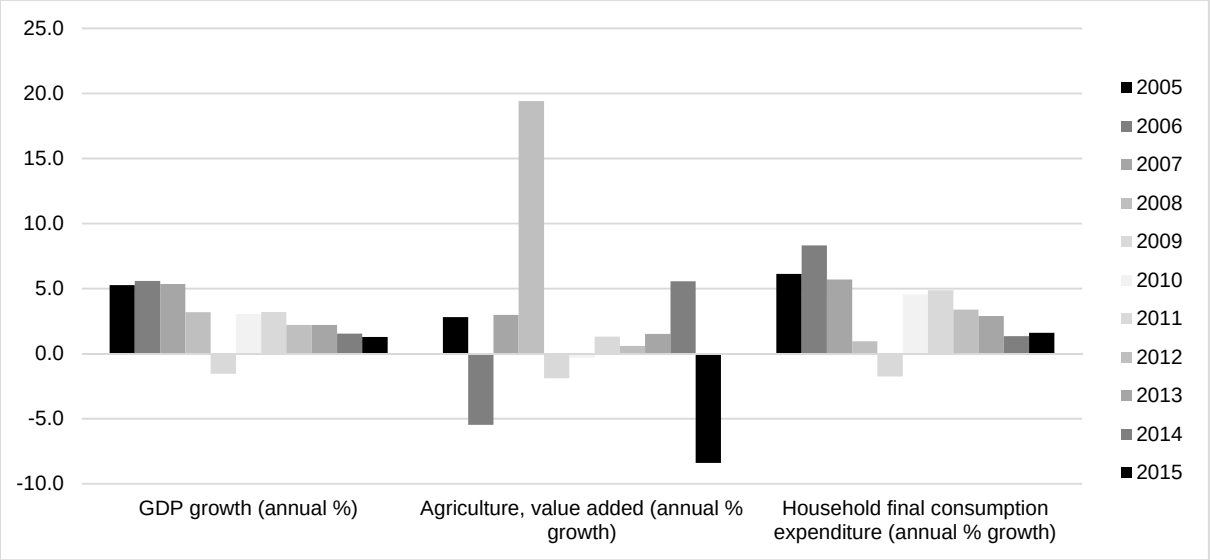
Table 2: South Africa Population Growth by Province and Urban and Rural Settlements, 2000 and 2011

Province	Urban			Rural			South Africa		
	2000	2011	Annual Growth Rate (%)	2000	2011	Annual Growth Rate (%)	2000	2011	Annual Growth Rate (%)
Western Cape	3,787,434	4,933,785	2.4	442,954	327,954	-2.7	4,230,387	5,261,739	2.0
Eastern Cape	2,387,806	2,948,888	1.9	4,513,109	3,965,479	-1.2	6,900,915	6,914,367	0.0
Northern Cape	625,576	812,220	2.4	250,569	72,391	-10.7	876,145	884,612	0.1
Free State	2,026,699	2,364,841	1.4	781,997	392,262	-6.1	2,808,695	2,757,103	-0.2
KwaZulu-Natal	4,422,634	5,109,401	1.3	4,632,324	5,580,124	1.7	9,054,958	10,689,525	1.5
North West	1,422,508	1,537,879	0.7	2,173,855	2,149,150	-0.1	3,596,363	3,687,029	0.2
Gauteng	7,634,846	10,968,996	3.3	300,610	74,616	-11.9	7,935,456	11,043,612	3.1
Mpumalanga	1,274,669	1,590,116	2.0	1,793,727	1,799,774	0.0	3,068,396	3,389,889	0.9
Limpopo	748,506	718,727	-0.4	4,823,535	5,076,419	0.5	5,572,041	5,795,146	0.4
All provinces	24,330,677	30,984,853	2.2	19,712,680	19,438,169	-0.1	44,043,357	50,423,022	1.2

Source: Authors calculations from 2000 and 2011 Income and Expenditure Surveys (2016).

A gradual slowdown of the national economic performance measured by the GDP growth rate is recorded over the decade 2005-2015 (Graph 6), and households' final consumption expenditures show a similar pattern. On the other hand, agriculture growth shows an erratic patterns.

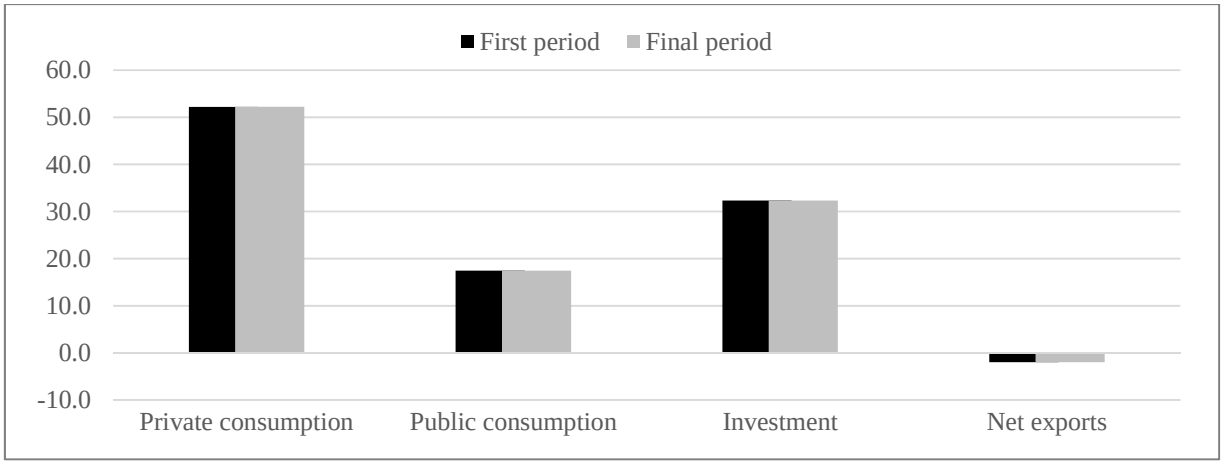
Graph 6: Real Performances of South African Economy 2005-2015, Annual Growth (%)



Source: Authors calculations from the World Development Indicators, World Bank (2016).

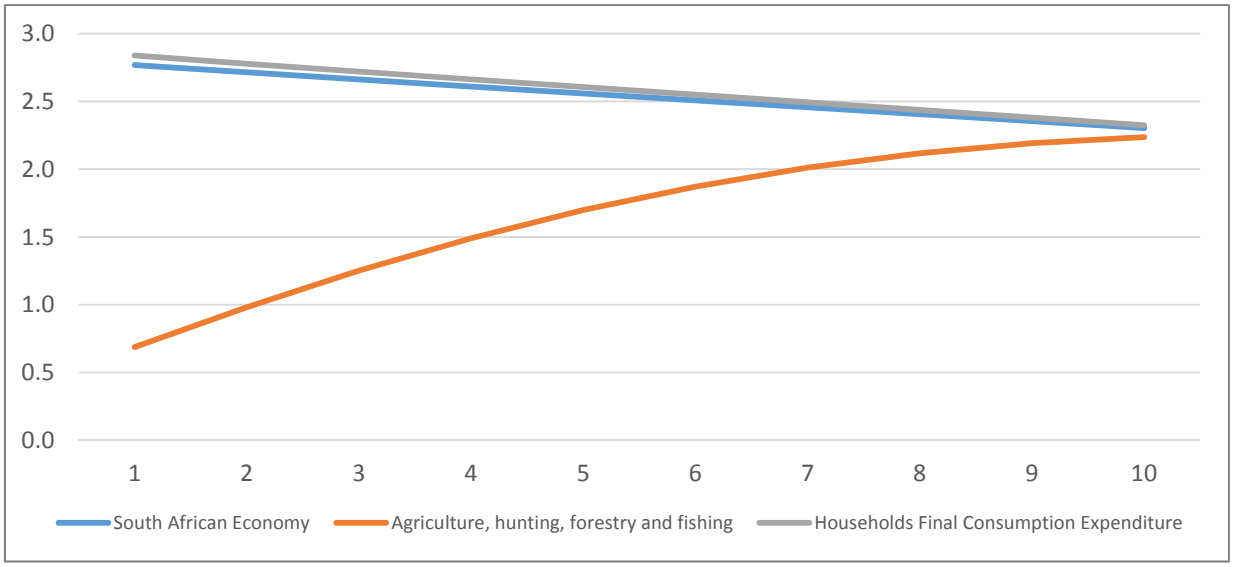
The reference scenario traced out a business as usual path showing stability in economic structure (Graph 7). There is gradual slowdown of the national economy and households final consumption expenditures while there is increasing growth for the agricultural sector which converges towards the national economy growth rate average of 2.3% per year (Graph 8). The share of rural households in total expenditures remains stable at 20%. Graph 9 displays a relatively good representation of actual economic and sectorial structure of the economy over the period and hence the calibrations carried are reliable and robust. The next section discusses the result of the three scenarios, exchange rate policy, fiscal policy, agricultural growth policy and non-agricultural growth policy.

Graph 7: South African Macroeconomic Structure and Trends, Ratio-to-GDP for Selected Macroeconomic Variables, Simulation Results (%)



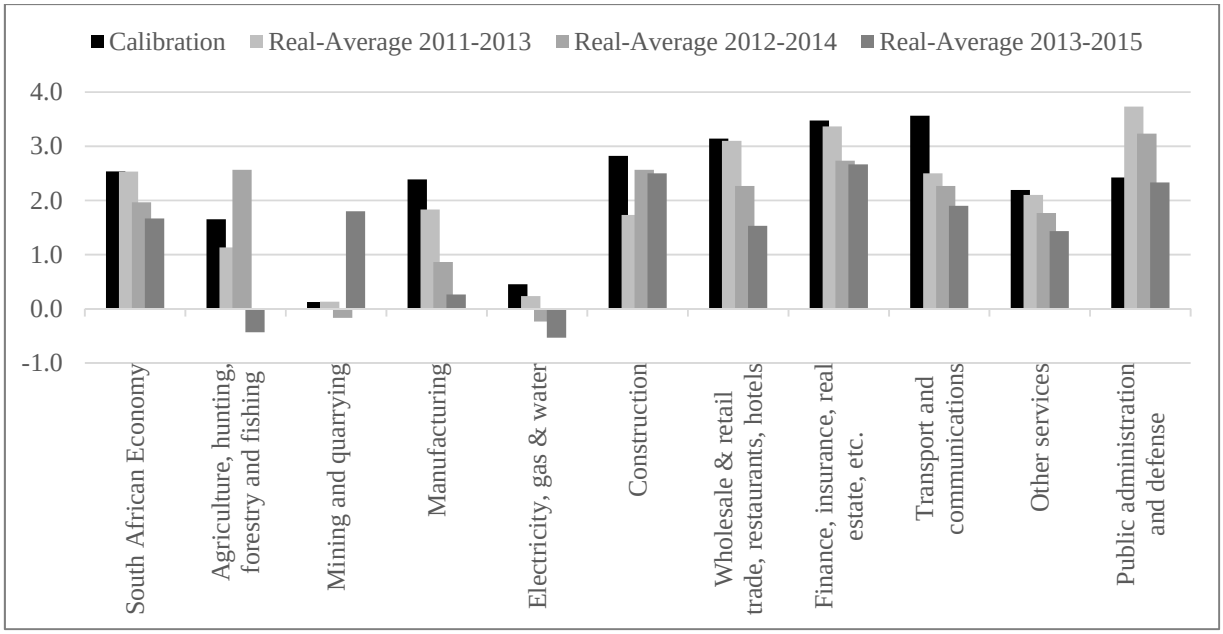
Source: Simulation results (2016).

