

Agricultural economic reforms, gender inequalities and poverty in Senegal

Pierre NZIENGUI MAMBOUNDOU

LE Havre Normandy University

pierre.nziengui-mamboundou@univ-lehavre.fr

Abstract

The failure to achieve the Millennium Development Goals (MDGs) and the definition of new Sustainable Development Goals (SDGs) revive debates and studies on ways and means to eradicate poverty and inequalities. The main purpose of this study is to identify economic sectors that could be drivers of development and to reveal the mechanisms by which public policies could be more effective to fight against gender inequalities and poverty. In this perspective, the agricultural and public infrastructure sectors occupy a prominent place.

We build a dynamic computable general equilibrium model (CGEM) coupled with a micro simulation module to evaluate the statistical effects of agricultural reforms in Senegal on the evolution of gender inequalities and the well-being of the population. This research pays particular attention to the effects on the labour market according to gender and the skills of the agents. Specifically, the study deals with the impact of an improvement of public infrastructures in connection with agriculture following an increase in the public investment budget in this sector. In addition, this research analyses the effects of an increase in agricultural subsidies on inequality and poverty. Our study reveals that the financing of agricultural infrastructures has short- and long-term positive effects on the reduction of poverty and gender inequalities. On the other hand, agricultural subsidies can only reduce gender inequalities and poverty in the short term.

Keywords: gender inequalities, poverty, public investment, agriculture, 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. In urban areas, the capital Dakar concentrates 26% of the 43% of the poor. (ANSD, 2011). The gender development index that measures gender inequalities in health, education, and economic opportunities, is estimated at 0.88 (UNDP 2015). The value of this index reflects the existence of strong gender inequalities. This hypothesis is confirmed by employment statistics in Senegal. Indeed, we observe that women's unemployment is 23.5% against 11.4% for men. The participation rate of women is only 42.7% when that of men exceeds 66%. Similarly, the employment rate of working women is estimated at 32.8% while that of men is 59%. Moreover, it appears that the female workforce is more present in the independent activities rather than salaried. They represent 49.7% of self-employed workers compared to 33.2% of salaried workers. (ENES 2015). The preponderance of women in self-employment increases their vulnerability. These activities offer no social protections to actors in the event of economic difficulties or loss of business. In addition, these types of jobs are mainly entitled to low pay, which promotes their dependence on men, as well as the increase of gender inequalities in terms of income. The lack of productive jobs, the importance of informal activities and the low level of literacy of the population (particularly women) can explain this difficult economic and social situation.

To solve this situation, the government has set up an ambitious economic and social program called the "Senegal Emergent Plan (SEP)". This program, aims to transform the structure of the economy by improving the productivity of current growth drivers, improve human capital and local governance. The transformation of the economy involves the creation of infrastructures that encourage the attractiveness of investments in key sectors such as agriculture and services and the improvement of the business framework. Improving human capital means better access to school, health and social protection to fight against inequalities. Good governance aims to increase controls to ensure that budget resources are well managed. In this objective, governments make agriculture development a priority to revitalize the economy. This because agriculture occupies the majority of the assets and faces many difficulties. The agricultural component of the SEP intends to focus on "the control of water, the increase of productivity, and the improvement of the competitiveness of the sectors". Thus, the Senegalese government intends to increase the infrastructure for producing, processing and marketing agricultural products, fostering innovation and supporting farmers in the acquisition of inputs and adequate production equipment.

This study aims to evaluate the statistical effects of an increase in investments in public agricultural infrastructure, following an increase in the public investment budget in this sector, on the evolution of gender inequalities and well-being. It is also interested in the potential effects of increased agricultural subsidies on poverty and gender inequalities. The analysis pays particular attention to the effects on the labour market based on gender and the skills of the agents. The relevance of this research lies in the fact that agriculture is not only a priority for the government but also the country's largest employer. Its development can therefore be a lever to reduce income inequality but also poverty.

This research is articulated in six sections including this introduction. The section two provides a literature review on the impact that agriculture development can have on poverty and inequality, the effects of improving public infrastructure in an economy, and the issue of gender inequality. The third section discusses the methodological framework and data used to conduct this study. The fourth and fifth sections will present the framework of the study and the analysis of the different results of the simulations. The last section concludes.

2. Literature Review

The search for ways and means to eradicate poverty and reduce inequalities, especially those relate to gender, is at the heart of current public policies in developing countries. In this perspective, several studies have conducted to identify areas that could constitute levers for development and reveal the mechanisms by which public policies could be more effective. They help to understand the explanatory factors for the persistence of poverty. In many of these analyses, the agricultural sector and/or the public infrastructure sector occupy a prominent place. Indeed, many of them provide information on the role that agriculture and infrastructure can play together or separately in reducing poverty and inequality.

Thus, it appears that by its status as the leading employer in several poor countries, agriculture remains a lever of choice to reduce inequalities and poverty. (Diao et al. 2010). However, for several scholars such as Mellor (1995) and Gollin (2010), the agricultural sector can only be a real asset for development if it undergoes profound transformations. It must move from traditional agriculture to modern agriculture. This transformation requires the development of infrastructure to boost production and facilitate its commercialization. (Adelman, 2001).

This vision reinforced by the success of the green revolution in Asia between the late 1960s and the early 1970s. It has indeed established that an increase in agricultural productivity, through reallocation factors of production, with a view to modernizing agricultural farms, was generating growth (Estudillo and Otsuka 2010).

