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Agricultural economic reforms, gender inequalities and poverty in Senegal

Maisonnave Hélène¹² and Nziengui Mamboudou Pierre¹

Abstract³

In Senegal, as in many developing countries, the agricultural sector plays a key role in the economy. As well as supplying food, agriculture is the most important source of employment, especially for women. Through the Plan for an Emerging Senegal (PES) the Senegalese government is implementing an ambitious financing plan to improve the productivity of the agricultural sector and to improve women's employment opportunities.

Our study assesses the impact of two PES measures (investing in the agricultural sector and an increase in production subsidies for the agricultural sectors) on economic growth, women's employment, poverty and inequality using a dynamic computable general equilibrium model linked to a micro-simulation model.

While on the one hand, we find that investing in the agricultural sectors has positive impacts on growth, improves women's work opportunities, decreases poverty and inequality both in the short and long term, however increasing production subsidies in the agricultural sectors has positive effects only in the short term and does not reduce inequality or poverty in the long term.

Keywords: *gender, poverty, public policies, agriculture, dynamic CGEM, Senegal.*

1. Introduction

Senegal, like many developing countries, faces a particularly difficult economic and social situation. According to the National Statistics Agency, in 2011, poverty affected about 47% of the population, including 57.1% of people living in rural areas. The capital, Dakar, accounts for 26% of the total number of poor people (ANSD, 2013). The high level of poverty is reflected in gender dynamics. The gender development index that measures gender inequalities in health, education and economic opportunities is estimated at 0.88 (UNDP 2015). This high index value suggests the occurrence of significant economic and social disparities related to the gender of the economic agent.

The low participation of women in the labour market, the dominance of self-employed labour (low paid and vulnerable to economic vagaries), difficulties in accessing credit, and low access to infrastructure are the main factors limiting women's economic activities in Senegal. The results of the National Employment Survey confirm the inequality indicators by showing that women have a less desirable position in the labour market compared to men. Indeed, the unemployment rate for women is 23.5% vs. 11.4% for men (ANSD, 2015). Women are mostly

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unskilled (72.1%) and only 42.7% of them are active, compared to men who are more active (65.8%).

On the same note, the employment rate of women is estimated to be 32.8% while that of men is 59 % (ANSD, 2015). In addition, it appears that the female labour force tends to be more self-employed than employed. Women represent 49.7% of self-employed workers compared to 33.2% of salaried workers (ANSD, 2015). Concerning salaried jobs, women hold 22% of permanent positions, 32% of fixed-term contracts and 28% of seasonal contracts. (ANSD-ESP II 2011). If we look at the main occupations of women as self-employed workers, we can see that they work mainly as agricultural laborers (31.5%) and as caregivers (30.5%) (ANSD 2015). The predominance of women in self-employment increases their vulnerability. To address this situation, the government has set up an ambitious economic and social program called the “Plan for an Emerging Senegal” (PES). This program aims to transform the structure of the economy by improving the productivity of current growth drivers, human capital and local governance. Transformation of the economy involves the creation of infrastructures that encourage investment in key productive sectors (e.g. agriculture), services and also improvement of the business environment. Therefore, the agricultural objective of the PES intends to focus on water management, increasing productivity, and improving the competitiveness of sectors. The Senegalese government also intends to expand the infrastructure for producing, processing and marketing agricultural products, fostering innovation, and assisting stakeholders in the acquisition of inputs and appropriate materials. These policies should not only increase and diversify agricultural production but also improve the competitiveness of the sectors. Furthermore, the Senegalese government expects that the improvement of the agricultural sector will lead to an increase in job creation, with the resulting incomes having a positive impact on household consumption. In this way, the PES will have a positive impact on the reduction of poverty. Similarly, since women mostly carry out agricultural activities their incomes should increase. Indeed, the distribution of female jobs by sector shows that they are mainly active in the agricultural sector. Agriculture concentrates 46.40% of the female workforce. (ANSD-ESP II 2011). In addition, 15.3% of female-headed households work in the agricultural sector. They cultivate 31.9% of agricultural land in urban areas and 23% in rural areas. The development of agriculture could then lead to increased autonomy among women including increased incomes. This study aims to evaluate the effects of two public policies targeting the agricultural sector on growth, employment (notably women’s), poverty and inequality. Specifically, our study focuses on the impacts of two scenarios: (i) an increase in public investment in the agricultural sector, (ii) an increase of production subsidies for the agricultural sector. For this assessment we use a dynamic computable general equilibrium model (CGE) linked to a micro-simulation model. We believe that CGE models are the most appropriate tools able to capture the interrelations that exist between production activities, labour markets, and generation of incomes for agents, notably households. This macroeconomic framework allows to consider the impact on the whole economy and on the different agents, such as the government. The dynamic dimension allows us to capture the Senegalese government’s multi-year plan and the long-term effects of this policy. The use of a micro model allows us to assess the impact of simulated policies on household poverty (a macro model alone would not allow this).

