CGE Analysis of Rural Economic Development through Agriculture Policy in South Africa: A Focus on Poverty, Inequality, and Gender.

Photo: World Wide Views

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Abstract

The South African economy is dualistic in nature, a remnant of historic laws that segregated the country along racial lines, perpetuating poverty, unemployment, and inequality. Levels of all three remain persistently high and are severe among vulnerable groups, including women and people living in rural areas. Though South Africa is one of Africa's economic giants, the government continues to look for solutions to address these challenges and to adopt inclusive strategies to ensure that the poor and women are not left behind in poverty-reduction efforts. Agriculture and the rural economy have always been considered strategic in creating jobs and reducing poverty and inequality. We assess the economy-wide and distributional effects of government intervention through agriculture-related support, focusing on possible differential impacts for rural and urban people and for working men and women. We simulate reallocation of land from commercial to smallholder farming and of increased agricultural capital. Our results indicate an overall positive impact on consumption and GDP. While gender inequality in the labor market could decline if existing policies continue without modification, poverty will persist and rural households would benefit relatively less than urban ones. As a result, complementary policies are needed to reduce poverty and inequality.

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I.   Introduction

1.1 Context of the Study

South Africa is one of Africa's economic giants, but its levels of unemployment, poverty and inequality remain persistently high. South Africa contributes 16% to Africa's Gross Domestic Product (GDP), but these triple challenges persist, and women and those living in the rural areas are the most vulnerable. Economically, the country has been performing modestly over the years, especially when compared to other African countries. However, within its borders, such achievements are not shared equally by all. The World Bank (2018) found that South Africa was one of the most unequal societies in the world and suggested that the country should prioritize policies that created jobs and reduced poverty and inequality. Agriculture is believed to be key to Africa's future (Alliance for a Green Revolution in Africa, 2018). According to Phoofolo (2018), growth in the agricultural sector contributes relatively more to poverty reduction than does growth in other sectors of the economy, yet rural areas have not been included in the economic growth waves experienced by most African countries in the recent past. Consequently, rural communities in most African countries, South Africa included, are home to the poorest people.

Rural development has long been considered a strategy to improve the socioeconomic lives of the rural poor through extending the benefits of development to them, including to small-scale farmers, tenants, and the landless (World Bank, 1975). Sustainable rural development can contribute to three critical goals of poverty reduction: more widely shared growth, household food security, and sustainable natural-resource management (World Bank, 2006). Rural economic development refers not only to what takes place on the farm but also to a complex process that requires coordination among institutions and departments. As Bertolini (2019) pointed out the harmful impacts of rural poverty do not affect rural areas alone but also the entire socioeconomic context. If not addressed, lagging rural poverty can perpetuate the rural-urban economic divide, exacerbate inequality, promote congestion in urban areas, and worsen related social problems, further increasing social-policy spending. An analysis of rural development should therefore take an economy-wide approach because non-agricultural activities affect rural households, rural-urban links, and the relationship

between the agricultural and non-agricultural sectors (Du Toit, 2016; Mabugu, 2016).

The potential of rural development as a strategy to improve the socioeconomic life of the rural poor in South Africa, and the need to rekindle it, is widely acknowledged even within government circles (Bank & Hart, 2017). Despite this potential the country's agricultural sector is one of the least supported globally (Department of Agriculture, Forestry and Fisheries, 2014). South Africa's public spending on agriculture as a share of total government expenditure was above that of only six other countries in Africa between 2005 and 2015 (Alliance for a Green Revolution in Africa, 2018). In 2019, agriculture received 1.68% of total public expenditures, which is far lower than the 10% share of public expenditures that was committed by all African heads of states and governments under the Comprehensive Africa Agriculture Development Programme and reaffirmed under the Malabo Declaration. As a result, the country's rural economy is said not to be vibrant enough to provide its rural communities with adequate and sustainable remunerative employment or self-employment opportunities (Department of Agriculture, 2001). Given the low public spending on agriculture in South Africa, reallocation of land from commercial to smallholder agriculture could be one way of providing the rural poor with resources to improve their livelihoods. There are discussions of land expropriation in the country, which could see land being redistributed without compensation ("South Africa Takes," 2020; Mutlokwa, 2020). It is a contentious issue, with supporters arguing it is an essential measure while critics dispute that it is a threat to property rights that can choke off investment (Friedman, 2018).

Women play a crucial role in African agriculture, which is mainly characterized by low technology but high intensity in land and labor. The Organisation for Economic Cooperation and Development 2016) highlighted the importance of gender in rural development, pointing out that, in many countries, women are significant actors in the agriculture sector and rural development. According to Arndt, Benfica, and Thurlow (2011), women make up 60% to 80% of the workforce in agriculture in many African countries and play a significant role in food production, though they have little control over resources. As the Economic Community of West African States (2017) has noted, equal participation of men and women in social, economic, and political life is far from being achieved. Based on the proportion of women in the agriculture and non-agriculture rural economy, however, agricultural policies are highly

likely to have positive impacts on women.

While there has been an increase in access to basic services among people in rural areas, and some progress has been made in terms of reduction in rural poverty over the past twenty years, the Department of Planning, Monitoring, and Evaluation has argued that high levels of poverty and inequality are still a characteristic of rural South Africa. In the National Development Plan 2030, the National Planning Commission (2012) asserted that South Africa's rural communities should be offered better opportunities to participate fully in the socioeconomic and political life of the nation. The Department stated, in 2014 and 2020, that the focus of the South African Government during the 2014-2019 and the 2019-2024 Medium Term Strategic Framework would remain sustainable rural development and agrarian reform, with targets and actions that include greater support to smallholder farmers.

Statistics South Africa (2017a) has provided evidence of the need to focus on interventions that benefit women when addressing poverty. The 2015 lower-bound poverty line for men was 38.2% in comparison to 41.7% for women (Statistics South Africa, 2017a). Thus, if Sustainable Development Goals, especially SDGs 1 and 5 (no poverty and reducing gender inequality, respectively), are to be achieved in South Africa, the government needs to adopt pro-poor and gender-inclusive interventions.

1.2 Research Questions and Objectives

We analyzed policy strategies intended to improve the rural economy. The South African economy is characterized by marked, multifaceted differences between men and women, which calls for gender-sensitive government strategies to achieve the leave-no-one-behind principles of Sustainable Development Goals. Policymakers, however, first need to know what impact existing and proposed policies are having or may have, and the goal of this study is to contribute to that knowledge. Government policies must be assessed to understand how they affect gender inequality and related socioeconomic challenges in South Africa, particularly unemployment, poverty, and income inequality. The focus of this study is therefore to assess the economy-wide and distributional effects of proposed government

policies to understand whether they are likely to address or perpetuate the challenges we have mentioned.

Specifically, we intended to address:

- The impact of reallocating land from commercial to smallholder agriculture.
- The impact of supporting the rural economy by increasing agriculture capital spending.
- Whether such interventions would yield differential impacts on men's vs. women's labor and on rural vs. urban households?

To respond to these questions, our objective was to use CGE and microsimulation modelling to analyze the effects of reallocating land to smallholder agriculture in South Africa and of increasing agricultural capital spending on the rural economy to examine whether differential effects could be seen on men's vs. women's labor and on rural vs. urban households.

2. Literature Review

2.1 Gender Issues in South Africa

2.1.1 Gender Disparities in the South African Labor Market

The labor market in South Africa is characterized by significant gender disparities and is more favorable to men than to women (Statistics South Africa, 2018). Women are more likely to be unemployed than men. The South African labor market has historically been segmented along racial, class, and gender lines with white men occupying the jobs associated with high returns and good opportunities (Casale & Posel, 2005; Kehler, 2001). Black and Colored women have been the most vulnerable groups and have additionally been more likely to be the primary breadwinners in larger households than white or Asian women. Black and Colored women also earn less because they are concentrated at the lower end of the labor market (Bosch, 2020).

Although the proportion of women in the total population of South Africa was 51% in 2017, women accounted for only 44% of the employed (Statistics South Africa, 2017b). Women still bear the brunt of unfair discrimination in most sectors. After the enactment of legislation to remove unfair discrimination, substantial positive changes were witnessed, and women began to be represented among top earners (Casale & Posel, 2005). In 2018, however, women were over-represented in low-paying work (97% of domestic workers) and underrepresented in high-paying work (32% of managers were women; see Bosch, 2020). Ironically, though statistics show an increase in women's participation in the labor force, the greater percentage is employed in the informal sector or is self-employed, categories typically associated with low and insecure earnings and few possibilities for advancement (Casale & Posel, 2005).

As a result of gender inequality in South African society, poverty levels in the country vary not only between population groups and location but also by gender. Black African women in rural areas, characterized by low levels of education, are the main victims of the struggle against poverty and inequality. In 2015, 41.7% of women lived below the lower bound poverty level compared to 38.2% of men. While a household headed by a man has a 28% probability of being poor, the probability that a household headed by a woman will be poor is 48% (Department of Women, Youth, and Persons with Disabilities, 2019). Because gendered poverty is mainly founded in patriarchal societies that do not view women as equals, labor-market wage differentials between men and women are an outcome of deeply rooted cultural systems. In South Africa, poverty is most pronounced in rural areas, where gender plays a significant role in decision-making (Cheteni et al., 2019).

2.1.2   Existence of Gender Disparities in Wages

South Africa's progressive labor laws notwithstanding (the Employment Equity Act, which emphasizes the principle of equal pay for equal work; the King IV Code, which requires employers to do a gender/pay audit, adjust remuneration policies, and provide implementation plans for changes; and the Johannesburg Stock Exchange, which requires listed companies to disclose remuneration policies and to report gender discrepancies in pay), gender disparities in wages exist. Given that, the problems seem to emanate from

limited monitoring and implementation of such laws and policies (Casale & Posel, 2005).