For the institutions in charge of development, the construction of better infrastructures has become paramount. This is because they promote lower transport costs, increased competition, reduced trade margins and contribute to improving farm incomes while offering better opportunities for private investors (FAO, 1996). This view is also supported by several empirical analysis that show that investing in infrastructure is critical to increasing farmers' access to inputs and opportunities. It makes it possible to stimulate the economy of rural areas while facilitating their integration into other national, regional and international markets. (Fan and Zhang 2004).

Zhang (2008) shows that in developing countries, where the agricultural sector is full of a majority of jobs (formal and/or informal), increasing productivity is a factor of economic development. This insofar as it contributes to reducing inequalities and poverty, especially in rural areas. This analysis follows a previous econometric study of the effects of government infrastructure spending on rural poverty reduction in India (Fan et al. 2000). In this study, the authors conclude that over the period 1970-1993, these expenditures positively influence the reduction of poverty. Indeed, through public investments in research and development, road and/or irrigation infrastructure, the government allows an increase in the productivity of agricultural factors. This situation leads to an increase in yields, which has a positive impact on farmers' incomes.

Baba et al. (2010), using an econometric model, also applied to India, show that the combination of private and public investment in the agricultural sector between 1969 and 2002 leads to higher economic growth. However, the poor redistribution of wealth has not made it possible to reduce significantly the evolution of poverty over this period. For Pinstup-Andersen et al. (2007), improving agricultural productivity requires not only the construction of infrastructure such as roads, storage areas, markets, etc., to facilitate access for farmers to marketing spaces; but also by the construction of irrigation systems, the adoption of new farming practices or the financing of inputs to improve agricultural yields and ensure quality production. In the same perspective, Arndt et al. (2000) demonstrates, using a computable general equilibrium model (CGEM) applied in Mozambique, that an improvement in agricultural productivity through the incorporation of new production technologies leads to higher operators' incomes. Moreover, since in Mozambican households agriculture more practiced by women than by men, women now have more income to support themselves. This could lead to an improvement in their living conditions and a reduction in the income gap between men and women. Improving agricultural productivity then becomes a lever for reducing gender inequalities. Different authors in several other countries will explore the positive link between the development of agriculture and the growth of public infrastructure. Using both econometric and CGEM models, these analysis will confirm the positive role played by the development of specific and/or structuring infrastructures, on the dynamism of economic activities in general and agricultural in particular. Irz et al. (2011) conclude that a 1% increase in agricultural GDP because of public investment in agriculture-related infrastructure leads to an average increase of 1.61% in the income of the top quintile poor in developing economies. Thirle et al. (2001) are in the same vein, demonstrating that a 1% increase in agricultural productivity in developing nations results in a reduction of 0.62% to 1.3% of the poor living in developing countries below the poverty line of less than one dollar a day.

Mogues et al. (2012), consider that investment in the agricultural sector is a factor of significant economic development. This is because of its ability to contribute not only to improving the health of individuals but also to improving their income. For the authors, investing in agriculture can improve productivity and influence the increase in farmer resources. In addition, this investment leads to a reduction in the prices of products that makes it possible to raise the purchasing power of households. Finally, the development of the agricultural sector allows an increase in production for self-consumption thus promoting food security and self-sufficiency. Sennoga et al. (2013) conclude that when public resources directed to sectors that can stimulate economic growth, such as agriculture, they can improve productivity and fight against poverty. Taking the case of Uganda, they show that a reallocation of resources allocated to non-productive sectors (public administration, security) to productive sectors such as agriculture leads to a reduction of poverty. This improvement in the level of poverty results from an increase in the productivity of agricultural capital that allows farmers to have more resources. This increase in productivity results from an increase in investments in agricultural infrastructure or an increase in structuring investments allowing the marketing of products. By studying the Ugandan plan to modernize agriculture with the help of a dynamic CGEM, Benin et al. (2008) conclude that, due to its good integration with the rest of the economy, an increase in investment in this sector will have positive effects on the rest of the economy. Zidouemba and Gérard (2015) investigate the effects of public investment on agricultural

productivity and food security in Burkina Faso. With the help of a dynamic CGEM, they show that public investment directed towards the agricultural sector favours an improvement of the economic growth of the country.

The economic literature also provides information on the negative impact that gender inequalities can have on economic development when they not tackled.

Cuberes et al. (2013) characterize gender inequalities as the significant gaps that exist between men and women both in the labour market and in the domestic sphere. These differences related to the fact that in many countries women discriminated against in accessing jobs in several productive sectors. These findings corroborate the conclusions of the WDR report, which reveals that the existence of discrimination against women in the access to the labour market impairs their productivity and affects the level of their salary compared to men. (WDR 2012). At the micro economic level, the theory of human capital, based on the study of Becker (1957), Mincer et al. (1974, 1993) on the functioning of the labour market, has given a scientific justification to the existence of gender inequalities. The gender inequalities would result from the difference in human capital, that is, the qualifications and/or experiences accumulated by the workers according to their sex. It is clear from the studies that, due to their roles in the domestic sphere, and also because of their reproductive function, women accumulate less human capital than men do. This situation explains that they are paid less than the latter because they are less productive. Unlike the theory of human capital, the theory of discrimination carried by Arrow (1971), Phelps (1972) etc., postulates that the level of human capital is not sufficient to justify the presence of gender inequalities. Indeed, econometric studies show that differences in productive characteristics account for 40% to 95% of the gender pay gap. (Havet 2004, L'Héritier 1992). As a result, for the proponents of the theory of discrimination, the inequalities of income and/or access to employment observed in the labour market are the result of an aversion of employers, co-workers or customers to categories of workers. These categories are usually women, and/or racial minorities. The persistence of gender inequalities observed at the microeconomic level will have an impact on macroeconomic variables. To account for these effects, a number of studies decide on the consequences of gender inequalities on economic growth. Cavalcanti and Tavares (2008) show, through a growth model in which they integrate wage discrimination against women in the United States that a 50% increase in the wage difference between the sexes leads to a reduction of per capita income and total production. Cuberes and Teignier (2012) conclude that when women are excluded from managerial positions, output per capita decreases by 12%, also leading to a proportional contraction in per capita income. In addition, they find that if women are totally excluded from the labour force, the loss in terms of per capita income could reach 40%. These analyses follow the research of Dollar and Gatti (1999), Forbes (2000), and Klasen (2003), who established that when women are excluded partially or totally from economic activity and/or when they are victims of wage discrimination, the production of the economy is negatively impacted. This negative impact results from the fact that the marginalization of women deprives the economy of a part of the factors of production while restricting the capacities of household consumption. These two situations prevent the optimal functioning of both the labour market and the goods and services market. By analysing gender inequalities related to access to education, Klasen and Lamanna (2009) determine that these have a negative effect on investment, job distribution and wages.