Several studies provide information on the role that agriculture can play in reducing poverty and inequality. Indeed, by employing more of the population than any other sector in many developing countries, agriculture remains a lever of choice to reduce inequalities and poverty (Diao *et al.* 2010). However, for several researchers such as Mellor (1996) and Gollin (2010), the agricultural sector can only be a real asset for development if it undergoes profound transformations. It must undergo transformation from traditional to modern agriculture. This

transformation requires the development of infrastructures to boost production and facilitate its commercialisation (Adelman, 2001).

For Pinstруп-Andersen and Shimokawa (2007), improving agricultural productivity requires not only the construction of irrigation systems, the adoption of new farming practices or the financing of inputs to improve agricultural yields and ensure quality production. The authors also emphasize the importance of the creation of physical infrastructures such as roads, storage areas, markets, etc. in order to improve producer's access to markets.

Sennoga and Matovu (2013) conclude that public resources directed to sectors that can have base for transferrable skills and that can support the broad-based expansion of economic capacities of both individuals and firms, can lead to improved productivity and effectively combat poverty. Sennoga and Matovu (2013) analyse the case of Uganda and conclude that a reallocation of public resources from non-productive sectors (e.g. public administration, security) to agriculture as a productive sector leads to a reduction in poverty. This is made possible by the good linkages of the farming sector within the other industries. Mogues *et al.* (2012) consider that investment in the agricultural sector can play a key role in economic development through two channels: by improving individual's health and by improving their incomes. For the authors, investing in agriculture can improve productivity and increase farmer's resources. Additionally, such investments lead to a reduction in the prices of products, which can result in increasing the purchasing power of households.

Concerning Senegal, Boccanfuso *et al.* (2007) evaluate the impacts of a 10% increase in agricultural productivity on poverty by using a static CGEM including a multi-household module. This methodological choice allows them to carry out a more detailed analysis of poverty situations. The authors find an interesting result: the effect of increasing agricultural productivity seems to benefit mainly urban households, though the policy was aimed at reducing poverty in rural areas. The authors explain this mainly from fact that the source of income for poor rural households is decreasing, and also from the fact that the increase in agricultural productivity leads to a reduction in prices, which benefits the net buyers but disadvantages the net sellers.

Most of the studies that use a CGEM and incorporate a gender dimension, deal with the impact of trade liberalisation on gender (Fontana and Wood, 2000; Cockburn *et al.*, 2007; Chitiga *et al.*, 2010; Latorre, 2016).

There are few studies that deal with the impacts of agricultural policies specifically on gender. Arndt *et al.* (2000) show that an improvement in agricultural productivity through the incorporation of new production technologies leads to an increase in farmer's incomes in Mozambique. Additionally, since women in Mozambique are more engaged in agriculture than men, their incomes increase more importantly than men's. This reduces female poverty, dependency on men and reduces gender disparities in terms of income.