For Bosch (2020), pay equality means basic pay or wages; guaranteed benefits such as medical aid, retirement, life insurance, and leave; and such incentives and rewards as bonuses, share options, retention bonuses, and study schemes. Yet gendered wages continue to prolong the "sticky floor" effect, whereby certain groups remain in the bottom decile of earners where, in fact, the highest proportion of women workers can be found. (United Nations University World Institute for Development Economics Research, 2019).

2.2 South African Government Policies on Rural Development and Gender

Mabugu (2016) argued that industrialization and modernization are intricately connected to rural development, both historically and among rapidly growing developing countries. Xiaoyun (2014) pointed out that China developed its economy by shifting its policy from a heavily industry-based and urban-based strategy to one that promoted labor-intensive and light industries in rural areas. The result was an increase—from 9.9% to 43.2% between 1978 and 2006—in the rural economy's contribution to national industrial growth.

According to the South African Department of Agriculture, Forestry, and Fisheries (2014), South Africa has among the least supported agricultural sectors in the world. The Alliance for a Green Revolution in Africa (2018) provided evidence that South Africa had the 7th lowest public spending on agriculture as a share of total government expenditure among all African countries (after Egypt, Congo, Angola, Equatorial Guinea, the Democratic Republic of Congo, and South Sudan) from 2005 to 2015. Information from Statistics South Africa (2017a) has shown that the poverty rates for rural areas (according to the upper-bound poverty line) were 87.6%, 88%, 77%, and 81.3% for the years 2006, 2009, 2011, and 2015, respectively; and 52%, 46.8%, 38.8%, and 40.6% for the urban areas during the same years. Such statistics make clear why South Africa has chosen to prioritize rural development and agrarian reform as outlined in the 2019-2024 Medium Term Strategic Framework, the 2014-2019 Medium Term Strategic Framework, and the National Development Plan 2030. In 2009,

the government launched the Comprehensive Rural Development Programme as a food-insecurity- and poverty-response strategy (Government of South Africa, 2009). The New Growth Path (Economic Development Department, 2010) and the National Development Plan 2030 (National Planning Commission, 2012) both articulate a vision of an integrated rural economy with land reform, job creation, and increased agricultural production. The National Development Plan 2030 specifically outlines the potential to generate one million agricultural jobs through a land-reform program and growth of irrigated and land-based agriculture. The focus of the current government policy cycle, the 2019-2024 Medium Term Strategic Framework, is on rapid and sustainable land reform and agrarian transformation aimed at improving the country's economic, environmental and social viability through achieving sustainable rural development and agrarian reform (Department of Planning, Monitoring, and Evaluation, 2020).

2.2.1. Government Policies to Address Gender Inequality

South Africa inherited an unequal socioeconomic system from the apartheid era. Black women, especially those in rural areas, have been the most affected by the triple oppressions of race, gender, and class. Since the dawn of its democracy, the South African government has been progressive in increasing women's empowerment. In the recent policy cycle, 2014 to 2019, the priorities for accelerating progress for women and girls in South Africa have included improving access to education for girls, employment creation, sustainable growth, and the economic empowerment of all women, especially "women owned businesses, SMMEs, women cooperatives, women vendors, hawkers and village and township enterprises; development of rural women; among others" (Department of Women Youth and Persons with Disabilities, 2019, 8). The 2019-2024 Medium Term Strategic Framework acknowledges that the economic empowerment of women is central to addressing the acute gender imbalances and ensuring women's inclusion in economic participation in South Africa (Department of Planning, Monitoring, and Evaluation, 2020).

According to the Department of Women, Youth, and Persons with Disabilities (2019), South Africa's efforts have encompassed ensuring non-discrimination and equality under the

law, agricultural productivity, food security for women, poverty reduction, and the promotion of women's enterprises and women's entrepreneurship. The country's gender-responsive policy priorities have been included in short-term (2019-2024), medium-term (2019-2030), and long-term (2019-2044) planning. The priorities are meant to address issues that include effective gender mainstreaming across all sectors of society, reducing gender inequality, greater emphasis on women's economic emancipation, and the transformation of unequal gender relations (Department of Women, Youth, and Persons with Disabilities, 2019).

2.2.2. Government Support for Women in Agriculture

Given that governments cannot directly affect such factors as fertility, cultural norms, or household influences that affect women's participation in the economy, the South African government, through its various departments in agriculture, land reform, and rural development, has rolled out several funding schemes to capacitate farmers. Special preference has been given to women to create a conducive environment for women's participation in the economy. Included in the interventions are the South African Department of Agriculture, Forestry, and Fisheries' Female Entrepreneur Awards, a program that acknowledges, encourages, and increases participation of women, young women, and women with disabilities in agriculture, forestry, and fishery. The AgriBEE Fund, another initiative that seeks to empower women in agriculture, forestry, and fisheries, includes the complete agricultural value chain from production, processing, and marketing to distribution, and it aims to promote entry and participation of previously marginalized groups (Department of Women, Youth, and Persons with Disabilities, 2019).

2.3. Women in Agriculture

Data on land and property ownership among women is limited, but rural women are acutely affected by lack of property rights and access to land. This gives the government an opportunity to make an impact through land redistribution and ownership. A few women are involved in commercial agriculture; however, the majority are involved in subsistence farming

for household food consumption (Hart & Aliber, 2010). Land ownership is intricately linked to food security, nutrition, and gender. Households headed by women are more vulnerable to food insecurity because of poverty, which can be exacerbated by lack of land ownership, means of production, and income-generating activities. The 2016 Vulnerable Groups Indicator showed a higher percentage of women (13.8%) living in households that experienced hunger compared to men (10.3%) (Statistics South Africa, 2016). Because of the strong links among food security, nutrition, and gender, the land issue becomes critical in ensuring a gender-sensitives approach to food security.

Gender dynamics in agricultural production result in women's being marginalized through lack of education, which limits their ability to take advantage of new technologies, low financial literacy, low access to extension services, and the complicated balance between paid work and unpaid care work that increases in the event of sickness in the home. This is worsened by the already low support to agriculture in general. Technological and infrastructural interventions in agriculture, which are mostly high input, are also not gender-sensitive, and most are geared toward servicing commercial farmers (Hart & Aliber, 2010).

2.4.   The Link between Gender and Investment in Agriculture

Seguino (2016) pointed out that women have trouble in converting their productivity into improved livelihoods, relatively and absolutely with respect to men because of macro-level policies and job segregation by gender. Collins (2016) argued that Africa is far from reaching gender equality where agricultural investment is concerned. A growing consensus, then, is that promoting gender equality and women's empowerment is a driver for food security, poverty reduction, and rural development. Achievement of gender equality is recognized as a catalyst for reaching food self-sufficiency in Africa and eradicating poverty, unemployment, and hunger (Byerlee, De Janvry & Sadoulet, 2009).

It is widely acknowledged that gender inequalities in agriculture continue. The Economic Community of West African States (2017) noted that equal participation of men and women in social, economic, and political life is far from being achieved. In line with this

consciousness, Seguino (2016) directed attention to the positive ripple effects that emerge from financing for gender equality through targeted government spending, especially in agriculture. Seguino (2016) suggested a gender and ethical paradigm to achieve policy objectives, particularly within the context of Sustainable Development Goals.

Because women's role remains a critical subject on the development agenda of several countries, Agénor (2017) argued for the importance of analytically understanding and quantitatively measuring how women are affected by both gender-specific and public policies, particularly in terms of employment and income. According to Agénor (2017), the promotion of women's participation in the labor force and of gender equality are desirable from the point of view of social equity and are also good economics. Agénor pointed out that these goals can be achieved through macroeconomic and other relevant interventions that reduce the structural constraints on women's participation in the job market, most of which are the result of cultural and social norms. In South Africa, structural constraints manifest in the form of low financial literacy among women, the need to balance productive work and unpaid care work, and gender-based segregation and discrimination that confine women to jobs with poor working conditions and lower pay.

2.5. Importance of Smallholder Farming to Agriculture

2.5.1. Contribution of Small-Scale Farms to the Agriculture Sector

Lerman and Sutton (2008) conducted a comparative study to assess differences in efficiency between large commercial farms and small-scale farms in Moldova. Their findings established that small individual farms were more efficient and more productive than large corporate farms. Mburu, Ackello-Ogutu and Mulwa (2014) found that small-scale wheat farmers in the Nakuru District of Kenya had higher technical efficiency than did large-scale farmers. Muyanga and Jayne (2019) identified the existence of a U-shaped relationship between farm size and productivity in Kenya: an inverse relationship for farms up to three hectares, a flat relationship for farms between three and five hectares, and a strong positive relationship for farms between five and seventy hectares. Sheng, Ding and Huang (2019)

conducted a similar study for Northern China, and their results confirmed the existence of a mild U-shaped relationship between cropping area and maize yield. Their findings also indicated that the negative farm size-productivity relationship for small farms could be attributed to those farms' use of labor-intensive technology. Consequently, the inverse relationship between farm size and productivity for small farms could be smoothed using capital-intensive technology (Sheng, Ding, & Huang, 2019). These studies indicate the important contribution of small-scale farms to the agriculture sector.

2.5.2. Potential of Smallholder Agriculture in South Africa

Writers like Kang'ethe and Serima (2014) have argued that subsistence agriculture is the mainstay of small-scale farmers across Africa and that informal agriculture's potential contribution to job creation is a key policy issue today in South Africa. While informal-sector agriculture is not synonymous with small-scale agriculture, Cousins (2018) has pointed out that they significantly overlap in South Africa because of the evident subsistence needs and informal orientation of most smallholder farmers. Based on Cousins' arguments, small-scale or smallholder agriculture in South Africa is the same as informal agriculture.

Even though the agriculture sector's contribution both to jobs and to GDP in South Africa is relatively small, it is still believed to be vital to the South African economy. While agriculture is approximate 4% contribution to GDP in South Africa may seem minuscule, Mkhabela (2020) argued measuring the contribution of agriculture through GDP reduces its overall importance because of its strong backward and forward linkages. In addition, Mkhabela pointed out that supporting agriculture to ensure that it continues to thrive is a pragmatic macroeconomic policy strategy for South Africa. Furthermore, given the size of the South African economy, the country's agriculture sector is larger than the economies of some African countries.