In addition, they conclude that gender inequality at the grassroots level does not have a significant negative effect on growth. However, persistent inequalities in access to education will affect negatively and significantly growth and income distribution. Indeed, these inequalities are detrimental to the productivity of the labour force in general and women in particular. They accentuate an unequal distribution of resources, which will increase poverty and hinder growth.

In the case of Senegal, the development of agriculture, public infrastructures and the study of gender inequalities have already been the subject of various analysis. Mesplé-Somps et al. (2000) analyse the impact of public infrastructures on the economy. This study, carried out with the help of a dynamic CGEM, aims to verify that the decline in the infrastructure deficit in Senegal can lead to an improvement in the country's economic and social situation. Their analysis shows that when domestic resources finance infrastructure, the economy benefits from a positive impact on its growth. However, with external resources, the opposite result occurs. Boccanfuso et al. (2007) study poverty reduction strategies with a static CGEM including a multi-household module. This methodological choice thus allows them a more detailed analysis of poverty situations. By focusing on the economic effects of a policy that increases agricultural productivity by 10%, the authors conclude that such a measure will improve the well-being of urban households. This improvement stems from lower prices resulting from an increase in the domestic supply of agricultural products. Cockburn et al. (2010) mobilized a sequential dynamic CGEM with micro simulations to analyse the effects of trade liberalization on poverty and gender inequalities. Their simulations reveal that rural households benefit more from the liberalization process than urban. On gender, there is an increase in gender pay disparities. This situation results from the fact that liberalization is more profitable for sectors intensive in male labour. On the other hand, male-headed households have a much lower level of poverty than those headed by women. Therefore, while liberalization leads to increased economic growth, this increase reinforces wage inequalities as well as those related to access to jobs between men and women. Savard et al. (2012) study the effects of several policies, in relation to official development assistance, foreign direct investment and foreign trade, on poverty and inequality. Through a multi-household CGEM, they conclude that an increase in agricultural productive capital is an asset in reducing poverty of rural households.

In view of the analysis presented above, it appears that for Senegal, the question of reducing gender inequalities through public investment in agricultural infrastructure has not specifically studied. Therefore, in this research, we will contribute to the debate on the impact of agricultural public investments on poverty and gender inequalities.

3. Methodology

Increased public investment in infrastructure may have convergent and/or divergent effects on all of a nation's economic variables. Therefore, in order to take into account all the effects of such an economic policy on agents' behaviours, we use a CGEM as a methodological tool for analysis. Thanks to their ability to take into account the overall structure of an economy, while describing the interrelations that may exist between agents, the CGEM s seem to us to be the appropriate methodological framework for such an analysis.

3.1. The model

The model we use for our analysis is constructed from the PEP 1-t model of Decaluwé et al. (2013). It is a dynamic CGEM that incorporates the classical features of the general equilibrium. In this model, the process of maximizing producer profit is done by integrating the technological constraint related to production. Producers have both the opportunity to sell their goods on the local market or in the international (export) market. This possibility depends on the elasticity of the transformation of the products in relation to different markets. This duality made possible by a function with constant elasticity of transformation (CET). Consumers, for their part, maximize their utility by considering the budget constraint. They have the opportunity to consume local or imported products; this choice described in the model through a utility function with constant elasticity of substitution, which highlights an imperfect substitution between locally produced goods and those coming from outside (Armington Hypothesis). The elasticity values of the CES and CET are based on the research of Zidouemba et al. (2015).

The balance between supply and demand in all the different markets are obtained through the variation of relative prices within the model. In the model, household resources come from wages (which correspond to earnings from the labour factor), dividends (return on capital), and transfers from other agents. These resources are used for their consumption as well as the creation of savings. This is modelled as a fixed part of disposable income.

Government revenue comes from tax revenues and transfers received from other agents. These resources will be used for public expenditure and the payment of transfers to non-governmental agents. For the purposes of the study and in order to get as close as possible to the realities of the Senegalese economy, certain aspects of the model have been modified compared to the basic version.