Graph 8: Calibrated Performances of South African Economy over a 10-year Period, Annual Growth (%)



Source: Simulation results (2016).

Graph 9: Real and Calibrated Average Annual GDP Growth Rates by Industry (%)

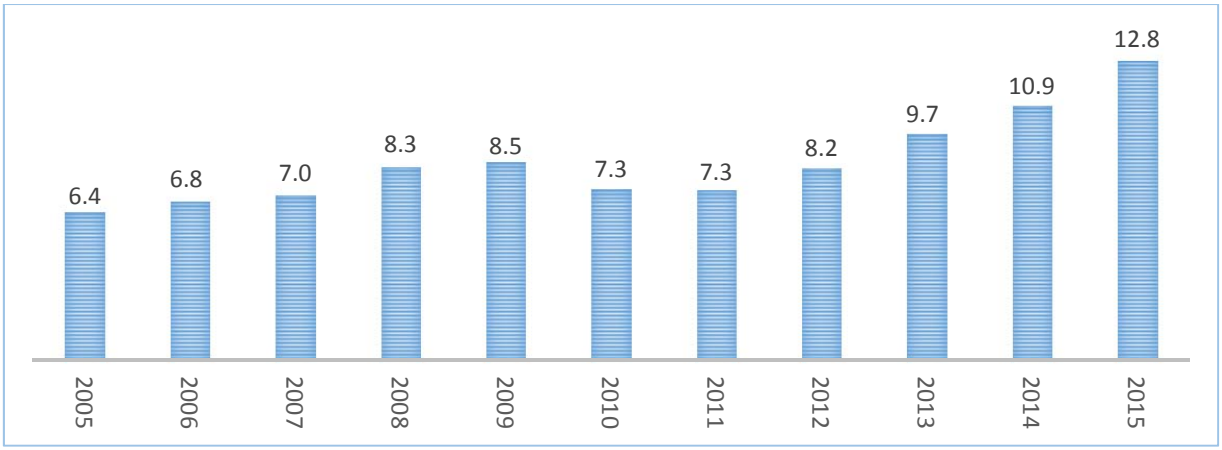


Source: Authors from simulation results and the World Development Indicators, World Bank (2016).

4.2 The Exchange Rate Policy

Graph 10 shows a 100% exchange rate depreciation between 2005 and 2015, i.e. an average depreciation of 7% per year over the same period. Our simulation test of the exchange rate depreciation is in line with these figures, and this is reflected in Figure 11.

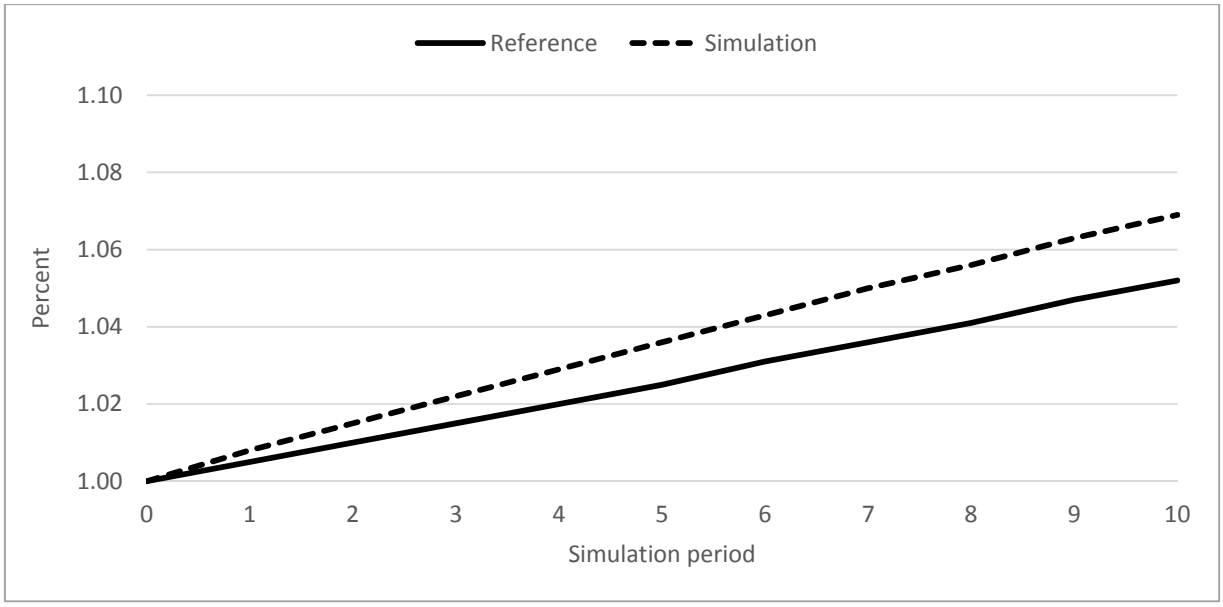
Graph 10: Official exchange rate (LCU per US$, period average)



Source: World Development Indicator, World Bank (2016)

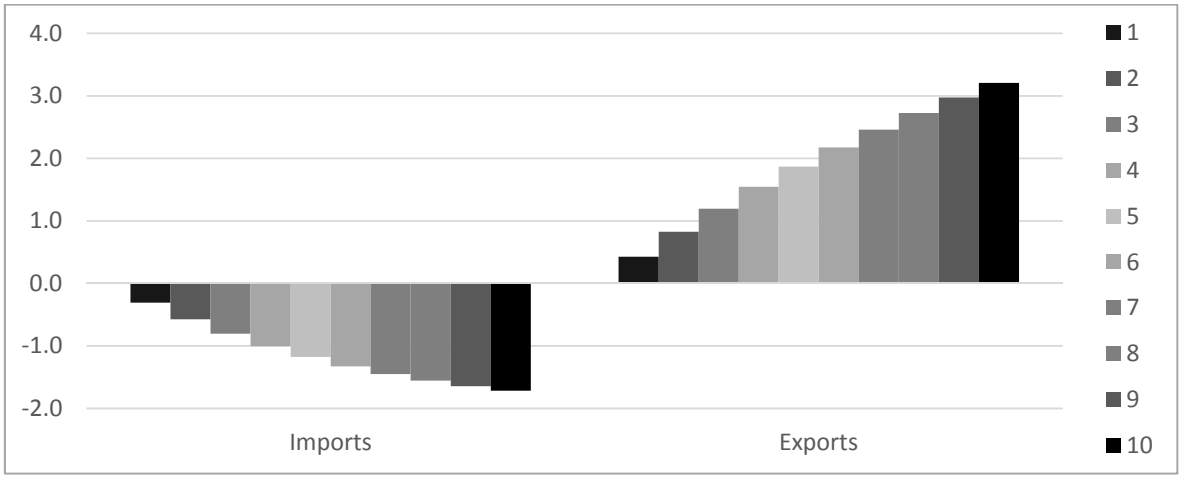
The exchange rate depreciation leads to an increase in export volumes and a decrease in import volumes (Graph 12) due to price increases of traded commodities in the domestic market, in local currency, given in Graph 10).

Graph 11: Annual Change Annual Changes in Trade Prices (%)



Source: Authors from the simulation results (2016).

Graph 12: Annual Change in Trade Volume, Compared to the Reference (%)

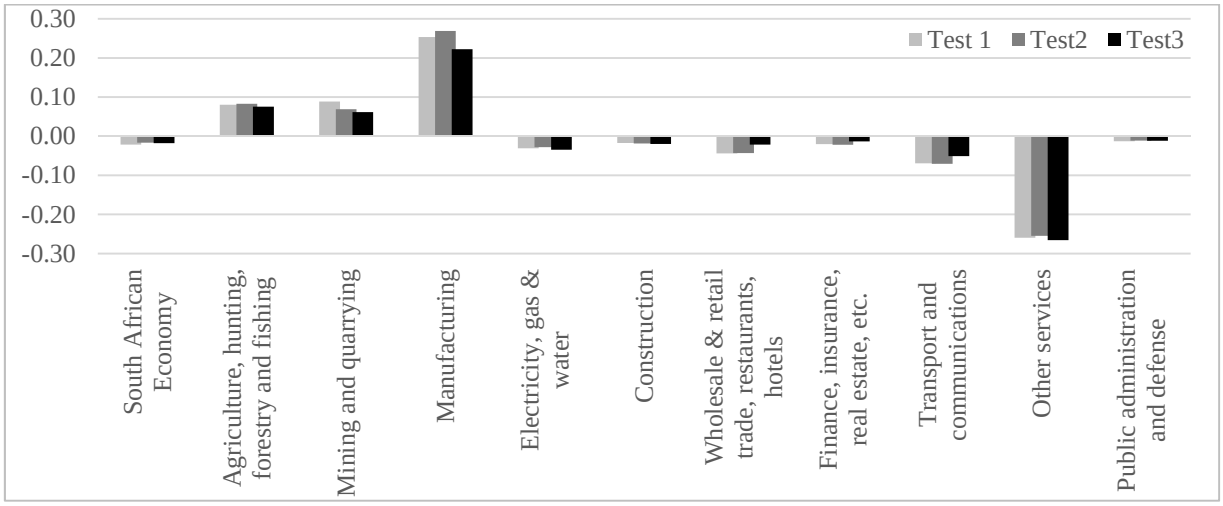


Source: Authors from the simulation results (2016).

Note: legend 1-10: Ten-year simulation period.

Agriculture, Mining, and Manufacturing industries benefit from the real exchange rate depreciation and they become more competitive in foreign and domestic markets (Graph 13). Indeed, Agriculture, Mining, and Manufacturing products are more traded than the other service sectors in Graph 13. Thus, Agriculture and Mining are more export-oriented, while Manufacturing is more import-oriented as seen in Graph 14. Services lose from the real exchange rate depreciation because of the fall in consumer purchasing power, as well as their initially less trade-oriented character. There are no major changes in results under alternative trade elasticities sensitivity tests as seen in Graph 13.