Zidouemba *et al.* (2018) analyse the effects of the transformation of agriculture on the economic situation of women in Burkina Faso. With the help of a CGEM, they show that an increase in investment in agricultural capital has positive effects on employment in general and especially for women. This improvement in employment opportunities positively impacts their incomes and enables a reduction in gender disparities in terms of jobs and revenue.

Cockburn *et al.* (2010), following Annabi *et al.* (2008), use a sequential dynamic CGEM with microsimulations to analyse the effects of trade liberalisation on poverty and gender disparities. Their simulations reveal that rural households benefit more from the liberalisation process than urban dwellers. Regarding gender, there is an increase in gender pay disparities. This situation results from the fact that liberalisation is more profitable for sectors that use more male labour.

It can also be noted that male-headed households have a much lower level of poverty than female-headed ones. Thus, while liberalisation leads to increased economic growth, this increase, reinforces wage disparities as well as the differential access to jobs by men and women.

Our study could shed some light on the impact of agricultural sector reforms on women's employment, growth, poverty and inequality in Senegal. It may also fuel the public debate within the PES framework that is currently taking place.

2. Methodology and Data

To evaluate the effects of these policies, we use a dynamic CGEM based on Decaluwé *et al.* (2013). The model is fully described in Decaluwé *et al.* (2013). Here we present the main characteristics of the model and the changes we made given the purpose of our study. In line with the SAM, the model has 22 activities and commodities, including two agricultural sectors (subsistence and export agriculture). The production function technology is assumed to be of constant returns to scale and is presented in a four-level production process. In the first level, output is a Leontief input-output of value added and intermediate consumption. In the second level, a CES function is used to represent the substitution between composite labour and capital. In the third level, composite labour demand is also a CES function between skilled, semi-skilled and unskilled labour. Finally, at the fourth level, each of these skills categories is further disaggregated between men and women.

Households are disaggregated according to their location, either rural or urban. The model discerns three sources of income: labour income (salaries and wages), capital income and transfers income from institutional sectors (households, firms, government and rest of the world). Households use their income for paying taxes, transfers to other institutions, consumption and saving. On the consumption side, household behaviour is modelled as a Linear Expenditure System and subject to its budget constraint.

Firms mainly derive their income from capital income, plus transfers from other institutions. They pay income tax and transfers to other institutions (dividends) and save the surplus. Government's income is derived from direct taxes paid by households and firms, indirect taxes on domestic sales, import tariffs, transfers from other institutions, and a share of capital income. Government savings is equal to government income less its consumption and transfers paid to other institutions.

To link Senegal and the rest of the world, we use the traditional small country assumption, meaning that Senegal does not have any influence on world prices. We also assume that Senegalese producers cannot sell as much as they would like to on the international markets. To sell more in these markets and to increase their market shares, producers have to be more competitive than other producers. Thus, export supply is constrained by export demand, which is assumed to have a finite elasticity, reflecting the level of competitiveness of local producers on the international market.

In order to take into account the Senegalese context, we change a hypothesis from the PEP 1-t model. Senegal is faced with unemployment for both skilled and semi-skilled workers. Following Blanchflower and Oswald (1994), we assume that there is an equilibrium wage rate compatible with the unemployment rate. The authors show the existence of an empirical relation linking wage rates and unemployment rates, also called a "wage curve". This relation shows a negative slope between unemployment rates and wage rates.

Labour is mobile across sectors whereas capital is sector specific. The stock of labour rises at the population growth rate each year while the stock of capital of each sector depends on the new investments made in the sector. The allocation of new investment follows a modified version of Jung and Thorbecke (2003).

In terms of closure rules, we assume that the nominal exchange rate is the numeraire. The rest of the world’s savings is fixed, meaning that Senegal cannot borrow from the rest of the world. Then, world prices are fixed, based on the assumption that Senegal is a small country. Government spending is also fixed.