• Production

Production is calculated through a multi-level function. At the top, it is the result of a combination of value added and intermediate consumption through a Leontief function. Output is therefore a fixed proportion by volume of value added and intermediate consumption. Producers' profit maximization therefore is done by considering the prices of production factors (prices of capital and wages) as well as intermediate inputs. Value added at the second level of the production function modelled through a function with constant elasticity of substitution (CES) between labour and capital factors. This choice of function allows producers to respond to changes in factor returns by substituting them for their needs and availability. For the purpose of our study, we disaggregated the factor by sex and level of proficiency. As a result, the different sectors have the possibility of using six categories of labour, thus forming the composite labour LDC, which will be the only one to combine with the capital. These are men and women depending on whether they are skilled, semi-skilled or unskilled. Their matching made possible through a CES function. The calibration of the CES function done so that it combines, for each industry, labour by gender when workers have the same level of qualification. Therefore, the model substitutes male and female labour if and only if their level of qualification is identical. Technically, this means that the company first decides what skill

level it needs, and then, whether a woman or a man in that particular skill level, but not the other way around, should do the work. (See. Figure 1).

This choice of modelling, which corresponds to a better representation of the Senegalese labour market, is the first contribution of this research compared to the basic model. In the semi-skilled and unskilled labour market, we postulate that labour is more physical than technical or intellectual. Therefore, it is more advantageous for men than for women. In the skilled labour market, we assume that the labour is mostly intellectual or even technical. Therefore, we assume that women have a better chance of getting a job. These rigidities in the substitution of female and male labour according to the level of qualification modelled thanks to the elasticities of labour. The aggregation of skilled, semi-skilled and unskilled labour into a composite workforce by sex and different skill levels derived from a CES function that is as follows:

$$LDC_j = B_{LDj} * [\beta_{LDj} * LQ_j^{-\rho_{LDj}} + \alpha_{LDj} * LMQ_j^{-\rho_{LDj}} + (1 - \beta - \alpha) * LNQ_j^{-\rho_{LDj}}]^{-1/\rho_{LDj}}$$

With:

LDC_j : *composit labour demand*;

B_{LDj} : *scale parameter for CES function*;

β_{LDj} : *share parameter for CES function*;

α_{LDj} : *share parameter for CES function*;

ρ_{LDj} : *elasticity of substitution*;

LQ_j : *composit skilled labour demand*;

LMQ_j : *composit semi – skilled labour demand*;

LNQ_j : *composit unskilled labour demand*.

The following equation describes the aggregation of labour by gender in the skilled labour force through a CES function. We do the same for unskilled and semi-skilled workers.

$$LQ_j = B_{Qj} * [\beta_{Qj} * LHQ_j^{-\rho_{Qj}} + (1 - \beta_{Qj}) * LFQ_j^{-\rho_{Qj}}]^{-1/\rho_{Qj}}$$

In addition, the capital accumulation equation has also been modified to incorporate the creation of new agricultural public investment into the capital stock. To do this, the accumulation of capital has split into two equations, representing the stock of agricultural and non-agricultural capital. The agricultural capital stock equation thus incorporates new agricultural public investment while the non-agricultural capital equation remains similar to the base model. Thus, the farm capital stock equation at period t depends on the capital stock in the period $t - 1$ the rate of capital depreciation, private agricultural investment in $t - 1$ and public agricultural investment in $t - 1$.

• The labour market

Unlike the basic PEP 1-t model, in which full employment of factors is assumed, our model integrates the existence of unemployment. For the case of Senegal, unemployment is introduced by modifying the labour supply function. In the model, unemployment concerns only skilled and semi-skilled workers. In addition, to take into account the adjustments between the unemployment rate and the wage level, a wage-curve is introduced with reference to the method of Blanchflower and Oswald (1994).

- **The closure of the model**

The closure of the model highlights a number of strong assumptions. Thus, international prices are exogenous, in order to respect the small country hypothesis. The underlying idea is that Senegal cannot influence price developments in international markets. In addition, the current account balance also fixed to highlight the fact that it is impossible for a country of this type to go into debt indefinitely on the rest of the world. The supply of labour in our model as well as the incompressible consumption are also exogenous it is fixed at the first period and then it increases at the population growth rate. Like the basic model, the volume of public investment, public expenditure and capital stock kept exogenous. We have added the public agricultural investment budget in order to apply our shock to this variable, which remains our variable of interest.

- **The micro simulation model**

Inspired by the toolkit of Tiberti et al. (2017), it is based not only on some of the results from the CGEM but also on microeconomic elements from Senegal's 2011 household survey. For example, the CGEM BAU data on labour demand (by type of labour), wages (by type of labour), household income (by household type) and consumer prices compared with results of different simulations. By comparing the BAU data with the CGEM results over the chosen analysis period, the micro simulation model calculates the poverty indicators. Thus, according to the characteristics of the persons who are informed by the household survey (income level, gender, level of education, level of consumption by type of products, etc.), the model determines the impact of the CGEM's macroeconomic results on poverty and inequality. To do this, it determines the Foster-Greene-Thorbecke (FGT) indicators for the incidence of poverty and the depth of poverty as well as the Gini index.

3.2. Data

The data used for the analysis comes mainly from two sources. On the one hand, there is the 2011 Social Accounting Matrix (SAM) of Fofana et al. (2014), updated to the 2015 data from which we have built a matrix more in line with the problematic of the study.

The changes we made, were to disaggregate the factor by gender (male and female) and by level of qualification. The skill level depends on the level of education. Moreover, using data from the household survey entitled the 2011 Poverty Monitoring Survey of Senegal (ESP II), it was possible to postpone the disaggregation of labour according to gender and skills within the twenty-two (22) production sectors that we selected. For this purpose, in deciding on the effects of economic reforms on economic agents, whether they are men or women, we need to highlight this dimension in the structure of the labour market. The household survey also allowed us to perform this disaggregation by calculating the distribution by gender for all sectors of the economy. In addition, the National Employment Survey (ENES 2015) provided information on unemployment rates by gender and qualifications.