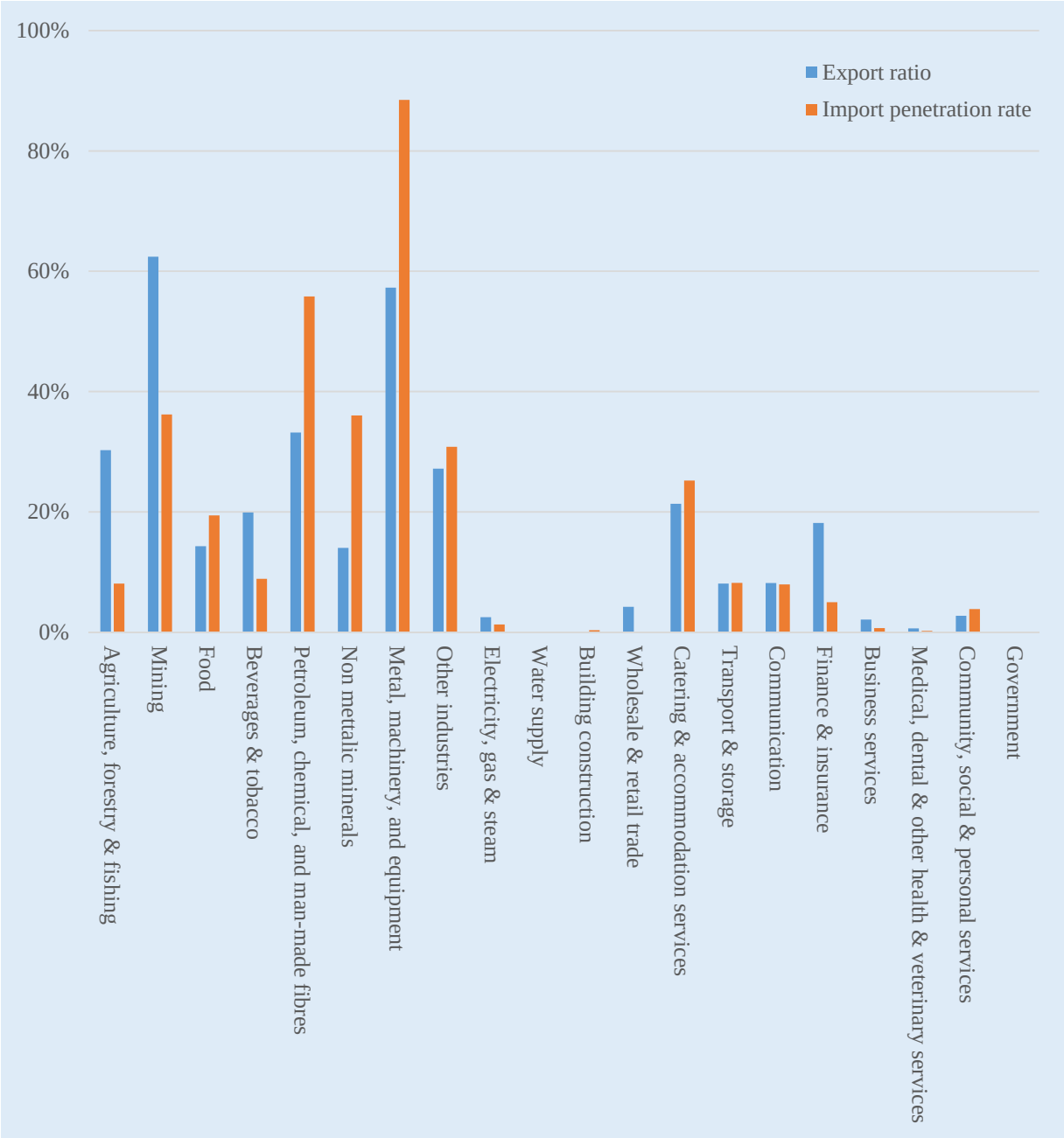
Graph 13: Change in Growth Rates as Compared to the Reference (%)



Source: Authors from the simulation results (2016).

Legend: Calibrated trade elasticities (Test 1); Higher import elasticities (Test 2); Higher export elasticities (Test 3).

Graph 14: Export and Import Intensities of South African Economy

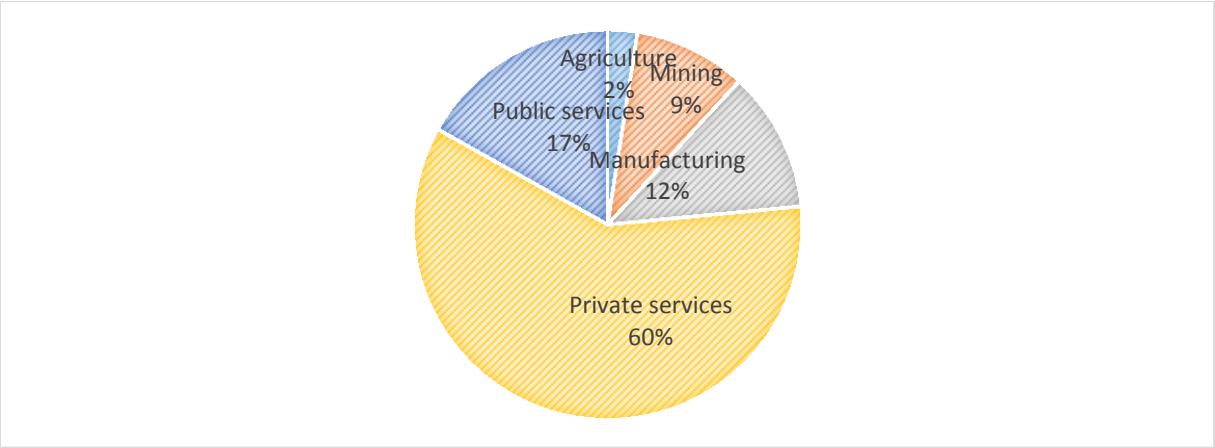


Source: Authors from South Africa's 2013 SAM (2016).

Agriculture, Mining and Manufacturing contributed 23% of total value added in 2013 as seen in Graph 15. Thus, the increase in income from these three sectors is not enough to counter the fall in value added income from the private services sectors. As a result, the positive income effect of the exchange rate depreciation which has not been compensated by the negative price effect, leads to lower consumer purchasing power and consumption expenditures. Therefore, less traded and higher income elastic products, i.e. private services, are the most affected. This is concerning

as services contributed more than three-quarters of the welfare creation in South Africa in 2013.

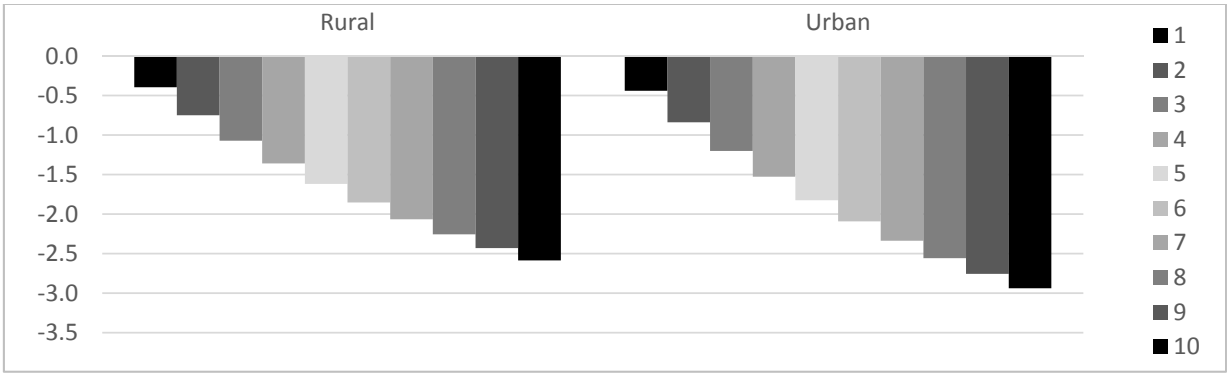
Graph 15: Structure of the Economy: Contribution to Value Added.



Source: Authors calculations from the 2013 SAM for South Africa (2016)

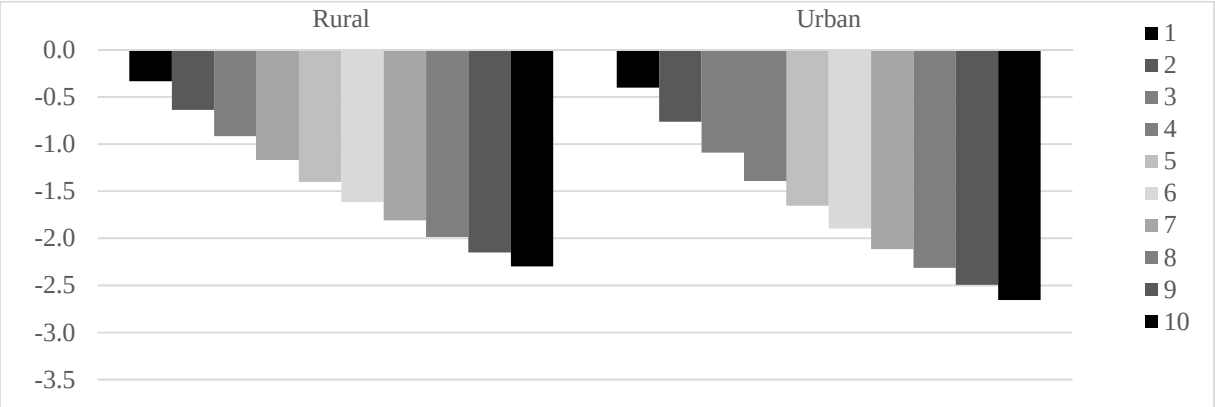
Impact on households' income and final consumption is quasi-neutral between urban and rural populations driven more by the income effect, although with a little more burden on urban households than rural households as seen in Graphs 16 and 17.

Graph 16: Change in Households Final Consumption over the Ten Year Period (%)



Source: Authors from the simulation results (2016).