Statistics South Africa (2017c) pointed out that the growth rate in agriculture value added was central to lifting seasonally adjusted and annualized quarter-on-quarter GDP to 2.5% in the second quarter of 2017, after experiencing a decline in growth for two consecutive quarters. The 33.6% increase in agriculture production (the highest, followed by the electricity, gas, and water sector that grew at 8.8%) drove the recovery in GDP growth.

Agriculture value added grew at 28% and 15% in the first quarter and second quarter of 2020, respectively. No significant change has occurred in the unequal distribution of land in South Africa from the time when the practice was institutionalized during the apartheid era, and commercial farms continue to be held largely by white farmers while black communities' own small farms (Obi & Ayodeji, 2020), and South Africa's land-reform program has apparently not been successful in redistributing agricultural land. Obi and Ayodeji (2020) suggested that the South African government should prioritize support to increase farmers' productivity, emphasizing optimal land and gender equity. Moyo (2010) argued that efficient land reform and improved access to farming inputs was one solution to deteriorating welfare conditions in South Africa.

2.6. Lack of Information on Agricultural Activities

Statistics South Africa has acknowledged that agricultural statistics in South Africa fall short of providing the guidance needed for policy planning and formulation. Information on smallholder and subsistence agriculture is lacking, as is information that covers all agricultural activities. Assessing the involvement and role of women in agriculture, however, requires such information (Statistics South Africa, 2013). Schulze et al. (2008), "Commercial Farms Ensure" (2018), and Pienaar and Traub (2015) have all pointed out that commercial agriculture produces 95% of the marketed agricultural output in South Africa. The smallholder agricultural sector is responsible for the remaining 5% of agricultural production on an estimated 13% of total agricultural land (the other 87% is used by commercial agriculture); see Aliber and Hart (2009). Beinart and Delius (2018) estimated that agricultural land occupied by smallholder farmers in South Africa accounted for 23-25%. Freguin-Gresh, D'Haese, and Anseeuw (2012) argued that the smallholder agricultural sector lacks access to resources that include infrastructure, land, water, and credit services. Increasing resources to this sector could improve its contribution in the economy and positively affect women's outcomes.

2.7. Previous Related Studies

Since the early 1990s, several studies have used CGE methodology to evaluate the impact of policy on economic outcomes in South Africa (McDonald & Punt, 2005).

2.7.1. Studies on Rural Development

Many of the studies on rural development that used CGE modelling have largely focused only on the impact of agricultural policies or improvements in the agriculture sector (for example, Hérault & Thurlow, 2009 and Chitiga, Mabugu & Fofana, 2017, for South Africa; Schünemann, 2017, and Dorward, et al., 2004, for Malawi; Otchia, 2014, for the Democratic Republic of the Congo; and Storm, 1994, for India). While Arndt, Davies, and Thurlow (2018) assessed the economy-wide impact of rural development related policies, they did not look at effects in terms of poverty, inequality, or gender.

Three studies closely related to ours are Chitiga, Mabugu, and Fofana (2017); Arndt, Davies, and Thurlow (2018) and Schünemann (2017). Specifically related to agricultural policy, Hérault and Thurlow (2009) used a CGE and microsimulation model to show that removing global and domestic price distortions on agriculture products would lower poverty and inequality. In the case of global price distortions, however, poverty reduction is lower in rural areas relative to urban areas because rural households receive lower wages and are deeply rooted in poverty. They argued that price distortions may, to some extent, explain poor performance in rural development and agricultural outcomes.

Chitiga, Mabugu, and Fofana (2017) used a dual-economy dynamic CGE model to assess the effects of macroeconomic policy on rural and urban households, agricultural growth, and the relationship between growth in non-agricultural and agriculture sectors. The Chitiga group carried out three simulations: an exchange-rate policy (exchange rate depreciation, i.e., an average 7% per annum depreciation between 2005 and 2015); an agricultural growth policy (a 1 % annual increase in agriculture total-factor productivity); and a non-agricultural growth policy (an expansionary fiscal policy in the form of an increase in government spending that averaged 20% of GDP). They found that an expansionary fiscal policy had negative effects on agriculture and rural development because rural households

experienced a lower decrease in consumption; the depreciation of the exchange-rate simulation resulted in a decline in the national economy; and an increase in agricultural productivity yielded a small positive impact on the overall economy, benefiting rural households relatively more.

Arndt, Davies, and Thurlow (2018) used a dynamic CGE model with model parameters based on the 2015 South African SAM to study the impact of, first, investments in major cities; second, investments in rural areas intended to increase employment opportunities; and third, investment in secondary cities that had relatively stronger links to rural areas. Their findings indicated that increased investment in urban areas should not be at the expense of rural areas because lower agricultural production would cause higher food prices, lower real income, and outmigration leading to a rise in urban poverty.

2.7.2. Studies on Land Reallocation

In modelling land reallocation from large-scale commercial farmers to small-scale holders, Chitiga and Mabugu (2008), in their study on land reform in Zimbabwe, did not model smallholder agriculture by household or farming group but according to sectors, considering each sector's output to be homogeneous. The authors stated that to assume different production functions by type of farmer would have required detailed production-technology information. They modelled land as a factor of production among skilled labor, unskilled labor, and capital, and, using a CGE model with five household groups divided according to labor use, farming structure, and urban vs. rural location, simulated a land transfer of 40% from commercial farmers to communal farmers.

Mkhabela, Ntombela, and Mazibuko (2018) modelled land reform in South Africa using a CGE model with two agricultural industries that reflected the dualistic structure of the South African agriculture sector. They aggregated individual primary agricultural industries into one sector and then distinguished between agricultural outputs from white-owned and black-owned commercial operations, guided by industry production shares. In a related study, Mukarati, Mongale, and Makombe (2020) also modelled land reform in South Africa in the form of land reallocation from large-scale commercial farmers to small-scale holders. Among

other things, they disaggregated the agricultural sector into large-scale commercial and smallholder agriculture accounts. Using extrapolation, they divided agricultural-sector capital accounts into agricultural land and equipment, if the total quantity of productive agricultural land remained constant, and that land was either used by large commercial farmers or by small-holder beneficiaries. Land was redistributed to farmers who were assumed to be constrained in technology and production options. Their study included a poverty and inequality analysis of land reallocation but did not include the impact on gender.

2.8. Conclusion

The studies reviewed here have generally found that growth in the agricultural sector caused relatively higher positive effects for rural households relative to urban households. Hérault (2006) emphasized the relevance of CGE-microsimulation analysis of any policy change in the South African context, given high poverty and inequality levels, because such an approach would enable a detailed assessment of the impact of policies on poverty and inequality, identifying winners and losers. We contribute to this avenue of research literature by focusing on government rural-development interventions to increase agriculture resources in South Africa. Using CGE-microsimulation methodology, we have attempted to understand the differential impacts of such efforts not only in terms of sectors and urban-rural classification but also in terms of gender and other household characteristics.

3. Data

The aim of this study is to examine the impact of an expansion of smallholder agriculture and an increase in agriculture mechanization along gender, geographical location of labor, and the geographical location of households.

3.1 SAM

3.1.1 Original Dataset

We relied on the 2015 Social Accounting Matrix (SAM) developed by Van Seventer, et al. (2019) and available from the United Nations University World Institute for Development Economics Research. The original SAM comprised 104 commodities and sixty-two sectors, four labor categories by education level, capital, fourteen household groups, a public sector, a representative firm, and the rest of the world. While this rich and highly disaggregated SAM provides great flexibility for varied analysis, it does not provide a disaggregated public sector, thereby limiting analysis of government policies. In addition, it provides disaggregation neither by rural-urban divide nor by gender, which are our focus areas, and furnishes no information on racial groups, which are closely linked to rural development, poverty, and inequality.

3.1.2 Adjustments to the Original SAM

In addition to focusing our analysis by aggregating sectors, we disaggregated labor by skill level and gender. Further, we disaggregated households by rural-urban region in addition to using the income levels in the original SAM. Our adaptation of the SAM employed various data sources, including the 2015 Labor Market Dynamics in South Africa, the Labor Force Survey for the Fourth Quarter of 2015, and Statistics South Africa's 2015 Living Conditions Survey (2017d). We further categorized education levels up to secondary education (unskilled), matric,[1] and tertiary education (both classified as skilled), giving us a total of six labor categories. We disaggregated labor by gender as well as by skill, proportional to Labor Market Dynamics information that provides unemployment rates by education: tertiary education (11.7%), matric (26.3%), and up to secondary education (29.6%), as well as the number of employed by gender and skill (unskilled men = 25.4% and unskilled women = 36.2%).

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[1] "Matric" is the high-school-graduation certificate in South Africa.

We aggregated commodities for a total of thirty-one and activities for a total of thirty, including the agricultural sector. Following Schulze et al. (2008), "Commercial Farms Ensure" (2018), Aliber and Hart (2009), and Pienaar and Traub (2015), we used available information to make up for the lack of data on smallholder agriculture. Cousins (2018) pointed out that the South African agricultural sector is extremely skewed in terms of size, capital, and formality between large-scale and small-scale farming. It is on the basis of this information that we disaggregated agriculture into large-scale (or commercial) and smallholder subsectors. Given the subsistence nature of informal agriculture, it makes sense to assume that the capital for this sector is largely land. Thus, we assumed that capital reallocated from commercial to smallholder agriculture was land.

3.1.3   Other Data

In addition to the SAM data, we used elasticities and parameters for the South African economy to capture the structure of the South African economy. These included unemployment rates for the six levels of education as provided by Statistics South Africa, income elasticities of demand provided by Burger et al. (2015) and Mabugu, Chitiga and Fofana (2013), Armington elasticities (Gibson, 2003), the wage differential between working men and women as given by Mosomi (2019), and the Frisch parameter given by De Wet (2003).