4. Overview of simulated policies

4.1. Increase in public investment budget in agriculture

Content within axis 1 of the SEP entitled "Structural transformation of the economy and growth" the vitality and development of agriculture is a priority for the public authorities. The agricultural sector is indeed essential for the Senegalese economy, insofar as it remains the main source of income for the majority of households. Therefore, due to low storage capacity, difficult access to quality fertilizers, lack of control of irrigation techniques or lack of funding, agriculture does not play a leading role in the country's economic performance. This unattractive picture is also the result of a lack of structuring infrastructure to facilitate the marketing of products, and to attract investors. To solve this problem, the SEP is considering increasing initiatives to transform traditional farms into modern and competitive units. It is therefore a question of encouraging the development of farms with adequate irrigation systems and agricultural equipment to produce more and better. This desire responds to the need to increase the country's attractiveness to potential new private investors but also to facilitate the sale of products to national, sub-regional and international markets. Particular emphasis placed on the construction and maintenance of a reliable road network to open up production areas. This vast agricultural recovery plan must ultimately lead to an improvement in the productivity of factors of production, and lead to an increase in the economic performance of the sector. The aim is to make agriculture the engine of sustainable growth through not only increased production but also the creation of stable and quality jobs.

4.2. Increase in agricultural subsidies

In order to increase farmers' chances of success, the public authorities intend to diversify the means by which they will accompany them in their productive process. Thus, while it is true that the PES puts a particular emphasis on the realization of infrastructures, other avenues have also proposed. Indeed, the government intends to diversify its support by putting in place a specific system to support the SMEs / SMIs that evolve in this sector. This is because SMEs / SMIs are the lever for the vitality of the economy. Therefore, the government intends to promote the advent of an innovative financing system, allowing farmers to acquire agricultural inputs of good quality. This financing system will also enable them to equip their farms with adapted production equipment to modernize production units and increase production yields. To this end, several public programs are working not only to rebuild Senegal's seed capital, but also to modernize both production practices and the equipment used to produce.

5. Results and discussions

Referring to the priorities identified by the PES and based on the three-year public investment program for the period 2018-2020, we first simulate an increase in the public agricultural investment budget of 36%. This increase will be gradual at 16% in 2018 and 10% in 2019 and 2020. In a second step, we simulate an increase in agricultural production subsidies of 36% over the period 2018-2020. The results will be analysed and discussed, looking in turn at the effects on macroeconomic and sectoral variables in both short and long term.

5.1. Increase in public investment budget in agriculture

5.1.1. Impact on macroeconomic indicators

- **Short term**

The increase in the public agricultural investment budget is supposed to lead to an increase in the volume of agricultural investments. This increase in the volume of agricultural investment reflects an increase in public agricultural infrastructure and an increase in the stock of agricultural capital. As a result, production in the agricultural sector is expected to increase, which should lead to higher incomes for farmers and wage earners and their households. Income growth should, subject to a controlled evolution of the consumer price index, induce an increase in household consumption and positively affect economic growth. The obtained results show a positive effect of the measure on real GDP growth of 0.13% in the short term. This statistic reflects the fact that the development of infrastructure related to the agricultural sector is a channel for improving growth in Senegal. The rise in real GDP should lead to a drop in unemployment rates and an increase in the demand for unskilled labour in order to maintain the momentum of business wealth creation. This hypothesis confirmed to a certain extent because unemployment rates for skilled workers are falling while unemployment is rising for the semi-skilled. The rise in the unemployment rate for this segment of the labour market could be explained by the fact that the construction of infrastructure mobilizes more initially, as a first step, workers with a high level of qualifications. As a result, workers with high human capital benefit more from the measure. A comparison of trends in unemployment rates by gender shows that men are doing better than women. Indeed, the increase in unemployment among the semi-skilled is 0.05% for men against 0.17% for women. Among skilled workers, the decline in unemployment is also greater among men (-0.12%) compared to women (-0.03%). This unfavourable trend for women can lead to a rise of inequalities in access to the labour market. In addition, rising unemployment rates for semi-skilled workers should lead to lower wage rates in this segment of the labour market. Indeed, with unemployment rising for this category of labour, it is possible to assume that companies are now more able to replace this type of workforce. As a result, they have an advantage in negotiating wage levels with workers. Conversely, the decrease in unemployment observed among skilled workers should induce an increase in wages for this category of labour. This is because the fall in unemployment is creating a "scarcity effect" for skilled workers. Being in great demand, they can then "impose" their demands on companies in terms of salary compensation.

The results show an increase in wages for all categories of the labour market. There is indeed a rise of 0.09% in the wages of semi-skilled men and women, of 0.004% for unskilled men against 0.02% for their female counterparts and 0.13% for qualified men against 0.12% for qualified women. These counterintuitive results for the semi-skilled workforce could be explained by the fact that the policy favours an improvement in the competitiveness of firms, which would encourage them to increase the wages of their employees.

Gender comparisons by skill level of wage developments indicate a benefit for women among unskilled workers. At the level of the semi-skilled workforce, the evolutions are equivalent whereas at the level of the qualified employees one discerns a slight advantage for the men. Therefore, there should be a reduction in gender wage gaps. This is especially true since women

are mainly present in the unskilled labour force, a segment of the labour market in which their income is much higher than that of men.