Graph 17: Changes in Households Income over the Ten Year Period (%)

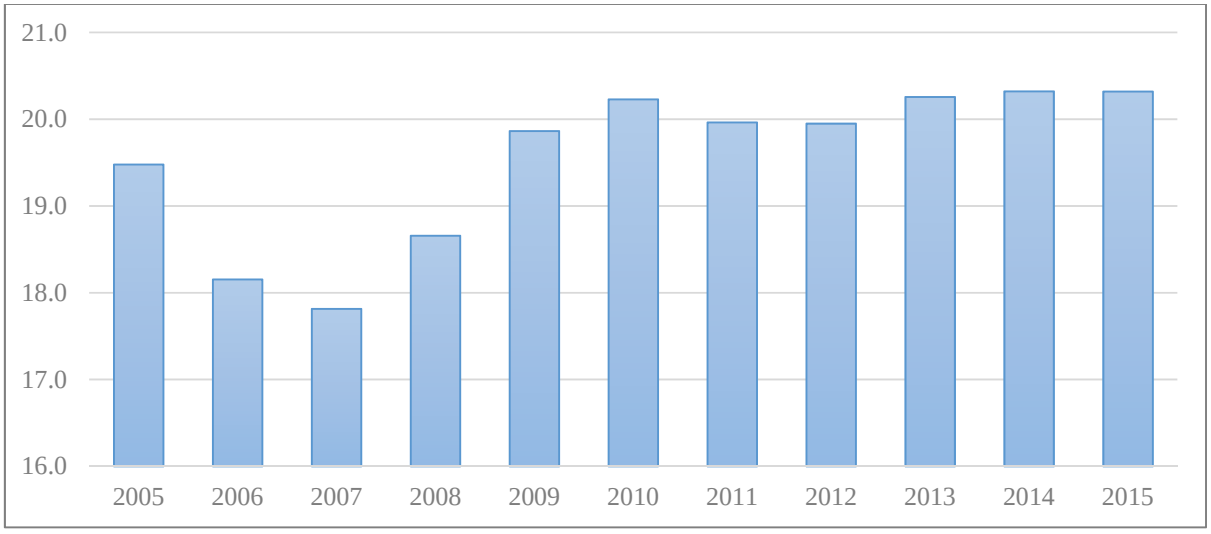


Source: Authors from the simulation results (2016).

4.3 The Fiscal Policy

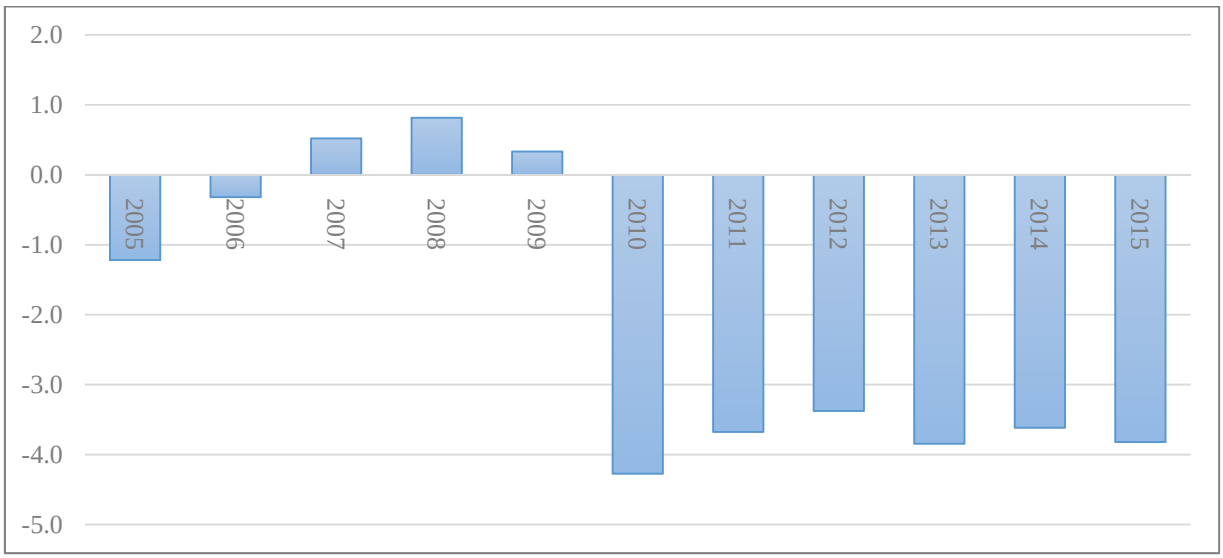
Graph 18 show an expansionary fiscal policy over the last decade (2005-2015) with an increase in government spending during the second half of the decade averaging 20% of GDP. Fiscal deficit has worsened over the same period, averaging deficits of 3.5% of GDP during the second half of the decade compared to a balanced budget during the first half as seen in Graph 19.

Graph 18: General government final consumption expenditure (% of GDP)



Source: World Development Indicator, World Bank (2016)

Graph 19: Fiscal Balance (% of GDP)



Source: World Development Indicator, World Bank (2016)

An expansionary fiscal policy scenario, i.e. high ratio of government spending to GDP, is implemented in this experiment. We assumed neutrality in government spending across industries and households. Government extra-spending is therefore financed successively by:

- Increase in households income tax (Test 1)
- Increase in government domestic borrowing (Test 2)
- Increase in government external borrowing (Test 3)

As presented in Table 3, the results show that the burden of the expansionary fiscal policy is put on private consumption (Test 1), investment (Test 2), and net exports (Test 3) respectively.

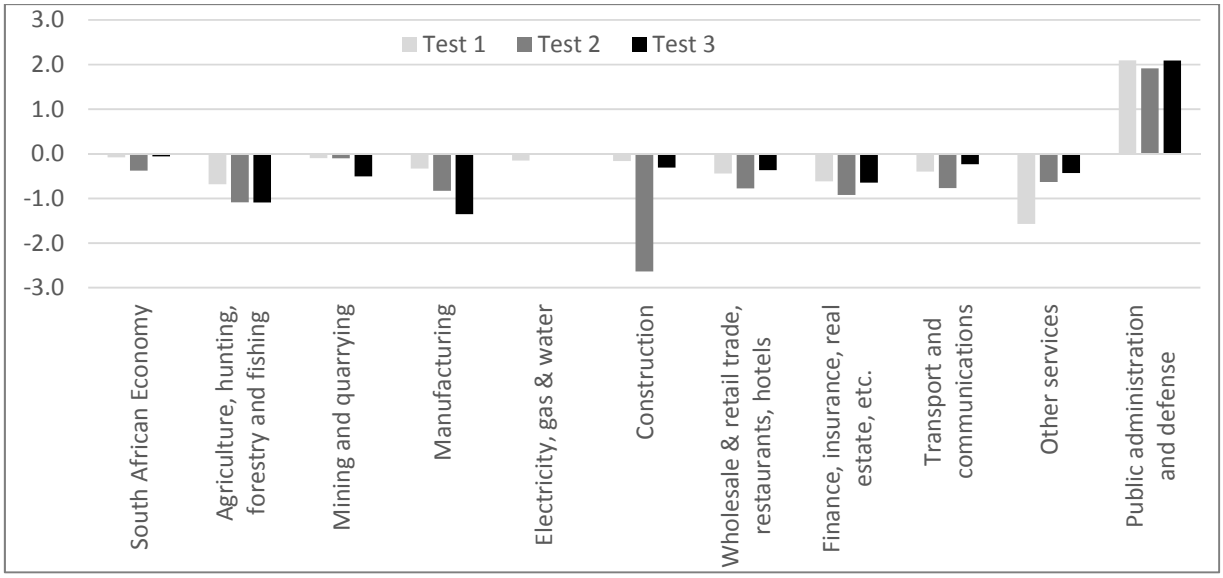
Table 3: Simulated Changes in Macro-Economic Structure (% of GDP)

	Private consumption	Public consumption	Investment	Net exports
Increase in households income tax (Test 1)	-5.0	5.0	0.0	0.0
Increase in government domestic borrowing (Test 2)	-0.1	5.0	-4.9	0.0
Increase in government external borrowing (Test 3)	0.6	5.0	-0.2	-5.4

Source: Authors from the simulation results (2016).

In terms of sector GDP, expansionary fiscal policy only benefits Public Administration and defense sector for all financing options as seen in Graph 20.

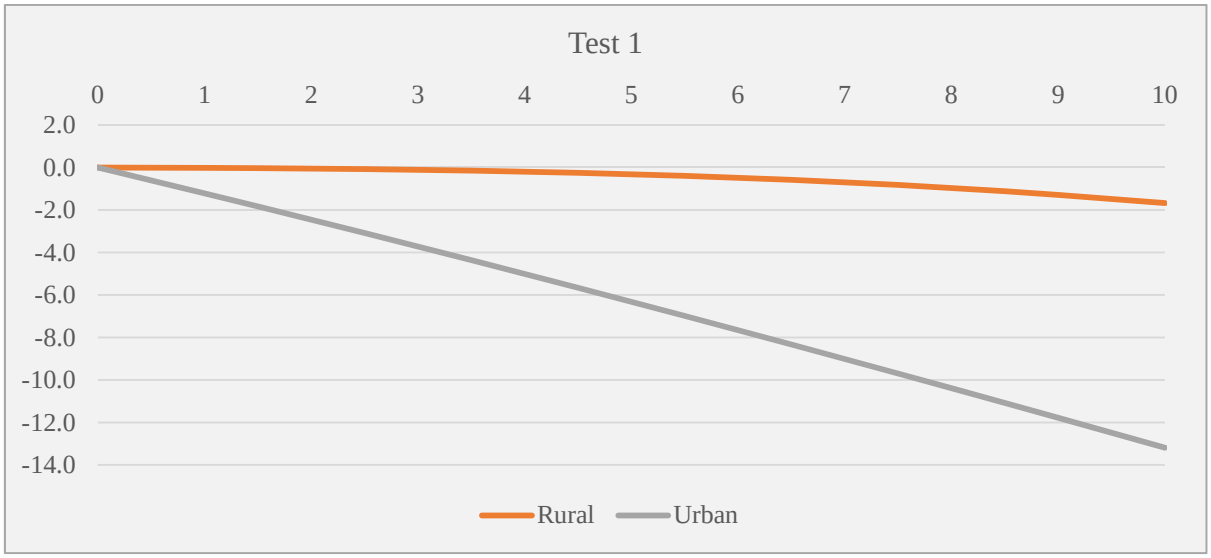
Graph 20: Sector GDP Growth Rates as Compared to the Reference (% point)



Source: Authors from the simulation results (2016).