3.2 Microdata

For the microsimulation analysis, we used household survey data, which are publicly available from Statistics South Africa and from University of Cape Town's DataFirst portal. We used South African National Income Dynamics Study data from 2014-2015 for the microsimulation model. The units of analysis in the National Income Dynamics Study are individuals and households, and the data include information on individual demographics, levels of education, income, and labor-market participation as well as on household characteristics that include income levels and sources, household size, education level,

consumption and spending, and gender of household head (Southern Africa Labor and Development Research Unit, 2016).

4.   Methodology

4.1 CGE Microsimulation Modelling

CGE microsimulation analysis was suitable for our research because it 1) allows simulation and testing of several scenarios, past or existing, to assess effects on variables of interest and 2) provides valuable information on the best potential policy interventions. Interventions of this nature require the use of general equilibrium modelling that can adequately assess sector-based changes and economy-wide effects. In addition, because another important focus of this study is to assess the welfare and gender effects of government interventions in the rural economy, we used Computable General Equilibrium (CGE) modelling in combination with microsimulation modelling to account adequately for the distribution effects of the interventions.

CGE models are excellent at capturing the economy-wide impacts of socioeconomic policies and shocks but cannot account for and analyze the effects of macroeconomic policies at a household or individual level or the effects of poverty and income distribution. The gap between economy-wide models like CGE models and microeconomic impact can be covered by microsimulation models that are top-down, bottom-up, or a combination of both, and which can be linked to the CGE models.

We used the PEP 1-t CGE model (in GAMS program) adapted for the structure of the South African economy by using the relevant elasticities and parameters. Because of the cumulative nature of investment, a dynamic CGE model was deemed more relevant to assess policy initiatives. In addition, because policy initiatives are rolled out over several years, a

dynamic model adequately captures the impact over time.

4.2 CGE Modelling

4.2.1 Additions to the Original Model

4.2.1.1 Unemployment

The PEP 1-t assumes full employment in the labor market, with equilibrium in the labor market being given by the equality between total labor supply and the sum of labor demanded by productive activities as follows:

$$LS_l = \sum_j LD_{j,l}$$

We adapted this model to capture the realities of high unemployment in South Africa. Labor supply is thus given by the sum of the different types of labor demanded by productive activities and unemployed workers as follows:

$$LDT_l = \sum_j LD_{j,l}$$

$$LS_l = LDT_l/(1 - UN_l)$$
$$LU_l = LS - LDT_l$$

where $LD_{j,l}$ is the demand for type l labor by the sector j, LDT_l is total demand for type l labor, LS is supply of type l labor, LU_l is the number of type l unemployed labor, and UN_l is the unemployment rate.

4.2.1.2 Wage Differential between Working Men and Women

Women's and men's wages are treated differently to account for the wage differential between working men and women in South Africa.

$$W_{mal} = W_l$$
$$W_{fem} = W_l * (1 - \phi\_W_l)$$

where W_l is wage rate of type l labor, W_{mal} is the wage rate for working men, W_{fem} is the wage rate for working workers, and ϕ_W_l is the wage differential between men'[s and women's labor. The wage differential for South Africa is 25%, with women workers earning on average 25% less than do counterpart men.

According to Mwakalobo (2005) and Mburu, Ackello-Ogutu, and Mulwa (2014), the Cobb-Douglas production function is commonly used to model smallholder agriculture. Studies that have used it to estimate smallholder farming production include Tenaye (2020) for Ethiopia and Mwakalobo (2005) for Tanzania. Obi and Ayodeji (2020) argued that, although the Cobb-Douglas production function is a long-established model, certain restrictions need to be amended to reflect the reality of the agriculture sector. Sau (1971) was of the same view and pointed out that a Cobb-Douglas production function was inadmissible for the agriculture sector because agricultural inputs are generally mutually complementary. Based on these arguments, we modelled production for smallholder agriculture as well as other sectors using a multi-level nested production function. Value added was modelled using a Constant Elasticity of Substitution (CES) function with aggregation of composite labor and composite capital; we used a Leontief combination of intermediate consumption and valued added to model output. Furthermore, to capture the realities of the South African economy, smallholder agriculture was allocated 5% of total agricultural labor, based on the average proportion of labor in smallholder agriculture, and capital was allocated 15% of total agricultural capital, given that smallholder agriculture land is estimated to range between 13%-25% (Aliber & Hart, 2009; Beinart & Delius, 2018; Valodia, 2007).

4.2.2 Closures

The exchange rate is the numeraire. Exogenous variables in the model are current account balance, minimum consumption of commodity *i* by type household *h*, government current expenditure, new capital investment in the public sector, capital demand, labor supply, agriculture skilled labor, world prices of exports and imports, and inventory changes. Capital is fully employed, assumed to be sector-specific and fixed in the initial period and assuming that the sector-specific rental rate of capital would adjust to ensure that demand

for capital equals total capital supply. Under the accumulation rule, demand for capital by industry in each sector is determined in the preceding period. Labor supply grows at the rate of population growth and is mobile across sectors, and total labor supply is the sum of labor demanded across sectors and unemployed labor.

4.2.3   Business as Usual (BAU)

To quantify the impact of rural development in agricultural-support scenarios, we first constructed a business as usual (BAU) growth path scenario for South Africa over a twenty-year period from 2015 to 2034 (to capture the National Development Plan 2030, the Comprehensive Rural Development Programme, and Sustainable Development Goal implementation periods). The simulations were applied from 2015 to assess the way in which the shocks would have affected South Africans had the government prioritized agrarian reform with a particular focus on smallholder agriculture (as set out in the 2014-2019 Medium Term Strategic Framework). The BAU scenario broadly assumed a balanced growth path based on recent past growth trends and serves as the counterfactual against which government interventions on the rural economy were compared. Population was assumed to grow at 1.3%, which is South Africa's estimated average population growth rate based on information from Statistics South Africa. Dynamic variables, which included labor supply, household consumption, the current account balance, public consumption, intermediate consumption, the minimum consumption of commodities in LES demand equations, public and private capital expenditure, and changes in inventories, were assumed to grow at the same rate as the population index.

4.2.4   Simulations

Bahta and Strydom (2015) mentioned that agricultural growth can be simulated in a CGE model in two ways: directly through exogenously increasing agricultural output by sufficiently adjusting agricultural productivity or inputs and indirectly through exogenously increasing agricultural productivity or inputs to stimulate output. The two simulations carried out to assess the differential impacts across gender and geographical location were:

1. An increase in smallholder agriculture capital spending. In this simulation, capital

spending for the smallholder agriculture sector was increased by 7.5% followed by 5% in each of the two consecutive years. This simulation shifted capital away from commercial agriculture, which could potentially have depressed overall economic activity. (Because capital is fixed, the increase in smallholder capital comes from commercial agriculture.) As capital demand for smallholder agriculture increased, labor demand by the sector would also be expected to increase given that the model assumes a Leontief production function. Even though the model assumes capital to be sector-specific, this simulation assumes uniform productivity between the two agriculture sectors. This is informed by arguments that, in South Africa, smallholder farms are as profitable, viable, and efficient as their commercial counterparts (Kirsten & Van Zyl, 1998).

2. An increase in agriculture capital investment. This simulation increased capital spending by 10% for the combined agriculture sector in three consecutive years and would be expected to trigger an increase in demand for labor used by the agriculture sector and, consequently, an increase in production by the sector and by other sectors with which it has strong interlinkages.

It is important to mention that these simulations did not involve similar costs and were compared only in terms of the direction (but not the magnitude) of change across variables. Simulations were conducted from 2016. Costs in the first simulation were borne by commercial agriculture because the redistribution of land was assumed to be in form of expropriation without compensation, which is the subject of discussion in policy circles and by scholars who include Clark (2019), Vorster (2019), and Mubecua and Mlambo (2020). According to Akinola (2020), the government has been considering adopting land expropriation without compensation since 2012 but only commenced it publicly in 2018. Compensation for land expropriation can be estimated using methods such as market value, shadow price, opportunity cost, and economic value of cultivated land. However, we did not model compensation. The second simulation was assumed to be financed through deficit financing. This would lead to a reduction in government transfers to other agents because current government expenditures on goods and services were assumed to be fixed.

4.3 Microsimulation

4.3.1 Microsimulation Models

In line with other studies such as Savard (2009), Hérault (2009), Estrades (2013), and Feltenstein et al. (2017), among others, Otchia (2019) explained in detail the two main types of microsimulation models and their subgroups. The first type of microsimulation model is the complete integration of the CGE and microsimulation models into a single model. This is achieved through integrating household survey data into the CGE model. Complete integration can be achieved via two different approaches: the Representative Household approach and the Fully Integrated approach. Under the Representative Household approach, households are disaggregated according to socioeconomic groups. The Fully Integrated approach is a further development of the Representative Household approach that replaces the Representative Household's groups inside a CGE model with all households available in the household survey. Fully Integrated models, in contrast to Representative Household models, allow intra-group variation. Their limitation is that they do not explicitly model household behavior so they cannot predict certain aspects of individual behavior (for example, whether a particular individual might lose a job or get a job based on individual or household characteristics).

The second approach to linking CGE models to microsimulation models is the layered approach whereby the two separate models are combined via interfaces. This approach consists of linking CGE models to the microsimulation in either a top-down, bottom-up, or iterative top-down/bottom-up combination. The top-down approach develops a separate microsimulation model, which is further combined sequentially with a CGE model. The model in the first stage is a CGE model with the same features as the Representative Household model. At the second stage is the microsimulation model, which captures the behavior of all households in the survey. This approach is implemented in two steps: first, the CGE model is used to simulate changes in prices, wages, and employment levels within sectors. The changes form the CGE model are then transmitted down to the microsimulation model in order to estimate corresponding changes in income and consumption. The basis of the microsimulation model is household-level survey data.

The microsimulation analysis considers heterogeneity in individuals' or households'

characteristics, including human capital endowments, sources of income, region of residency, consumer preferences, and household demographics. The microdata from the national survey were explained i above. The equations for the earnings of each working-age household member, for self-employment income for the household, and for utility gained by everyone's labor-market participation are the most important elements of microsimulation analysis (Davies, 2009). To ensure consistency between the SAM data used for CGE modelling and the survey micro-level data used for microsimulation modelling, we adjusted the sample weights of the survey data as pointed out by Robilliard and Robinson (2003) and Vandyck and Van Regemorter (2014), even though full consistency is not required when a sequential approach is used as Tiberti, Cicowiez, and Cockburn (2017) have argued.