The analysis of the real consumer price index shows a rise in prices of around 0.08%. The rise in the consumer price index, which is relatively smaller than the increase in average wage earners, suggests a positive effect on consumption. Therefore, we should expect that household consumption does not fluctuate positively.

On another level, the analysis of total investment shows that the latter is up 0.17%. This upward trend in total investment hides, however, the existence of a crowding-out effect between public investment and private investment. In fact, there is a reduction in private investment in the short term of 2.03%.

- **Long-term**

GDP grows by 0.26%. This dynamic of real GDP growth has positive effects on employment growth. This record shows a reduction in unemployment rates for all categories of the labour market. An analysis of the evolution of unemployment rates by gender shows a mixed result. In fact, for semi-skilled workers, the female unemployment rate (-0.15%) is lower than that of men (-0.09%). Conversely, we find that the unemployment rate of skilled men (-0.64%) is reduced more than that of skilled women (-0.58%). Overall, the decline in unemployment rates reflects the positive effect that this policy has on employment, without allowing to identify a sustainable trend pro women or pro men. The reduction in unemployment reflects an improvement in job opportunities for assets. It also leads to a labour scarcity effect that gives workers an advantage during wage bargaining. As a result, since workers are in a strong position, they can ask for higher wages. We should therefore see an increase in wages paid by companies. This hypothesis confirmed by the results, which shows a rise of 0.11% for the wages of unskilled men, 0.15% for unskilled women, 0.22% for medium-skilled men and 0.23% for their female counterparts. Among skilled workers, men's wages increase by 0.28% while women's wages increase by 0.27%. It is clear that women's wages are mostly higher than those of men. This rise is very marked among unskilled workers, which is rather positive insofar as, in the Senegalese economy, the majority of women are working in this segment of the labour market. Because of this overall advantage of women in comparison men, it is possible to say that the developed policy leads to a reduction of gender inequalities in terms of wage income distributed in Senegal. As for the consumer price index, we note that it is still rising (+ 0.21%), which could be an obstacle for the evolution of the purchasing power of households. However, in view of the magnitude of the increase in the number of jobs created, combined with the increase in wages paid, overall household incomes should increase in order to stem the potential negative effects of inflation. Finally, the growth momentum of total investment is continuing to intensify (+ 0.28%). Investment growth supported not only by the increase in public investment, which is up by 0.19%, but also by the rise in private investment of 0.23%. It therefore appears that the crowding-out effect noted in the short term has disappeared, and that the policy has had the effect of boosting the investments made by companies.

5.1.2. Sectoral results

There is a proportional increase in production and value added in food and export agriculture of 0.16% and 6.69% respectively in the short term. The growth of production in food and export

agriculture should lead to an increase in the demand for labour expressed by these different sectors. Indeed, the increase in production in labour-intensive sectors such as agriculture should push companies to hire more to meet their new production targets. However, the results on the aggregate labour demand of the agricultural sectors show a reduction of 0.24% for subsistence agriculture and 4.91% for export agriculture. An analysis of changes in the demand for agricultural labour according to gender and skill levels does not provide any exceptions. Indeed, all segments of the labour market see their demand contract. However, there are some differences in the size of the decreases. Thus, among unskilled workers, the demand for labour in subsistence agriculture shrank 0.23% for men and 0.25% for women. For semi-skilled workers, there is a reduction of 0.31% for men and 0.30% for women. Finally, among skilled workers, the demand for men's labour reduced by 0.33% and by 0.32% for women. In export agriculture, the demand for unskilled workers is down 4.89% for men and 4.91% for women. At the level of medium-skilled and skilled workers, there is a reduction in labour demand of 4.96% and 4.99% respectively for men and women.

The decline in the demand for labour highlights the fact that the measure further favours the use of capital to produce. At the same time, there should be an increase in the demand for farm capital. This hypothesis is confirmed by the results, which show an increase in demand for capital in subsistence agriculture of 0.71% and 26% in export agriculture. The analysis of agricultural foreign trade shows that the policy implemented favours a reduction in imports and an increase in exports. Indeed, the increase in agricultural production generated by the measure results in a drop of 0.08% in imports from food crops and 3.90% in export agriculture. Exports for their part grow by 0.21% for food crops and 8.21% for exports. The good performances of the agricultural sectors that we note, show that the development of agricultural infrastructures makes it possible to improve the competitiveness of the sectors. On the other hand, if this trend confirmed in the long term, the agricultural sectors could become levers to reduce the structural deficit of Senegal's trade balance.

In the long term, short trends tend to be prolonged and intensified. As far as production is concerned, it continues to grow both for food crops (0.34%) and for export agriculture (17.83%). This increase in production does not have a ripple effect on the demand for labour expressed by the agricultural sectors. In fact, there is a contraction in the demand for labour expressed by the food-farming branch of 0.54% and 10.71% for export agriculture. A more detailed analysis of labour demands by gender and qualifications shows that the overall trend reflected at all levels of the labour market. Thus, for food crops, there is a reduction of 0.51% for unskilled men against 0.56% for women. Among semi-skilled workers, the demand for labour shrinks by 0.61% for women against 0.60% for men. Finally, at the level of skilled workers, the demand for agricultural labour reduced by 0.64%.