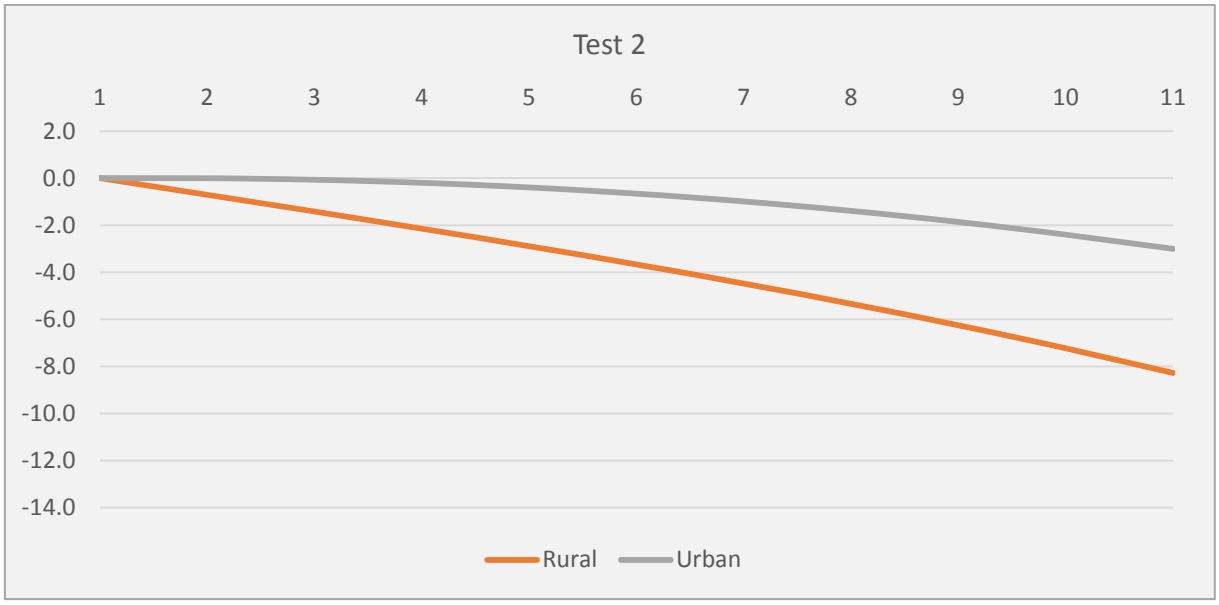
Rural households' consumption is less impacted than urban households' when income taxation compensates government higher expenditures (Graph 21). Indeed, urban households bear a heavier burden of the direct taxation as they are the main contributors to tax compared to their rural counterparts. One the other hand, rural households are worse off than urban households when government borrows internally or externally to balance its budget (Graphs 22 and 23). In the former case, the results are driven by the income effect which in turn is triggered by less agricultural growth. In the case of external borrowing, rural households benefit less from the price effect than urban households as imported goods, which are mostly consumed by urban households, become cheaper than local goods because of the exchange rate appreciation.

Graph 21: Change in Household Final Consumption, Test 1 Compared to Reference (%)



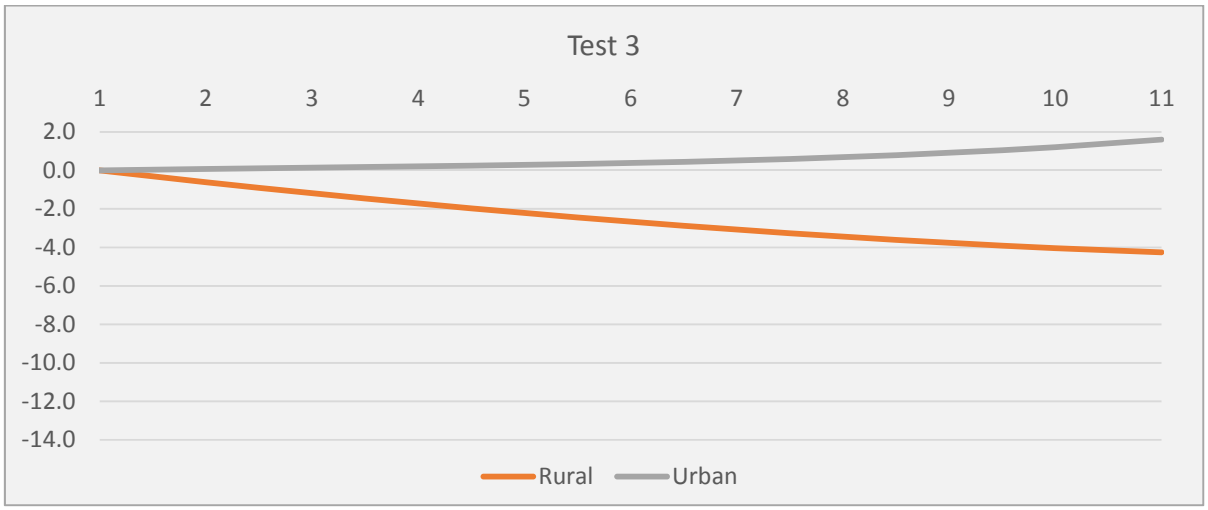
Source: Authors from the simulation results (2016).

Graph 22: Change in Household Final Consumption, Test 2 Compared to Reference (%)



Source: Authors from the simulation results (2016).

Graph 23: Change in Household Final Consumption, Test 3 Compared to Reference (%)



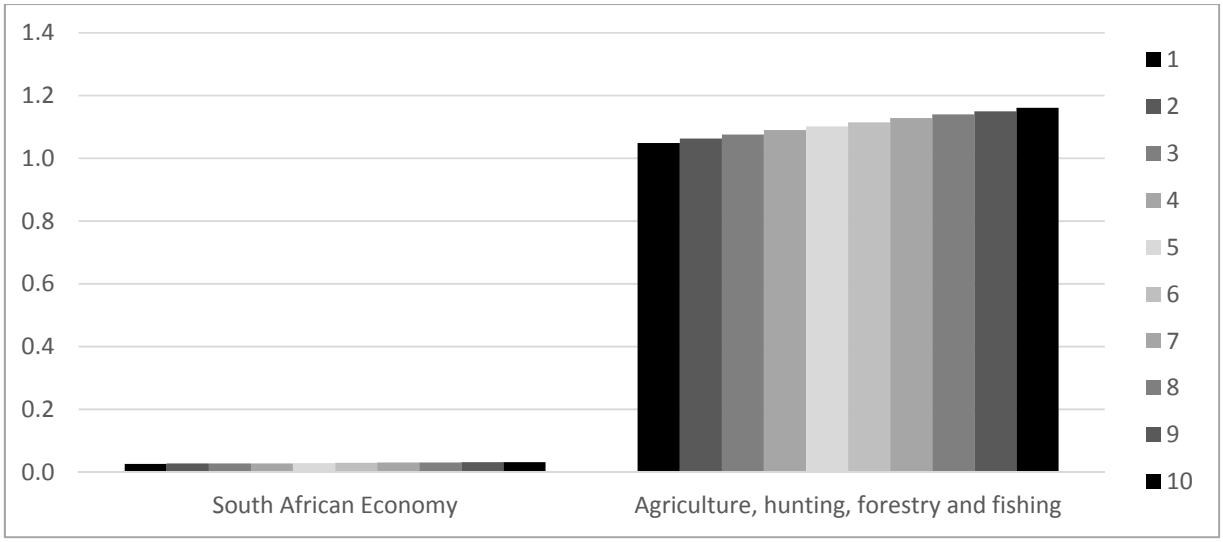
Source: Authors from the simulation results (2016).

4.4 Agricultural Growth Policy

Agricultural growth policy is implemented in this section to assess the effect on the rest of the economy. This is done by increasing this sector's total factor productivity by 1 percent annually which leads to an average 1.1 percentage points increase in agricultural value added (Graph 24).

The overall impact on the national economy is small as agriculture contribution to the national GDP is only 2.5% in 2013.

Graph 24: Changes in Annual Growth Rates, Simulation Compared to Reference (% point)



Source: Authors from the simulation results (2016).

An annual increase of 1% of the total factor productivity in agriculture over 10 years, leads to the results reported in Table 4. There is, as simulated, a 1.1% annual growth rate of agriculture, which translates to 50.6 billion, constant 2013 South African Rands (SAR), additional agriculture value added; i.e. 66% of the 2013 value added level. On the other hand, additional value added amounting to 1 billion, constant 2013 SAR, is generated in nonagricultural sectors, which amounts to 0.02% of the 2013 value added level.

Table 4: Agriculture contribution to Growth, Increase in Value Added over 10 Years, Compared to Reference

Industry	Share in total value added 2013 (%)	10-year value added (Constant 2013 SAR)	10-year Value added (% Ratio 2013 Value Added)
South African Economy	100.0	51,657	1.7
Agriculture, forestry & fishing	2.5	50,603	65.9
Mining	9.4	-3,997	-1.4
Food	2.0	1,462	2.3
Beverages & tobacco	0.8	-248	-0.9
Petroleum, chemical, and man-made fibers	2.0	-717	-1.2
Nonmetallic minerals	0.9	-468	-1.6

Metal, machinery, and equipment	3.8	-10,060	-8.5
Other industries	2.1	167	0.3
Electricity, gas & steam	2.4	-12	0.0
Water supply	0.7	60	0.3
Building construction	3.8	777	0.7
Wholesale & retail trade	15.6	4,718	1.0
Catering & accommodation services	1.1	91	0.3
Transport & storage	6.4	42	0.0
Communication	2.6	223	0.3
Finance & insurance	7.8	-499	-0.2
Business services	13.2	2,127	0.5
Medical, dental & other health & veterinary services	2.2	866	1.3
Community, social & personal services	3.7	-528	-0.5
Government	16.9	7,051	1.3

Source: Authors from the simulation results (2016).

An increase in the agricultural growth rate leads to positive effects on Food manufacturing (2.3%), General government services (1.3%), Medical, dental & other health & veterinary services (1.3%) and Wholesale and Retail Trade (1.0%). These are the sectors with strong linkages to the agricultural sector. On the other hand it leads to negative effects on Metal, machinery, and equipment (-8.5%), nonmetallic minerals (-1.6%), Mining and quarrying (-1.4%), and Petroleum, chemical, and man-made fibers (-1.2%). These are the sectors where resources and demand are moving away from into those that are benefiting. Finally, there are no major impacts on Catering and accommodation services (0.3%).