In order to capture the impacts of the government’s intervention in the agricultural sectors on poverty, we need to link the CGE model to a micro model. The microsimulation model based on Tiberti *et al* (2017), determines the Foster, Greer and Thorbecke (FGT) poverty indicators (i.e. poverty headcount ratio (P0), poverty gap ratio (P1)) and the Gini inequality index for poverty and inequality analysis. Specifically, once the CGE model is run, the new prices and volumes after a change in the government policy are transmitted to the micro module (top-down) in order to estimate changes in monetary poverty and inequality.

To implement a macro-micro approach, we need different sets of data, with different sources: the Social Accounting Matrix (SAM) which is based on national accounts and input-output tables, and the household survey to infer the impact of the policies on income distribution and poverty. Specifically, our SAM is based on Fofana *et al* (2015); it has 22 sectors and commodities, including two agricultural sectors (subsistence agriculture and export agriculture). Using the household survey, we disaggregated the labour force by gender. Thus, labour is disaggregated by both gender and skills. We have five representative agents: the government, firms, households (rural and urban) and the rest of the world.

To calibrate the unemployment rates, we use the 2015 employment survey, we borrow income and trade elasticities from Zidouemba and Gerard (2015) and use the population growth rate from the Senegalese National Statistics Agency.

As mentioned above, our model is dynamic. Without any simulation, the economy grows following the ‘business-as-usual’ (BAU) trajectory. The BAU scenario reflects the Senegalese Ministry of Finance GDP growth rates and forecasts for the period 2011-2024 (2011: base year of our SAM, 2024: end of our simulation).

3. Results and discussion

In accordance with the PES, in our first scenario we simulate increases in the public investment budget for the subsistence agricultural sector by 6% in 2018 and 4% in 2019-2020; as well as increases in the budget for the export agricultural sector by 10% in 2018 and by 6% in 2019 and 2020. Public agricultural investment as modelled here corresponds to the acquisition of agricultural equipment such as tractors, irrigation equipment, seed drills, etc.

In the second scenario, we evaluate an increase in production subsidies for the subsistence agricultural sector by 6% in 2018 and 4% in 2019 and 2020, and 10% for the export agricultural sector in 2018 and 6% in 2019 and 2020. The simulation results are analysed in the short term (effects in 2018) and in the long term (effects in 2024).

3.1. Simulation 1: Increased public investment in the agricultural sectors

Macroeconomic impacts:

Table 1: Impact on macroeconomic variables (in % change to the BAU)

	Real GDP	Real consumption,	Real consumption,	Consumer price index	Investment
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		rural households	urban households		
Short term	0.13	0.02	0.02	-0.08	0.18
Long term	0.26	0.03	0.02	-0.20	0.28

In the short and long term, increases in public investment in agriculture lead to a relative increase in GDP by 0.13% and 0.26% respectively. Indeed, this increase in public investment in the agricultural sectors (both subsistence and export) increases the stock of capital for each sector the following year and consequently the production. To increase their level of production, each of the agricultural sectors increase their intermediate consumptions and therefore positively impacting the other sectors. This positive impact on the other sectors of the economy leads to a decrease in unemployment in the long term, a decrease in the consumer price index and an increase in real consumption for both household types.

Sectoral impacts:

This policy increases the production of both agricultural sectors and particularly that of export agriculture in both the short and long term. Thus, we see an increase in the production of export agriculture by 6.69% vs. 0.16% for short-term subsistence agriculture and 17.83% vs. 0.34% in the long term. One of the objectives of the Plan for an Emerging Senegal is to promote agricultural exports. Concerning this sector, exports are increasing by 8.21% in the short term and by 21.5% compared to BAU in the long term. From this point of view, it can be said that the objective of increasing exports has been achieved.

As mentioned previously, this investment policy in the agricultural sectors has some positive spillover effects on some sectors of the economy: livestock, construction and trade. Other sectors face the repercussions of this public investment policy: there is a crowding out effect of private investment by public investment. In other words, the other sectors are affected during the year of the simulation by the fall in private investment (-2%).