As a result, it appears that the subsistence agriculture sector is further reducing its demand for female labour. In the case of export agriculture, particularly among unskilled workers, there is a 10.73% reduction in the demand for female labour and a 10.69% reduction in male demand. At the level of semi-skilled workers, the labour demand shrinks by 10.76% for men against 10.75% for women. The demand for skilled labour fell by 10.80%. Conversely, demand for capital continues to grow. It increases by 1.50% in subsistence agriculture and by 69% in export agriculture.

The analysis of the foreign trade results of the agricultural sectors shows an increase in exports and a fall in imports. In fact, exports of food crops grew by 0.45% while those of export agriculture increased by 21.50%. On the other hand, imports fell by 0.11% in food crops and by 8.24% in export crops. These statistics confirm the short-term trend in the potential of agriculture to reduce the structural deficit of the trade balance and reinforce the hypothesis of improving the price competitiveness of agricultural value chains. The analysis of the output of the twenty other sectors of the economy reveals, in the short term, that the production of seventeen of them is in regression. Only the livestock (+ 0.03%), construction (+ 0.05%) and trade (+ 0.02%) sectors are experiencing growth in their production. In sectors where production is increasing, there is an increase in the demand for labour. Thus, in the livestock sector, the demand for composite labour increases by 0.06%. In construction and trade, the demand for labour increases by 0.14% and 0.01% respectively. This general increase, however, hides some specificities according to the branches of activity.

In the livestock sector, there is a decline in the demand for skilled labour. This decrease is greater for male labour (-0.01%) than for men (-0.006%). Similarly, while the demand for semi-skilled and unskilled labour tends to increase, it increases more for men than for women. This is an increase of 0.08% for unskilled men versus 0.06% for women and 0.008% for semi-skilled men versus 0.006% for women. With regard to the construction sector, the increase in production leads to an increase of the demand for labour for all segments of the labour market. This increase is more favourable for men (+ 0.19%) than for women (+ 0.17%) for unskilled labour, and more favourable for women (+ 0.10%) than men (+0.09%) for skilled labour. At the level of semi-skilled workers, the increase in demand is 0.12% for both categories of labour. Finally, at the trade level, only 0.05% for men and 0.03% for women are rising for unskilled workers. Among skilled workers, there is a reduction of 0.04% for men and 0.03% for women. In the semi-skilled segment, the demand for labour fell for men and women by 0.02%.

If the fall in output recorded in other sectors of the economy expected to lead to a reduction in their demand for labour, it is clear that this is not the case for all sectors. In forestry, the food industry, the production of water, electricity and gas, transport, telecommunications, finance, real estate, training, and health, we are witnessing an increase in the demand for labour. This situation can be explained by the fact that these sectors, following the crisis they are going through, are reducing the capital they use considerably. Therefore, to maintain a certain level of production, they use more labour. Within these sectors, the sharp rise in the cost of using capital in relation to that of labour could explain this situation. With regard to the gender aspects, the demand for labour changes favourably for women compared to men when they are qualified and in all sectors. In the remaining sectors (extractive activities, non-food production, repair, accommodation, corporate services, public administration, personal activities), as we could intuitively expect, a reduction in the demand for labour but also in demand of capital.

In the long term, short trends continue for all sectors except construction. In fact, value added of this sector, which was expanding, is reduced by 0.005%. This decline, however, does not have an impact on the labour demand of the sector, which continues to grow. On the other hand, the sector's demand for capital (-0.35%) is more important, suggesting that the latter is substituting more capital for labour. The analysis of foreign trade highlights an increase in imports in all sectors of activity with the exception of extractive activities. This increase occurs

in the short and long term. With regard to exports, it appears that they were reduced for all products traded with the rest of the world in both the short and long term.

5.1.3. Impact on agents

In the case of households, the results show a growth in their incomes of 0.11% in the short term and 0.24% in the long term, without considering their place of residence. The rise in household incomes should lead to an increase in their consumption and savings. Our hypothesis confirmed by the results, which show an increase in household consumption and savings proportional to their income in the short and long term. The analysis of corporate accounts shows that their revenues are constantly rising. They increase by 0.18% in the short term against 0.29% in the long term. This positive performance should give them substantial means to increase their savings and therefore invest. The evolution of corporate savings confirms our assumptions as their savings increase by 0.17% in the short term and 0.28% in the long term.

The growth of household and corporate savings leads to an increase in resources to finance private investment. This may explain the disappearance of the crowding out effect of private investment in the short term.

As far as the government is concerned, its resources should increase. Indeed, the measure favours an increase in household and business income. This leads to increased consumption and production (of some sectors), anything that could lead to higher tax revenues. The analysis of the results reinforces this idea as we see an increase in government revenues of 0.16% in the short term and 0.26% in the long term. This increase in government income allows it to save to the extent that public spending fixed over the period. We note a rise in government savings of 0.45% in the short term and 0.57% in the long term.

5.1.4. Poverty impact

To assess the evolution of poverty and inequalities more precisely, we analysed the evolution of the FGT0, FGT1 and the Gini index indicators over our study period. Indicators FGT0 and FGT1 reflect changes in the incidence of poverty and the depth of poverty. The results show a reduction in the number of poor, a reduction in the income gap between the poor and the poverty line, and a decline in income inequality. In fact, the incidence of poverty reduced by 1.69%, the depth of poverty decreases by 1.62% and inequalities contract by 0.02% in the short term. In the long term, the number of poor people drops by 5.65%, the gap between the incomes of the poor and the poverty line reduced by 8.46%. Income inequality decreases by 2.82%.