4.3.2   Overview of the Top-Down Approach

We used the behavioral top-down CGE-microsimulation approach set out by Tiberti, Cicowiez, and Cockburn (2017). This approach was chosen for the strength of its ability to predict labor-market behavior based on individual or household characteristics, in comparison to the Representative Household approach explained earlier. Three occupational choices available to household members are (1) wage worker, (2) self-employed, and (3) not working. Workers are divided into two skill categories based on their levels of education: skilled (with a matric, a national technical certificate, or a tertiary qualification) and unskilled (with up to incomplete secondary education). In addition, observations with no education data were divided into the two skill categories on the basis Statistics South Africa's definitions: skilled (employed as technical and professional workers) and unskilled (employed as elementary and domestic workers). We present selected equations of the microsimulation model as in Tiberti, Cicowiez, and Cockburn (2017).

Individual labor supply is estimated using a reduced form model:

$$\ln \frac{P(E_i = m)}{P(E_i = 3)} = \alpha_m + \sum_{j=1}^{J} \beta_{mj} X_{ij} + \mu_{ij} = Z_{mi}$$

where E_i is the individual labor supply, Z_{mi} are individual utility functions from the two occupational choices, m, of being either a wage worker or self-employed (the utility of Category 3 is assumed to be zero), X_{ij} captures the individual's characteristics including level

of education and age, and μ_{ij} is the residual term.

Tiberti, Cicowiez, and Cockburn (2017) explained that the individual probability of being in one of the three labor categories is estimated by:

i. Other than reference category: $\quad P(E_i = m) = \dfrac{exp(Z_{mi})}{1 + \sum_{m=2}^{m=2} exp(Z_{mi})}$

ii. Reference category: $\quad P(E_i = 3) = \dfrac{1}{1 + \sum_{m=2}^{m=2} exp(Z_{mi})}$

The individual wage is estimated using the Heckman method which first allows for selection into employment based on variables that affect the probability of being engaged in employment (which is the likelihood of the wage being observed) but that do not directly influence earnings. The selection equation estimated using a logit model is:

$$s_i^* = \gamma Z_i + \mu_i$$

$$s_i = \begin{cases} 1 \ if \ s_i^* > 0 \\ 0 \ if \ s_i^* \leq 0 \end{cases}$$

where Z_i are relevant selection variables (age, gender, marital status, region and level of education).

This is then followed by estimation of the wage function:

$$w_i = \begin{cases} \beta x_i + \varepsilon_i \ if \ s_i^* > 0 \\ \quad . \ if \ s_i^* \leq 0 \end{cases}$$

5. Application and Results

5.1 Macro-Level Results Analysis

5.1.1 Reallocation of Land to Smallholder Farmers

CGE analysis provides numerous results because of its economy-wide nature. Only results linked to the focus of the study are presented. Results for changes in factor demand across sectors following reallocation of land from commercial to smallholder agriculture are given in Table 1 (capital) and Table 2 (labor demand). As expected, reallocating capital from

commercial agriculture to smallholder agriculture negatively affects capital demand for the former sector. The negative impact is observed throughout the period under study. Conversely, smallholder agriculture benefits in terms of increased capital demand throughout the period under assessment. If smallholder agriculture is owned mainly by black households, this would imply an achievement toward redressing the injustices of the past. Unfortunately, this cannot be determined through this study because households were not disaggregated by race.

Table 1: Capital Demand by Selected Sectors (Percent Change from BAU), Sim 1

Year	Commercial agriculture	Smallholder agriculture	Food	Petroleum & chemicals	Transportation	Finance & business services	Construction
2016	-0.052	12.269	0.004	0.000	0.001	0.001	0.002
2017	-0.133	17.601	0.009	0.000	0.002	0.004	0.006
2018	-0.240	17.556	0.016	0.000	0.004	0.006	0.012
2019	-0.333	17.517	0.021	-0.001	0.005	0.009	0.017
2020	-0.413	17.484	0.025	-0.001	0.006	0.011	0.021
2021	-0.481	17.455	0.028	-0.002	0.006	0.012	0.025
2022	-0.540	17.430	0.029	-0.003	0.007	0.014	0.028
2023	-0.590	17.409	0.031	-0.003	0.007	0.015	0.031
2024	-0.634	17.390	0.031	-0.004	0.007	0.016	0.034
2025	-0.671	17.375	0.031	-0.005	0.006	0.017	0.037
2027	-0.731	17.349	0.030	-0.005	0.006	0.018	0.041
2029	-0.754	17.339	0.029	-0.006	0.005	0.018	0.043
2031	-0.775	17.330	0.028	-0.007	0.005	0.018	0.045
2034	-0.792	17.322	0.027	-0.007	0.005	0.019	0.046

Source: Simulation results.

Table 2 shows that, as commercial agriculture land declines, its output also declines while smallholder agriculture output increases. This necessitates an increased demand for labor by the smallholder agricultural sector. Some sectors benefit from this as evidenced by their increased demand for more labor, while others are affected negatively, depending on their linkages with the two agriculture sectors.

Table 2: Composite labor demand by selected sectors (Percent Change from BAU), Sim 1

Year	Commercial agriculture	Smallholder agriculture	Food	Petroleum & chemicals	Transportation	Finance & business services	Construction
2016	-1.432	11.713	0.083	-0.015	0.013	0.023	0.059
2017	-1.973	16.823	0.108	-0.022	0.015	0.032	0.083
2018	-1.823	16.885	0.088	-0.024	0.010	0.028	0.079
2019	-1.694	16.938	0.071	-0.025	0.005	0.025	0.076
2020	-1.584	16.983	0.056	-0.026	0.001	0.022	0.073
2021	-1.489	17.022	0.044	-0.027	-0.002	0.020	0.070
2022	-1.407	17.055	0.034	-0.028	-0.005	0.018	0.068

2023	-1.337	17.084	0.025	-0.029	-0.007	0.016	0.066
2024	-1.277	17.109	0.018	-0.029	-0.009	0.015	0.065
2025	-1.226	17.129	0.012	-0.030	-0.010	0.013	0.063
2027	-1.144	17.163	0.004	-0.030	-0.013	0.011	0.061
2029	-1.111	17.176	0.000	-0.031	-0.013	0.010	0.060
2031	-1.083	17.187	-0.002	-0.031	-0.014	0.009	0.059
2034	-1.059	17.196	-0.005	-0.031	-0.015	0.008	0.058

Source: Simulation results.

Figure 1 shows the results for changes in labor demand across labor categories by gender and level of education (up to secondary-s, matric-m, and tertiary-t) following reallocation of land from commercial agriculture to smallholder agriculture. As demand for labor in commercial agriculture declines, output production also declines, resulting in decreased demand for labor by commercial agriculture. Even though smallholder agriculture production increases, and, consequently, demand for labor, this is not enough to counter the decline in demand for labor by commercial agriculture. Given that most workers in the commercial agriculture sector have lower education levels, both working men and women with up to secondary education experience a decline in demand across the entire period of assessment. Working men experience a higher decline or lower increase in demand because of the wage differential between men's and women's men's and women's labor, which makes women's labor relatively cheaper.

Figure 1: Demand for Labor (Sim 1)
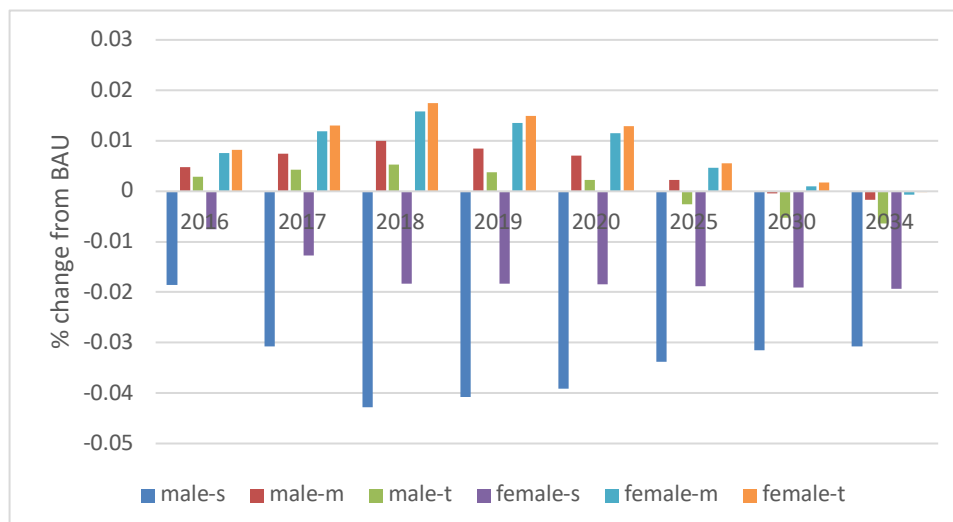
Source: Simulation results.

Table 3 shows how changes in Tables 1 and 2 and Figure 1 affect the rate of unemployment across labor categories by skill level. Overall, this simulation had a positive

impact on the labor market as indicated by a decline in the unemployment rate. The reason is that, as capital shifts from commercial agriculture, labor in that sector becomes more relative to capital. Thus, to maintain profit maximization, demand for labor by commercial agriculture declines so that the marginal products of labor and capital equal the wage rate and rate of return to capital, respectively.

On the other hand, as capital continues to increase for smallholder agriculture, labor from commercial agriculture and other sectors declines (those that are strongly linked to commercial agriculture and). Labor that is shed by these sectors, along with some labor that was unemployed before land reallocation, is now employed by small-scale farmers and other non-agricultural sectors where demand for labor has increased. The table also shows that workers with lower skills benefit (suffer) relatively less (more) than those with higher skills.