Table 5: Welfare Creation, Total Value Added over the 10-Year Simulation Period

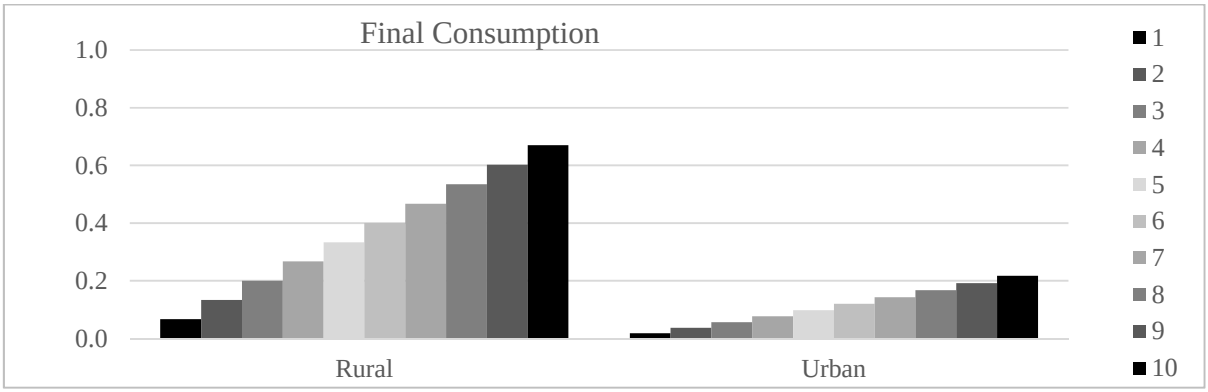
Industries	Share total value added 2013 (%)	Welfare (Constant 2013 SAR)	Welfare (% Ratio 2013 Value Added)
South African Economy	100.0	51,657	1.7
Agriculture, forestry & fishing	2.5	50,603	65.9
Mining	9.4	-3,997	-1.4
Food	2.0	1,462	2.3
Beverages & tobacco	0.8	-248	-0.9
Petroleum, chemical, and man-made fibers	2.0	-717	-1.2

Nonmetallic minerals	0.9	-468	-1.6
Metal, machinery, and equipment	3.8	-10,060	-8.5
Other industries	2.1	167	0.3
Electricity, gas & steam	2.4	-12	0.0
Water supply	0.7	60	0.3
Building construction	3.8	777	0.7
Wholesale & retail trade	15.6	4,718	1.0
Catering & accommodation services	1.1	91	0.3
Transport & storage	6.4	42	0.0
Communication	2.6	223	0.3
Finance & insurance	7.8	-499	-0.2
Business services	13.2	2,127	0.5
Medical, dental & other health & veterinary services	2.2	866	1.3
Community, social & personal services	3.7	-528	-0.5
Government	16.9	7,051	1.3

Source: Authors from the simulation results (2016).

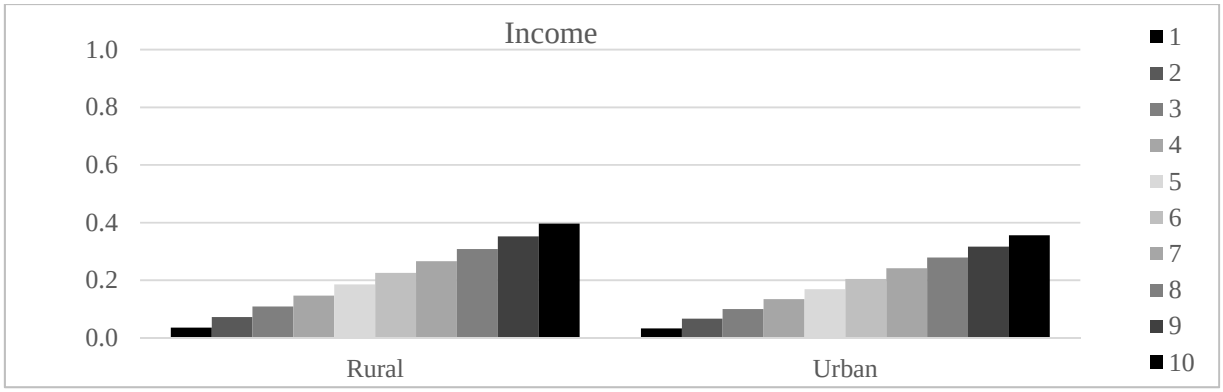
Agricultural growth is pro-rural as households' final consumption increases more for rural than urban households as shown in Graph 25. While the income effect is slightly pro-rural (Graph 26), the rural-urban results are mainly driven by the price effects which are much more pro-rural (Graph 27).

Graph 25: Change in final consumption compared to Reference (%)



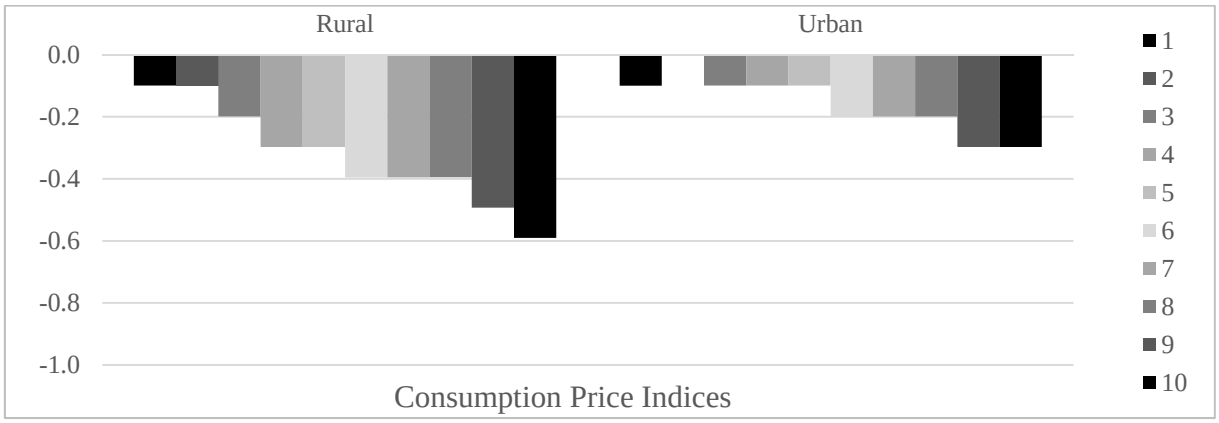
Source: Authors from simulation results (2016)

Graph 26: Change in income compared to Reference (%)



Source: Authors from simulation results (2016)

Graph 27: Change in Consumption Prices compared to Reference (%)



Source: Authors from simulation results (2016)

These results are consistent with expectations. As mentioned by Dorward et al. (2008), there are two potential roles that agriculture growth plays in the economic growth process. One is in driving growth through increases in productivity and income. The other way is by agriculture supporting growth by spreading benefits to other non-agriculture sectors linked strongly to it. Both these roles are clearly found in the simulation results of our study. By agricultural growth being pro-rural, it has the potential to encourage further rural development through increased demand. This is especially true if the very poor are also receiving the increased income. This is because the poor tend to spend more on non-tradable commodities produced locally in the economy, (Delgado et al., 1998; Hazell and Hojjati, 1995; Taylor and Thome, 2013))

4.5 Non-Agricultural Growth Policy

In this scenario, an annual increase of 1% of the total factor productivity over 10 years is simulated on non-agriculture sectors. We assess the impact of nonagricultural industries growth on agricultural growth and rural households' consumption. If the impact is positive, then industry is pro-agriculture, but if the impact is negative, then industry is non pro-agriculture.

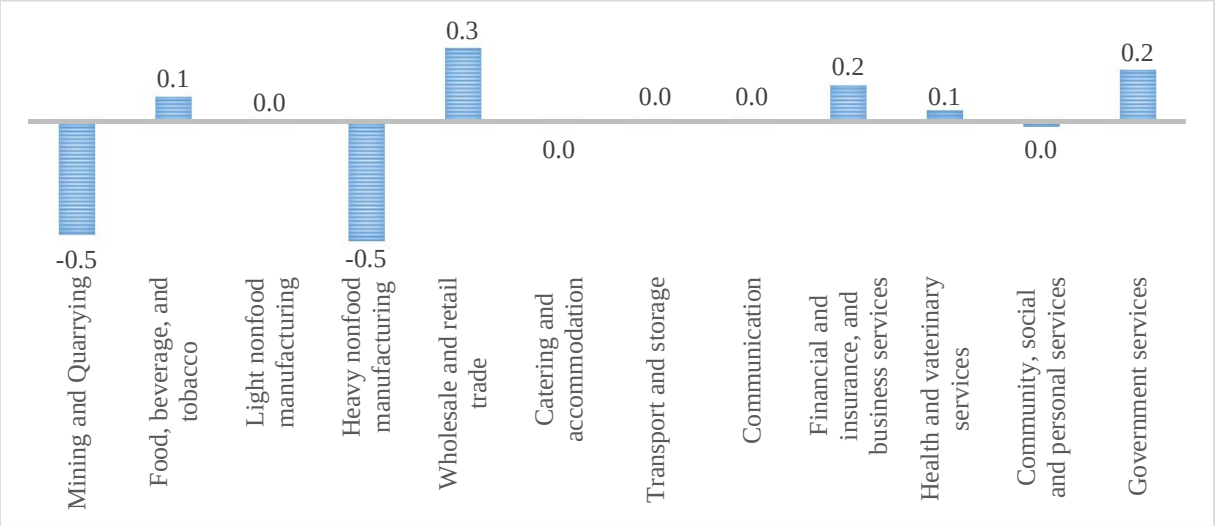
Among the thirty industries considered in our analysis, the below five have positive effect on agricultural growth, thus they are pro-agriculture (Graph 28):

- Wholesale and retail sale (input supply)
- **Food, beverage and tobacco industry (input demand and supply)**
- Government services (input demand)
- Financial and insurance, and business services (input supply)
- Health and veterinary services (input supply)

Nonagricultural industries impacting negatively the agricultural sector, or non pro-agriculture, because of the exchange rate appreciation effect and the fall in agricultural exports (Graph 26) are:

- Mining and quarrying industry
- Heavy manufacturing industry

Graph 28: Percent change in agriculture value added due to 1% annual increase of sector-specific TFP

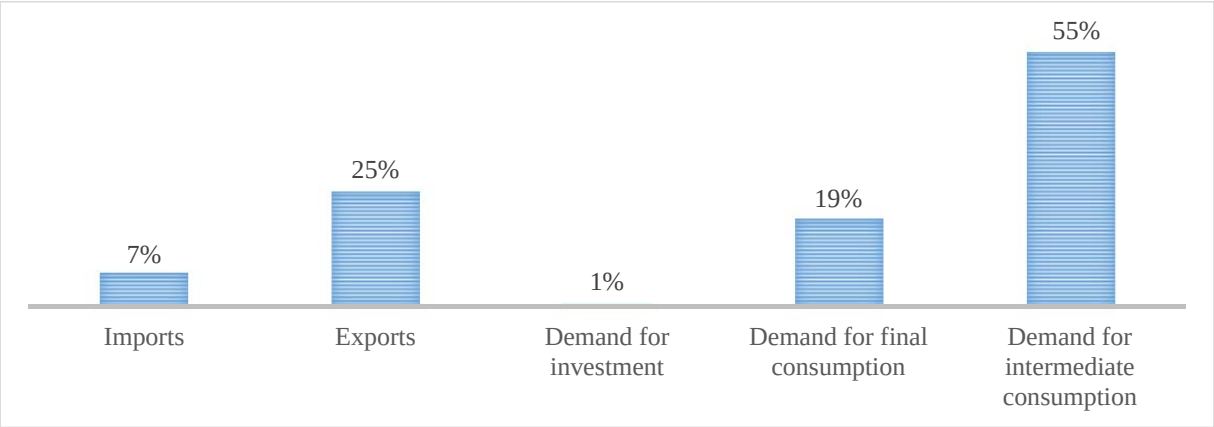


Source: Authors from simulation results (2016).