Private investment in agriculture is crowded out especially during the years of the SEP, and during this period it is more crowded out than investment in the other sectors. In the long run, however, the increase in private investment is greater in the non-agricultural sectors.

Interestingly, there is a discrepancy between the attractiveness of private investment in agriculture (which is not attractive for private investment given the relative low rate of return in this sector throughout the period) and its social benefits with poverty and gender inequality decreasing (see below).

This positive trend offset the negative effects so that the effect on long-term employment is positive. Indeed, in the short term, unemployment amongst skilled men decreases slightly by 0.13% while for women, it decreases by 0.03%. In the long term, the unemployment rate for skilled women drops by 0.57% while men's drops by 0.64%. Regarding semi-skilled workers in the long term, unemployment amongst women decreases by 0.16% while by 0.1% for men.

Impacts on agents:

In both short and long terms, this policy has positive effects on all economic agents. Indeed, given the overall positive impacts on the economy, households benefit from their wage rate increases, especially for women. In fact, the wage rate for skilled women increases by 0.15% compared to 0.11% for skilled men, while the wage rate for semi-skilled women increases by 0.23% (vs 0.22% for men). Concerning the unskilled, the increase in the wage rate is the same

for both sexes (0.27%). Consequently, labour income increases for both households, especially for urban households (0.21%) compared to rural ones (0.15%). Capital income also increases for both households in the long term, leading to an increase in household income by similar proportions, by 0.24% for urban vs 0.23% for rural households. Given the increase in household income, their consumption and savings increase.

The government’s income increases throughout the period (0.26% in the long term) due to the increase in direct taxes (households and firms) and indirect taxes (taxes on production, commodities and import duties). Firm’s incomes also increase in the long term by 0.16%.

Poverty results:

Table 2: Impact on poverty (in% change to the BAU)

	National FGT0	Rural FGT0	Urban FGT0	Global FGT1	Rural FGT1	Urban FGT1
Short term	-0.16	-0.11	-0.05	-0.06	-0.04	-0.02
Long term	-0.21	-0.09	-0.12	-0.13	-0.08	-0.05

The impact on poverty is particularly positive in the long term, where the poverty rate falls by 0.21%, and both rural and urban households benefit from it. Investing in the agricultural sectors contributes to lifting out people from poverty, especially those who are close to the poverty line.

In the short term, there is almost no impact on inequality (decrease by 0.04% at the national level). However, in the long run, there is a sharp decrease in the Gini index at the national level (-0.37%), inequality decreases more in the rural area (-0.20%) than in urban area (-0.17%).

3.2.Simulation 2: Increase in production subsidies for agricultural sectors

Macroeconomics impacts:

Table 3: Impact on macroeconomic variables (in % change to the BAU)

	Real GDP	Real consumption, rural households	Real consumption, urban households	Consumer price index	Investment
Short term	0.10	0.06	0.05	0.07	-0.01
Long term	0.01	0.00	0.00	0.01	0.01

The macroeconomic impacts of an increase in the production subsidies for both agricultural sectors are quite small. Indeed, we observe impacts only for the years the subsidies are increased, afterwards, there is practically no impact in reference to BAU. Increasing the production subsidies for both sectors leads to an increase in their production and an increase in their intermediate consumption. The impact on employment is positive as we find a decrease in unemployment by 0.17%. Real household consumption is 0.06% higher for rural households and 0.05% higher for urban ones in the short term, but in the long term there is no change compared to the BAU.

Sectoral impacts:

The export agriculture sector benefits mainly from this policy. Its production increases by 6% in the short term and by 0.4% in the long term. In order to produce more, the sector recruits all types of workers and increases its intermediate consumption. This leads to spillover effects on some other sectors in the short term. However, this increase in demand for workers has an upward impact on workers' wage rates, and consequently on production costs for all sectors of the economy. This increase in production costs leads to a decrease in production for some sectors.