Table 3: Unemployment Rate: (Percent Change from BAU), Sim 1

Year	Unskilled (up to secondary schools)	Skilled (matric or national technical certificate)	Skilled (tertiary)
2016	0.003	-0.045	-0.089
2017	0.002	-0.062	-0.121
2018	-0.001	-0.056	-0.107
2019	-0.003	-0.051	-0.096
2020	-0.005	-0.047	-0.085
2021	-0.006	-0.044	-0.076
2022	-0.008	-0.040	-0.068
2023	-0.009	-0.037	-0.061
2024	-0.010	-0.035	-0.055
2025	-0.011	-0.033	-0.049
2027	-0.012	-0.029	-0.040
2029	-0.012	-0.027	-0.037
2031	-0.013	-0.026	-0.033
2034	-0.013	-0.025	-0.030

Source: Simulation results.

The reallocation of labor across sectors does result in a decline in income for poor households, especially in rural areas, and an increase in income for wealthier household groups. Despite the decline in income, as Figure 2 shows, the positive impact of an increase in smallholder agriculture (as demonstrated by rising consumption) benefits both rural and urban households. Thus, in terms of household income, while this policy seems not to provide encouraging results, at least rural households benefit in the same way as their urban counterparts.

Figure 2: <u>Household Consumption (Sim 1)</u>
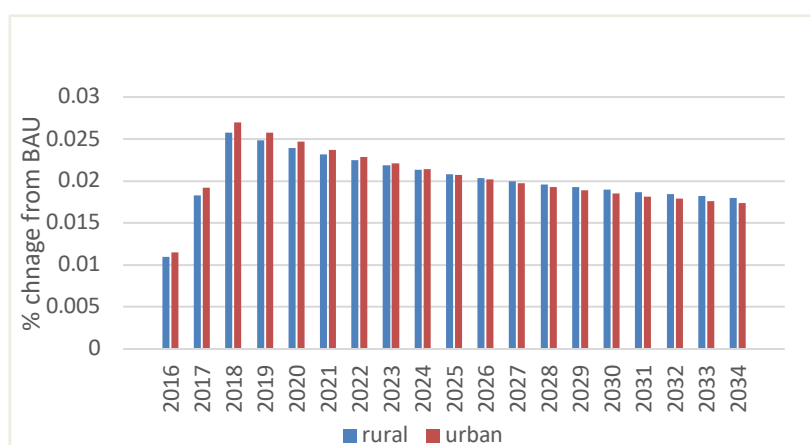
Source: Simulation results.

5.1.2   An Increase in Agricultural Capital

In this simulation, we increased capital for agriculture by 10%. While smallholder agriculture is key because it provides sources of livelihood for many poor people, particularly in rural areas, the importance of commercial agriculture to the economy cannot be overlooked. This simulation was intended to understand how labor and households would be affected by increasing capital demand for agriculture.

Table 4: Capital Demand by Selected Sectors (Percent Change from BAU), Sim 2

Year	Commercial agriculture	Smallholder agriculture	Food	Petroleum & chemicals	Transportation	Finance & business services	Construction
2016	18.754	19.548	0.096	0.024	0.036	0.029	0.012
2017	12.868	12.868	0.266	0.065	0.100	0.081	0.030
2018	11.205	12.229	0.371	0.094	0.142	0.117	0.044
2019	9.740	11.668	0.452	0.118	0.176	0.149	0.055
2020	8.451	11.178	0.514	0.139	0.204	0.177	0.065
2021	7.322	10.750	0.560	0.155	0.227	0.200	0.073
2022	6.334	10.377	0.591	0.169	0.244	0.220	0.080
2023	5.471	10.054	0.611	0.180	0.257	0.237	0.085
2024	4.720	9.773	0.622	0.189	0.267	0.250	0.089
2025	4.066	9.530	0.625	0.195	0.273	0.261	0.092
2027	3.004	9.138	0.613	0.203	0.279	0.277	0.096
2029	2.577	8.982	0.601	0.205	0.280	0.281	0.097
2031	2.206	8.847	0.585	0.206	0.278	0.285	0.097
2034	1.885	8.731	0.568	0.206	0.276	0.287	0.097

Source: Simulation results.

Table 4 indicates that an increase in capital spending for the agriculture sector has positive impacts on the economy as capital demand across sectors increases. This is because as the stock of capital increases, its rental rate declines. This also makes it possible for activities to increase demand for labor as well, as given Table 5. While increased capital across sectors requires more labor to work with to maintain equality between the value of each factor's marginal product to its price, this is not the case for commercial agriculture. However, demand for labor by commercial agriculture declines because its wage rate declines by less than the decline in rental rate of capital, making capital relatively cheaper.

Table 5: Composite labor demand by selected sectors (Percent Change from BAU), Sim 2

Year	Commercial agriculture	Smallholder agriculture	Food	Petroleum & chemicals	Transportation	Finance & business services	Construction
2016	-23.644	2.999	2.733	0.440	0.939	0.591	0.152
2017	-16.730	1.743	1.823	0.305	0.644	0.435	0.092
2018	-14.763	2.465	1.539	0.262	0.554	0.396	0.069
2019	-12.994	3.118	1.292	0.224	0.475	0.360	0.048
2020	-11.412	3.706	1.078	0.191	0.406	0.327	0.029
2021	-10.004	4.231	0.893	0.162	0.346	0.298	0.013
2022	-8.756	4.698	0.735	0.136	0.294	0.271	-0.001
2023	-7.656	5.113	0.600	0.115	0.249	0.246	-0.014
2024	-6.688	5.478	0.485	0.096	0.211	0.225	-0.024
2025	-5.840	5.800	0.388	0.080	0.179	0.205	-0.033
2027	-4.453	6.330	0.238	0.054	0.128	0.172	-0.045
2029	-3.891	6.546	0.181	0.044	0.108	0.158	-0.050
2031	-3.404	6.735	0.134	0.035	0.092	0.146	-0.053
2034	-2.982	6.899	0.095	0.028	0.078	0.135	-0.055

Source: Simulation results.

An increase in agricultural capital yields an overall increase in labor demand across all labor categories, except for men's unskilled labor in the short run, as shown in Figure.

Again, given the wage differential between men's and women's labor, it is expected that commercial agriculture would reallocate resources from labor to capital because it is the demand for men that declines.

Figure 3: Demand for labor (Sim 2)
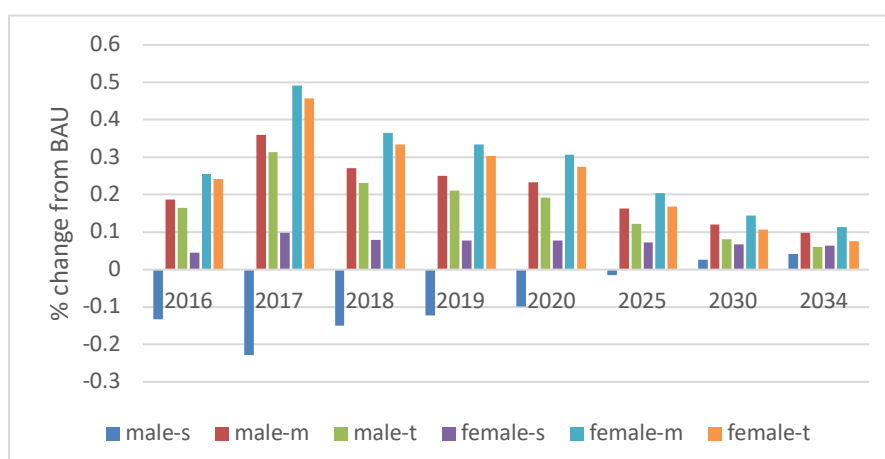
Source: Simulation results.

Table 6 gives changes in the rate of unemployment obtained from Simulation 2. The direction of change in unemployment is the same as observed in Table 3 for Simulation 1. Like in the case for Simulation 1, it shows that skilled labor experiences a higher decline in the level of unemployment than urban unskilled labor.

Table 6: Unemployment rate: (Percent Change from BAU), Sim 2

Year	Unskilled (up to secondary schools)	Skilled (matric or national technical certificate)	Skilled (tertiary)
2016	0.183	-1.232	-2.620
2017	0.106	-0.919	-1.924
2018	0.071	-0.850	-1.753
2019	0.039	-0.786	-1.596
2020	0.011	-0.727	-1.453
2021	-0.014	-0.674	-1.324
2022	-0.035	-0.625	-1.207
2023	-0.054	-0.581	-1.102
2024	-0.070	-0.542	-1.007
2025	-0.083	-0.506	-0.922
2027	-0.105	-0.444	-0.776
2029	-0.113	-0.417	-0.715
2031	-0.120	-0.393	-0.660
2034	-0.125	-0.372	-0.610

Source: SAM analysis

Figure 4 shows the impact of increasing agricultural capital on household consumption. Like the case of Simulation 1, consumption levels go up for all households. The consumption levels under Simulation 2 are relatively higher than under Simulation 1.

Figure 4: <u>Household Consumption (Sim 2)</u>
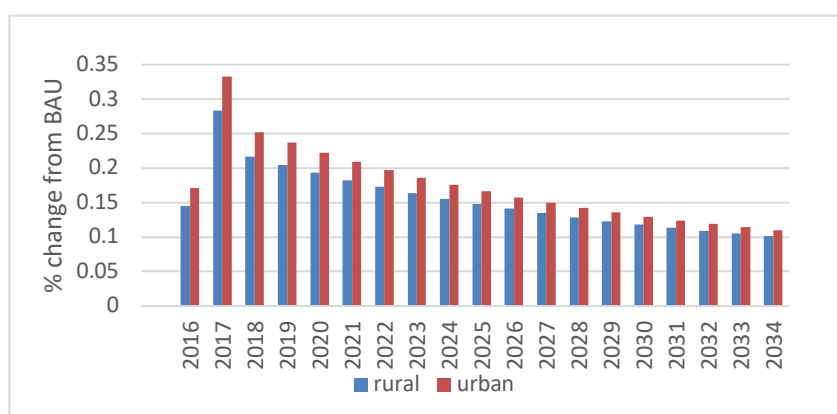
Table 7 compares the direction of change in GDP across the two simulations: For Simulation 1, the rate of change in GDP rises significantly before increasing at a declining rate. For Simulation 2, however, the change in GDP increases at a declining rate from the beginning of the simulation.