Legend: TFP: Total Factor Productivity.

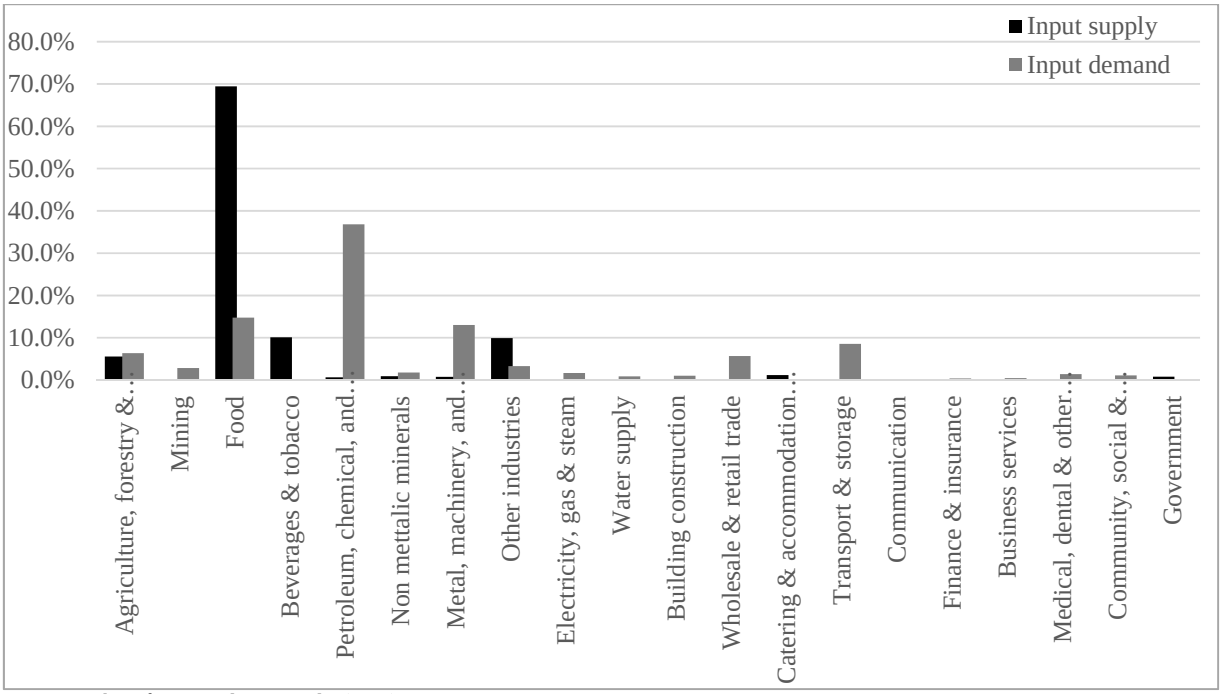
Graph 29 shows the structure of use of agricultural supply with 80% of agricultural goods used for input and exports. Agricultural products, are mainly inputs for Food industry, Beverage, and tobacco industry; and Other industries as seen in Graph 30. The same Graph also shows that the agricultural sector is using as main input the following products, Petroleum chemical, man-made fibers product; Food products; Metal, machinery, and equipment; Transport and storage services; and Wholesale and retail trade services.

Graph 29: Structure of the Demand for Agricultural Goods



Source: Authors from simulation results (2016)

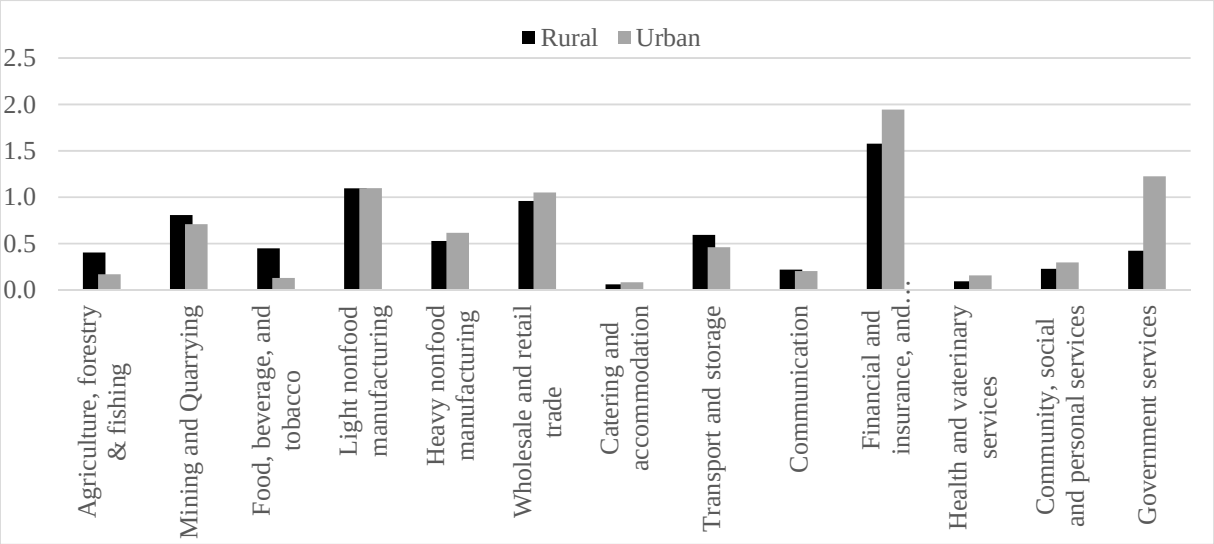
Graph 30: Structure of Agricultural Input Supply and Demand



Source: Authors from simulation results (2016)

Apart from agriculture, forestry and fishery, there are other non-agricultural industries that can be considered as pro-rural, since they positively impact rural more than urban households' final consumption. These are seen in Graph 31 and comprise, food, beverage and tobacco; mining and quarrying industry; transport and storage; and catering and accommodation. On the other hand, non pro-rural industries, that is, those impacting urban more than rural households' final consumption, are Government services; Financial and insurance, and business services; Wholesale and retail services; Heavy manufacturing; Health and veterinary services; Community, social and personal services; and Catering and accommodation. This analysis allows for options for targeting policies at rural development.

Graph 31: Percent change in urban and rural households' final consumption due to 1% annual increase of sector-specific TFP



Source: Authors from simulation results (2016).

Legend: TFP: Total Factor Productivity.

6. Conclusion

For long, rural areas have been stigmatised as poverty stricken, with low economic performance, and low economic contribution. Indeed, a higher proportion of the rural population lived in poverty (68.8%) compared to urban population (30.9%) in 2011. Between 2006 and 2011 the poverty rate dropped by 15% in rural areas and 24% in urban areas. South Africa has committed to rural development through the National Development Plan Vision 2030 and the Medium Term Strategic Framework (2014-2019). The commitment is implemented through the development of a "Comprehensive Rural Development Program" (CRDP). The study aims at contributing to better understand the issues of agricultural growth and rural development and their linkage to the national economy. More specifically, the study assesses the impact of macroeconomic performances on agricultural growth and rural households' wellbeing; as well as the relationship between non-agricultural industries growth and agriculture growth.

A recursive dynamic Computable General Equilibrium (CGE) model is developed to assess the strategic options for agricultural growth and rural development in South Africa with the following features: i) separation between urban and rural labour markets and workers for the nine provinces, and among skill categories; ii) treatment of labor force growth, and rural-urban migration and remittances; iii) separation between urban and rural representative household groups; iv) demographical growth and its effect on food and nonfood demand patterns; v) imperfect integration of goods markets with the separation between producer and consumer markets for locally produced goods; and vi) treatment of consumption of self-produced and marketed foods.

After the model is calibrated over a10-year period, i.e. Reference scenario, four policy scenarios are tested: exchange rate policy, fiscal policy, agricultural growth policy, and nonagricultural growth policy.

A depreciation of the exchange rate appears to be favorable to the agriculture sector, the mining sector, and the heavy manufacturing sector because they are all export-oriented. However, there is slight decline in the national economy because of the negative impact on private services which are less traded, more-income elastic and accounting for 77% of total value added in 2013. The impact on households' final consumption is neutral between urban and rural households (Income effect) with a slightly heavy burden on urban population.

An expansionary fiscal policy slows down agricultural growth regardless of the source of financing, i.e. household income taxation, domestic borrowing, or foreign borrowing. The final consumption effect is more favorable to rural population compared to urban population only when the deficit is compensated through the households' income tax. If government extra-expenses are financed primarily by household income tax, the expansionary fiscal policy hurts agricultural growth and rural consumption less as compared to nonagricultural growth and urban consumption. Therefore, it is quite likely that the negative impact of the expansionary fiscal policy on agriculture and rural development can be reversed if the revenue is directly spent on agricultural and rural development. A study focusing in detail on the spending side of government's extra revenue is suggested for future work.

Agriculture growth has a small effect on national economic performance as its contribution is only 2.5% of total GDP in 2013. An annual agricultural growth rate of 1.1% on average would positively impact the rest of the economy, i.e. the nonagricultural sector, with one billion additional value added creation, in constant 2013 SAR. Agricultural growth is pro-rural as

households' final consumption increases more for rural households than for urban households, primarily driven by the price effect. With the agricultural sector, Food and, beverage and tobacco is the only industry which appears to be pro-agriculture growth and pro-rural development. Although income and consumption changes are a good indicator of poverty, and therefore allow one to reasonably guess the direction of poverty reduction, it is suggested that for future work, actual poverty measures be calculated to determine the magnitude of poverty alleviation. After all, rural agriculture in South Africa and in many African countries, consists of both large scale and small scale farmers. A more micro analysis that distinguishes the effects between these two broad groups would allow a more precise understanding of policy impacts. After all, given the evidence cited earlier that some rural poor are moving out of agriculture activities, it becomes important to understand policy effects at the micro level. This would assist policy makers with more exact targeting where needed. Furthermore, calculations of the impact of these policies of inequality would further assist policymakers to understand which policies assist in welfare improving. This too is best done at a micro level.