Similarly to the previous simulation, exports for the agricultural export sector increase by 7% in the short term. However, in the long term, the increase is only by 0.41%.

In the short term, the quantity of labour demanded increases, leading to a decrease in unemployment, especially amongst women. In fact, the unemployment rate for skilled women falls by 0.21% vs. 0.04% for men, while the unemployment rate for semi-skilled women falls by 0.27% vs. 0.18% for men in the same category.

Effects on agents:

Households benefit from the increase in labour demand by the sectors, and for all categories of labour there is a wage rate increase. In the short term, the wage rate for skilled women increases by 0.18% vs. 0.17% for men. The wage rate for semi-skilled women increases by 0.09% vs. 0.08% for men. Finally, for unskilled women, the wage rate increases by 0.08% vs. 0.06% for men. This leads to an increase in rural household's labour income by 0.16% compared to 0.13% for urban ones. Capital income increases for both types of households, leading to an increase in rural household income by 0.11% and 0.12% for urban ones in the short term (0.01% in the long term for both households).

The government's income is decreasing (-0.1%) during the three year simulation period (as agricultural subsidies are increasing). This leads to a decrease in government's savings by 0.33% which affects total investment (-0.01%). At the end of the period, its income increases by 0.01%.

Poverty results:

Table 4: Impact on poverty (in % change to the BAU)

	National FGT0	Rural FGT0	Urban FGT0	National FGT1	Rural FGT1	Urban FGT1
Short term	-0.19%	-0.13%	-0.06%	-0.08%	-0.05%	-0.02%
Long term	+0.14%	+0.06%	+0.08%	+0.06%	+0.04%	+0.02%

The positive impacts on wages and labour demand leads to a small decrease of poverty in the short run, and this policy is helping more rural households to become non poor than urban households. The impact on inequality across the country is quite positive, with a decrease by 0.13%, and inequality is more reduced in rural areas than in urban areas.

However, in the long run, results are negative in terms of poverty and inequality. Indeed, as we mentioned above, this policy mainly benefits the export agriculture sector, which needs to hire workers to increase its production. This increase in demand for workers has an upward impact on workers' wage rates, and consequently on production costs for other sectors of the economy.

This increase in production costs leads to a decrease in production for some sectors. Moreover, as pointed out earlier, the decline in total investment in the short run (due to the decrease in government's savings) does not allow the economy to rebound in the long run. Consequently, poverty increases by 0.14%, and rural households are more affected by the increase. Furthermore, inequality increases by 0.04% at the national level, with a same trend in rural areas and in urban areas (0.02%).

4. Conclusion and policy recommendation

Ultimately, it appears that increased public investment in agriculture, and increased agricultural subsidies, have different effects on the Senegalese economy. These two economic measures lead to an increase in real GDP in the short and long term. In both cases, the good performance of GDP is mainly based on the good performance of farming. While both policies lead to an overall increase in the incomes of employees, only the first simulation produces enduring effects on unemployment. One of the objectives of the PES is to encourage agricultural exports. With both simulations, this objective is achieved, but the long-term effects are greater with increased public investment in agriculture.

By analysing the data through a gender lens, both simulations have positive impacts on women's employment and on increasing their wage rate in both the short and long terms for the first simulation. These impacts are seen mainly in the short term for the second simulation.

In terms of poverty reduction, the investment policy in the agricultural sectors brings more convincing results considering that poverty decreases in both short and long terms. There is a reduction in inequality and both rural and urban households benefit from it.

Given the above, we would recommend that the public investment policy in the agricultural sectors be given priority as a first step, as its positive social impacts in terms of poverty and inequality are greater both in the short and the long term. Additional investigations are also needed to assess the impact of this investment policy with different financing scenarios in order to avoid the crowding out phenomenon. Public-private financing could be considered in order not to burden public finances with all the financing.

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