Table 7: Real GDP Growth: (Percent Change from BAU)

Year	Sim 1	Sim 2
2016	0,028	0,428
2017	0,040	0,327
2018	0,038	0,309
2019	0,037	0,291
2020	0,036	0,275
2021	0,035	0,259
2022	0,034	0,245
2023	0,033	0,232
2024	0,032	0,220
2025	0,031	0,208
2027	0,030	0,189
2029	0,029	0,180
2031	0,029	0,172
2034	0,029	0,165

5.2 Microsimulation Results Analysis

5.2.1 Labor Market Results Analysis

5.2.1.1 Differences Across the Gender and the Rural-Urban Divide: Unskilled Labor

The relative log odds of being in wage employment vs. being unemployed increase by 0.129 for urban compared to rural workers. The relative log odds of being in self employment vs. being unemployed decrease by 0.02 for urban workers compared to rural workers. In other words, workers who stay in urban areas are more likely to be in paid employment (0.129) and less likely to be in self-employment (0.02). The relative log odds of being in wage employment vs. being unemployed decrease by 0.167 for men relative to women. The relative log odds of being in self employment vs. being unemployed increase by 0.981 for men relative to women. The coefficient of gender for the self-employed-worker category alone was statistically significant, however. These results are from the multinomial logit model estimation for unskilled labor supply, presented in Table 8, Columns 2 and 3.

Table 8: Labor Market Analysis: Selected Variables

	Unskilled labor		Skilled labor	
Variable	Wage worker	Self-employed worker	Wage worker	Self-employed worker
urban	.129	-.020	.740***	.272*
gender	-.167	.982***	.515***	.196
household head	.577***	.352	.623***	.638***
age	.037***	.079***	.054***	.088***
education	.364***	.730***	-.139***	-.415***
number of children	-.103***	-.029	-.161***	-.058
married	.316**	.215	.556***	.420**
constant	-2.633***	-8.922***	-.558	-1.123**

Source: Estimation results.

5.2.1.2 Earnings and Selection: Unskilled Labor

The wage function for unskilled workers indicates that being male increases one's earnings by 36% while increasing one's level of education increases earnings by 13%. Thus, unskilled women are likely to have lower wages compared to male workers. The results also imply that while being male increases one's earnings, it has a negative effect on the likelihood of being

engaged in unskilled work.

5.2.1.3 Differences between Genders and Across the Rural-Urban Divide: Skilled Labor

Skilled labor supply estimations are given in Table 8, Columns 4 and 5. The relative log odds of being in wage employment vs. being unemployed for skilled labor increase by 0.74 for workers dwelling in urban areas relative to their rural counterparts. The relative probability of being in remunerated employment compared to being unemployed is 100% higher for urban than for rural workers. The relative log odds of being in self employment vs. being unemployed increase by 0.272 for urban workers compared to rural workers. This gives a 31% higher probability of being in self employment vs. being unemployed for urban workers relative to rural workers. That is, urban workers are more likely to be in paid employment (0.74) or in self-employment (0.272) compared to rural workers. The relative log odds of being employed increase by 0.515 for men relative to women. The relative log odds of being engaged in self employment activities vs. being unemployed increase by 0.196 for men relative to women. This entails that the relative probability of being employed and of being self employed is respectively 67% and 22% higher for men than for women.

5.2.1.4 Earnings and Selection: Skilled Labor

Unlike in the case of unskilled workers, results for skilled workers indicate that being a man both increases earnings and has a positive effect on the likelihood of holding a skilled job. For skilled workers, men's wages were observed to be 21% higher than those of women. Being a household head, a higher educational level, and increased age also increase earnings by 8%, 3%. and 28%, respectively. As in the case of unskilled workers, women are likely to have lower earnings than men. Thus women, irrespective of their levels of skills, are likely to earn lower wages compared to men. In terms of social attributes, being married has a positive effect on the likelihood of having a skilled job while an increase in the number of children in a household has a negative effect on a member's likelihood of being in skilled employment. Women who are in households with more children are thus less likely to earn higher wages or be in skilled employment.

5.2.2 Changes in Poverty and Inequality

Progression of the poverty rate and poverty gap are presented in Figure 5 and Figure 6, respectively. The poverty rate does not change much under Simulation 1 but declines under Simulation 2 particularly in the short to medium term and rises in the long term.
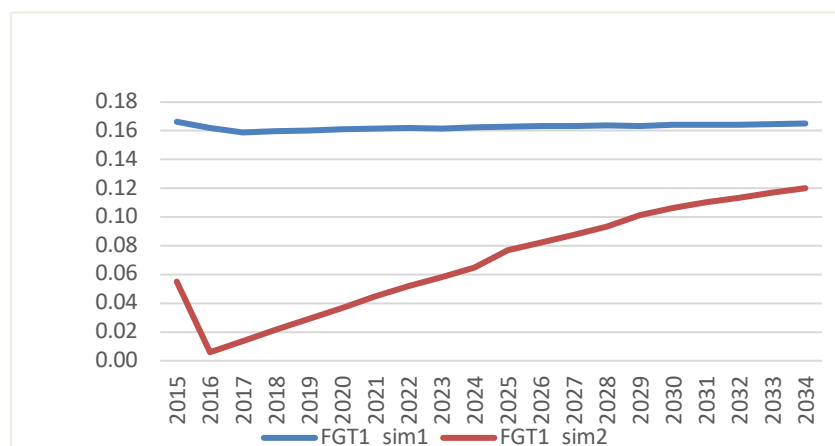
Figure 5: Poverty Rate
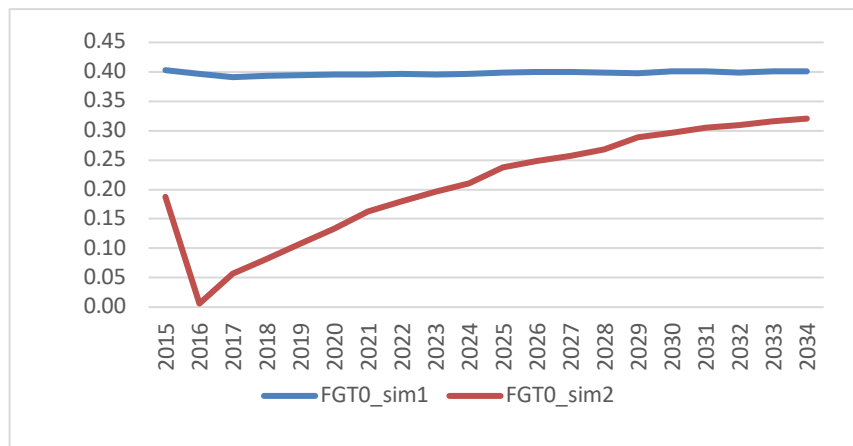
Source: Authors' estimation from results.

The simulated support of rural development through an increase in agriculture capital expenditure, specifically for smallholder agriculture, does not yield the anticipated positive impacts on poverty. This could be attributed to lower returns on capital and wages as well as a decline in household transfer income. The decline in prices was not enough to yield a positive impact on poverty reduction.

Figure 6: Poverty Gap Rate

Source: Authors' estimation from results.

Figure 7 and Figure 8 show the increasing difference in the poverty rate and the poverty gap rate over the simulation period while Figure 9 shows the robustness of the results as indicated by the FTG0 for Simulation 1, which always showed a higher poverty rate than did Simulation 2.

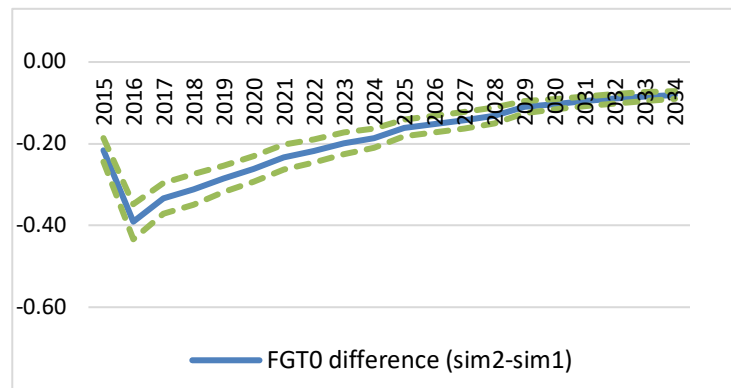**Figure 7: Difference between FTG0 under sim1 and sim2**
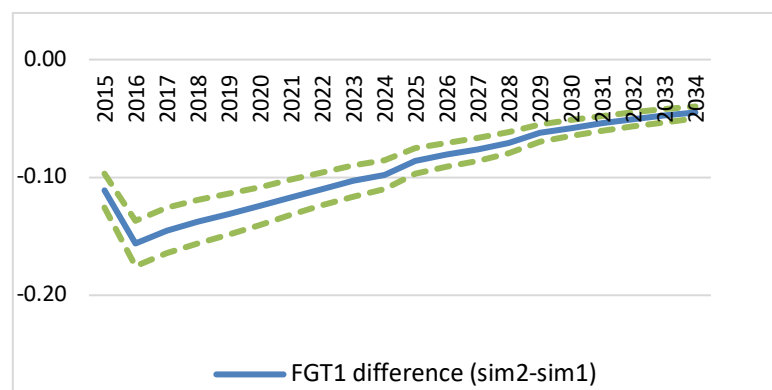