Reference

[1] Aquino L., Espíndola, Jaylson J., Silveira, T. J. P. Penna, (2006), "A Harris-Todaro agent-based model to rural-urban migration", Brazilian Journal of Physics, Volume 36, No3a São Paulo Sept. 2006, http://dx.doi.org/10.1590/S0103-97332006000500002

[2] Atkeson, A., and Kehoe, P.J., (2007), "Modeling the Transition to a New Economy", *American Economic Review*, Volume 97, 1, 64-88.

[3] Banerjee, A. V. and A. F. Newman (1998), "Information, the Dual Economy, and Development," *Review of Economic Studies*, 65, 631-653.

[4] Batra, R. N. and N. Naqvi (1987), "Urban Unemployment and the Gains from Trade," *Economica*, 54, 381-395.

[5] Beladi, H. and S. Marjit (1996), "An Analysis of Rural-Urban Migration and Protection," *Canadian Journal of Economics*, 29, 930-940.

[6] Bencivenga, V. R. and B. D. Smith (1997), "Unemployment, Migration, and Growth," *Journal of Political Economy*, 105, 582-608.

[7] Bertrand, T. and L. Squire (1980), "The Relevance of the Dual Economy Model: A Case Study of Thailand," *Oxford Economic Papers*, 32, 480-511.

[8] Bond, E., Riezman, R., Wang, P., (2016) "Urbanization and Economic Development: A Tale of Two Barriers," CESifo Working Paper N0 5742

[9] Bowlus, A. J. and T. Sicular (2003), "Moving Toward Markets? Labor Allocation in Rural China," *Journal of Development Economics*, 71, 561-583.

[10] Calvo, G. A. (1978). "Urban Unemployment and Wage Determination in LDC.s: Trade Unions in the Harris-Todaro Model," *International Economic Review*, 19, 65-81.

[11] Chang, R., L. Kaltanic and N. V. Loayza (2009), "Openness can Be Good for Growth: The Role of Policy Complementarities". *Journal of Development Economics*, 90, 33-49.

[12] Christiaensen, L., L. Demery, and J. Kuhl. 2011. The (evolving) role of agriculture in poverty reduction—An empirical perspec-tive. *Journal of Development Economics* 96: 239-254.

[13] Daniels, R.C, Partridge, A., Kekana, D. and Musundwa, S. (2013). Rural Livelihoods in South Africa. Cape Town: SALDRU, University of Cape Town. SALDRU Working Paper Number 122/ NIDS Discussion Paper 2013/4.

[14] Dercon, S. and D. Gollin. 2014. *Agriculture in African development: A review of theories and strategies.* CSAE Working Paper WPS/2014 22. Oxford: Centre for the Study of African Economies.

[15] Delgado, C.L, J. Hopkins, and V.A. Kelly., (1998). *Agricultural growth linkages in sub-Saharan Africa*. IFPRI Research Report 107. Washington DC: International Food Policy Research Institute.

[16] Dorward, A.R., E.W. Chirwa, and C. Poulton. (2008). *Improving access to input and output markets.* Paper presented at South-ern Africa Regional Conference on Agriculture: "Agriculture-led Development for Southern Africa: Strategic Investment Priorities for Halving Hunger and Poverty by 2015", 8-9 December 2008, Gaborone, Botswana.

[17] Drazen, A. and Z. Eckstein (1988), "On the Organization of Rural Markets and the Process of Economic Development," *American Economic Review*, 78, 431-443.
[18] Duranton, G. and D. Puga (2004), 'Micro-Foundations of Urban Agglomeration Economies', in J. V. Henderson and J.-F. Thisse (eds.) *Handbook of Regional and Urban Economics, Vol 4*. North-Holland.
[19] Esfahani, H.S., and Salehi-Isfahani, D., (1989) "Effort Observability and Worker Productivity: Towards an Explanation of Economic Dualism," *Economic Journal*, vol. 99 (1989), 818-836.
[20] Fei, J. C. H. and G. Ranis (1964), Development of the Labor Surplus Economy: Theory and Policy, Homewood, Illinois: Richard D. Irwin for the Economic Growth Center, Yale University.
[21] Glomm, G. (1992), "A Model of Growth and Migration," *Canadian Journal of Economics*, 25, 901-922
[22] Gollin, D., Parente, S., and Rogerson, R., "Structural Transformation and Cross Country Income Differences," Levine's Working Paper Archive, 506439000000000259, David K. Levine
[23] Goodfriend, M., and McDermott, (1995), "Early Development", *American Economic Review*, Volume 85(1), 116-33
[24] Griliches, Z. (1969), "Capital-Skill Complementarity," *Review of Economics and Statistics*, 51, 465-468.
[25] Harris, J. R. and M. P. Todaro (1970), "Migration, Unemployment and Development: A Two-Sector Analysis," *American Economic Review*, 60, 126-142.
[26] Hansen, and Prescott, (2002) "Malthus to Solow", *American Economic Review*, 92(4), 1205-1217.
[27] Hanson, J. A. (1971), "Employment and Rural Wages in Egypt: A Reinterpretation," *American Economic Review*, 61, 492-499.
[28] Henderson, J.V., (1974) "The Sizes and Types of Cities, *American Economic Review*, 64, 640-656.
[29] Henderson, J.V. (1988), *Urban Development: Theory, Fact and Illusion*, Oxford University Press.
[30] Henderson, J.V. (2003), 'The Urbanization Process and Economic Growth: The So-What Question', *Journal of Economic Growth*, 2003, 8, 47-71.
[31] Henderson J.V (2005a), "Urbanization and growth" in P. Aghion and S. Durlauf (eds.), *Handbook of Economic Growth*, Elsevier
[32] Henderson J.V. (2005b), 'Growth of China's Medium Size Cities' in *Brookings-Wharton Papers on Urban Affairs, 2005*, G. Burtless and JR. Pack (eds), Brookings Institution Press.
[33] Herrendorf, B., Rogerson, R., Valentinyi, A. (2013), "Growth and Structural Transformation," Chapter 6 in: Handbook of Economic Growth Volume 2, 2014, Pages 855–941
[34] Hazell, P., and B. Hojjati. 1995. Farm / Non-Farm Growth Linkages in Zambia. *Journal of African Economies* 4: 406-435.
[35] Itoh, Ryo, 2009. "Dynamic control of rural-urban migration," *Journal of Urban Economics*, Elsevier, vol. 66(3), pages 196-202, November.
[36] Jones, R. W. (1971), .A Three Factor Model in Theory, Trade and History,.in J. Bhagwati, R. Jones, R. Mundell and J. Vanek (eds.), Trade, Balance of Payments and Growth, Amsterdam: North-Holland.

[37] Khan, M. A. (1980), "The Harris-Todaro Hypothesis and the Heckscher-Ohlin-Samuelson Trade Model : A Synthesis," *Journal of International Economics*, 10, 527-547.
[38] Krusell, P., L. E. Ohanian, J.-V. Rios-Rull and G. L. Violante (2000), "Capital-Skill Complementarity and Inequality: A Macroeconomic Analysis," *Econometrica*, 68, 1029-1053.
[39] Laing, D., C. Park, and P. Wang (2005), "A Modified Harris-Todaro Model of Rural-Urban Migration for China," in F. Kwan and E. Yu (eds.), Critical Issues in China.s Growth and Development, Farnham: Ashgate Publishing Limited, 245-264.
[40] Lewis, W. A. (1954), "Economic Development with Unlimited Supplies of Labor". Manchester School, 22, 139-191.
[41] Liao, P.-J., Y.-C. Wang, P. Wang, and C. K. Yip (2014), "Education and Rural-urban Migration: The Role of Zhaosheng in China," Working Paper, Chinese University of Hong Kong, Hong Kong.
[42] Lucas, R. E. Jr. (2004), "Life Earnings and Rural-Urban Migration," *Journal of Political Economy*, 112, S29-S59.
[43] Meng, X., () "Labor Market Outcomes and Reforms in China", *Journal of Economic Perspectives*, Volume 26, No4, 75-102
[44] National Planning Commission (NPC). (2011). National Development Plan: Vision for 2030. Online: www.npconline.co.za.
[45] Parente, S. and E. Prescott (1994), "Barriers to Technology Adoption and Development," *Journal of Political Economy*, 103, 298-321.
[46] Ranis, G. and J. C. H. Fei (1961), "A Theory of Economic Development," *American Economic Review*, 51, 533-565.
[47] Renaud, B. (1981) *National Urbanization Policy in Developing Countries*, Oxford University Press
[48] Richardson, H. (1987), 'The Costs of Urbanization: A Four Country Comparison', *Economic Development and Cultural Change*, 33, 561-580.
[49] Rosenthal, S. and W. Strange (2004), 'Evidence on the Nature and Sources of Agglomeration Economies', *Handbook of Urban and Regional Economics, Vol. 4*, J.V. Henderson and J-F Thisse (eds.), North Holland.
[50] Sen, A. K. (1966), "Peasants and Dualism with or without Surplus Labor," *Journal of Political Economy*, 74, 425-450.
[51] Taylor, E.J., and K. Thome. 2013. *Local economy-wide impact evaluation of the FISP*. In A.R. Dorward, E.W. Chirwa, M.M. Matita, W. Mhango, P.M. Mvula, E.J. Taylor, and K. Thorne (eds.), Evaluation of the 2012/13 farm input subsidy pro-gramme, Malawi: Final report. London: SOAS, University of London. 76-80.
[52] Todaro, M. P. (1969), "A Model of Labor Migration and Urban Unemployment in Less Developed Countries," *American Economic Review*, 39, 138-148.
[53] Vacchiani-Marcuzzo, C. 2005. Mondialisation et Systeme de Villes (unpublished PhD thesis). University of Paris, Paris.
[54] Wang, P; & Xie, D. (2004). Activation of a modern industry. Journal of Development Economy, 74,393-410.
[55] World Bank (2009), *World Development Report 2009: Reshaping Economic Geography*, World Bank

Annexure I: Features of the Ag-CGE model

Model Specification: ***Within-period (Static)***

I. Supply side

- Sector-specific capital endowment
- Fixed total factor productivity
- Layered CES production and supply functions
- Imperfect transformation between local and external markets (CET)

II. Demand side

- Demand for households final consumption: Minimum consumption and supernumerary components (LES function)
- Demand for investment: Imperfect substitution (CD function)
- Demand for intermediate consumption: Imperfect substitution (CES function)
- Imperfect substitution between local supply and imports (CES)

III. Macro-constraints

- Perfect competition in products markets
- Perfect competition in high skilled labor markets
- Imperfect competition in skilled, medium skilled, low skilled, and unskilled labor markets
- Fixed trade prices: Small country hypothesis
- Fixed current account balance ratio to GDP: Flexible exchange rate
- Fixed public current expenditure on products ratio to GDP
- Fixed public deficit ratio to GDP: Compensatory direct tax
- Fixed global investment ratio to GDP: Compensatory households saving