Figure 8: Difference between FTG1 under sim1 and sim2

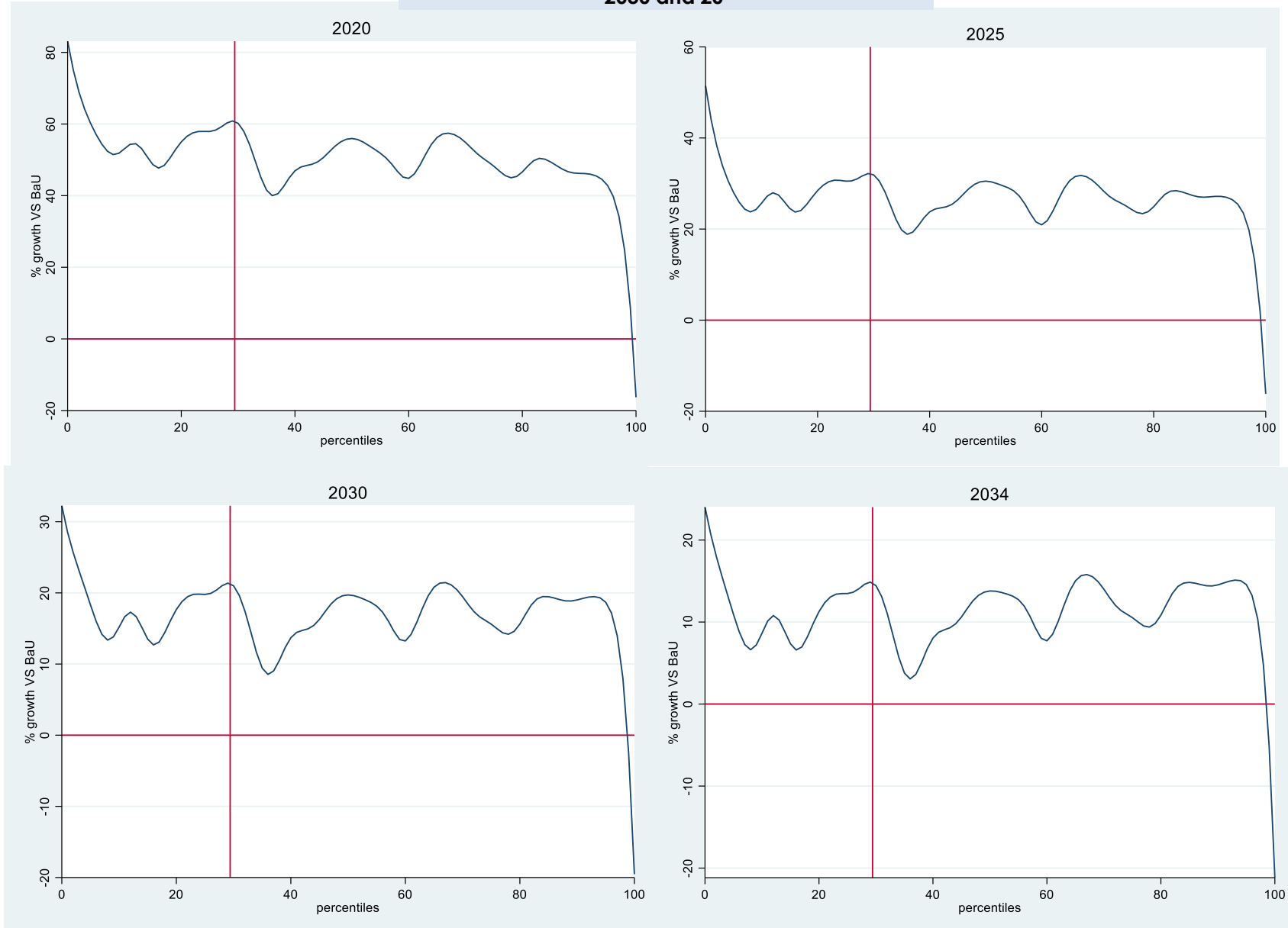Source: Authors' estimation from results.

Figure 10 shows Growth Incidence Curves, which measure the percentage change in consumption for all the percentiles in the population under , in comparison to Simulation 1. Figure 10 shows that households generally have lower incomes under Simulation 2 than under Simulation 1. The worst affected are the poorest (up to 20th percentile), and the richest households (the top 10%) would be negatively affected.

Figure 9: FTG curves for 2020, 2025, 2030 and 2034
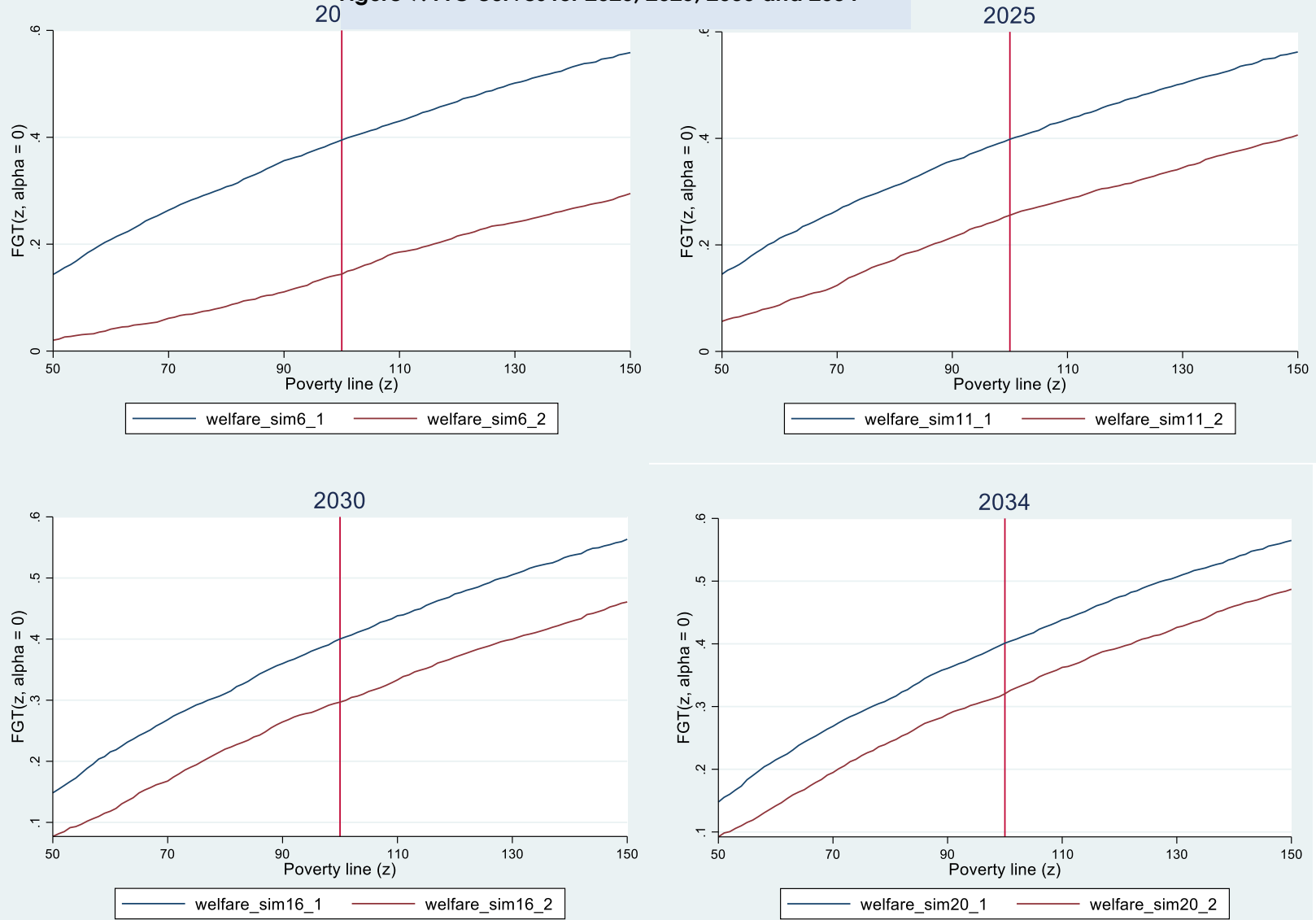
Source: Authors' estimation from results.

Figure 10: Growth incidence curves for 2020, 2025, 2030 and 20

Source: Authors' estimation from results.

6. Conclusions and Policy Implications

We analyzed the economy-wide and distributional impacts of government interventions on the rural economy through agriculture, focusing on the possible differential impacts for rural and urban people and working men and women. The study first used CGE modelling to estimate the macro impacts of reallocating land from commercial agriculture to smallholder agriculture in South Africa. Thereafter the results from the macro analysis were used to assess consequent effects on welfare. The first simulation modelled the redistribution of land from commercial agriculture to smallholder agriculture. The second increased capital for the agricultural sector, given that farming takes place largely in rural areas. Results from both simulations indicate that, generally, support for the agricultural industry could yield positive results for the South African economy. The simulations could potentially contribute to improvements in welfare as measured by the increase in consumption. However, rural households appear to benefit relatively less than their urban counterparts. In addition, the results show persistence of poverty despite such interventions.

The macro results show that women's labor benefits comparatively better than male labor. This result is encouraging as it suggests that increasing agriculture capital or reallocating land from commercial to smallholder agriculture could have positive effects on the gender inequality in the labor market. Unskilled labor also appears to benefit comparatively less than labor with higher levels of skills in terms of the decline in the rate of unemployment. However, based on the microsimulation analysis, skilled men are likely to be in wage employment or self-employment and to earn higher wages relative to women. For government's proposed policy of reallocating land from commercial to smallholder agriculture to have a significant impact on reducing gender inequality and poverty, corrective strategies would be needed to address unexpected negative impacts such as the worsening of the gender gap in the labor market. These findings are in line with the argument in Project Rise's "Can Land Reform Help Reduce Poverty and Inequality" (2018): while land is one of the key requirements to support small-scale farmers and other rural economy players, land alone is not enough to reduce poverty. Instead, a combination of well-structured strategies is required to promote rural development and attain much-needed welfare improvements in rural communities specifically, and in the whole society in general. Thus, a reexamination of

public strategies for rural development in connection with infrastructure development, pro-poor and gender-sensitive strategies might be a solution to rural economic growth and development.

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