5.2. Increase in agricultural subsidies

5.2.1. Impact on macroeconomic indicators

- **Short term**

The increase in subsidies to farmers should lead to increased resources for them. Therefore, it is assumed that their surplus income would be reinvested to produce more. The resulting increase in agricultural output is expected to drive up the demand for labour. Thus, since the agricultural sector is more labour-intensive than capital-intensive, it should have a positive effect on employment. We therefore assume that such a measure will lead to a reduction in

unemployment and will lead to an increase in the income distributed to agricultural workers and indirectly to their households. The rise in income would then result in increased consumption of households, which would lead to an increase in production and therefore growth. The results obtained are in line with the hypotheses previously formulated. Indeed, a positive evolution of real GDP is 0.10% in the short term. This statistic, which reflects an improvement in economic growth, shows the fact that the strengthening of government support for the agricultural sectors has positive effects on economic development. The effects of real GDP growth on employment should be reflected in lower unemployment. This is because as agricultural firms grow in production, they should seek to hire more workers to produce.

This assumption confirmed to the extent that we are witnessing a decline in unemployment rates for all segments of the labour market. An analysis of the evolution of unemployment by gender and skills shows that unemployment falls more for women than for men. For semi-skilled workers, the unemployment of men reduced by 0.17% against 0.27% for women. Similarly, among skilled workers, female unemployment fell by 0.22% compared to 0.04% for men. The reduction in unemployment should also have a positive effect on wages. In fact, the fall in unemployment could create a situation of scarcity of labour, which will give workers a certain flexibility to negotiate up their wages. As a result, there should be an increase in wage rates. The results confirm this hypothesis because we notice that the wages of unskilled workers grow by 0.18% for men against 0.19% for women; among semi-skilled workers, women's wages fluctuate by 0.10% compared to 0.09% for their male counterparts; finally, at the level of skilled labour, men's wages amount to 0.08% compared to 0.09% for their female counterparts. These trends should favour a reduction of gender income gaps across skill levels. However, it should also lead to a reduction in the inequalities linked to access to employment according to gender and skills, because the female workforce is proving to be more in demand than men are.

The analysis of the evolution of the real consumer price index shows a price increase of around 0.07%. This relatively moderate rise in prices, combined with rising wages, will probably lead to an increase in household consumption. The total investment fell by 0.004%. This statistic is not surprising in that the investment linked by the acquisition of capital. Thus, since the policy implemented favours more the labour factor than the use of capital to produce, companies prefer to substitute the realization of capital investment by the recruitment of more labour.

- **Long term**

GDP growth continues but less strongly. The increase is 0.009%. This dynamic of real GDP growth also has less positive effects on employment growth. This result shows a reduction in the unemployment rate exclusively for qualified men (-0.01%). In terms of other types of labour, there is therefore an increase in unemployment of around 0.01% for semi-skilled men, 0.02% for medium-skilled women and 0.003% for qualified women. An analysis of the evolution of unemployment rates by gender leads to a more favourable trend for men rather than women. In general, the rise in unemployment rates reflects the inability of this economic policy, in the long term, to generate sustainable jobs. The increase in unemployment reflects a deterioration in job opportunities for assets. It also gives more power to companies in setting wages. As a result, since workers are in a weak position, they will no longer be able to negotiate higher wages. We should therefore witness a regression of wages paid by companies. This assumption is not supported by findings that show an increase of 0.003% for the wages of

unskilled men and women, 0.009% for semi-skilled workers, and 0.13% for skilled men versus 0.11% for skilled women. This counterintuitive situation might be justified by the fact that by shedding part of its labour force, firms are saving on structures that allow them to increase the wages of the remaining workers in activity.

As for the consumer price index, we note that it is still up (+ 0.01%), but in a much lower proportion than before. This state of affairs could be an asset for the evolution of household purchasing power. Indeed, faced with unemployment that increases almost for all components of the labour market and revenues at the same time that grow very weakly, a small price variation could help preserve the purchasing power of households.

Finally, the total investment grows by 0.01%. This growth supported by private investment, which increases by the same percentage. Therefore, companies will prefer to invest in the acquisition of capital and free labour in order to be more competitive.

5.2.2. Sectoral results

The increase in agricultural subsidies to producers should positively affect the evolution of production in both sectors. An increase in subsidies gives producers more resources to allocate to production. Therefore, they should increase their production capacity either by investing or by recruiting more labour. The analysis of the results shows a different impact of the measure on the two agricultural sectors. Indeed, at the level of food farming, the policy has no effect of training on production. The latter tends to fall by 0.01% in the short term and 0.004% in the long term. In the case of export agriculture, conversely, there is an increase of 6.55% in the short term and 0.38% in the long term. This result could be explained by the size of the subsidies paid. Indeed, given that subsidies for export agriculture are larger than subsistence agriculture, farmers will focus on this type of agriculture. Output growth in export agriculture should lead to an increase in labour demand expressed by this sector. Since agriculture is a traditionally labour-intensive sector, it is expected that an increase in the production of such a sector would lead to an increase in the need for labour. In contrast, the reduction in food crop production is expected to lead to a contraction in the labour demand of this sector.

The results confirm the assumptions made in the context of subsistence agriculture. In fact, there is a reduction in labour demand of 0.02% in the short term and 0.0002% in the long term. With regard to export agriculture, the results only partially confirm the assumptions made previously. It appears that the labour demand of the sector increases in the short term by 10.52% but contracts in the long term by 0.26%.

The analysis of the evolution of the demand for agricultural labour according to gender and skill levels reveals some specificities. Thus, in food-producing agriculture, the labour demand of unskilled men is the one that regresses the most in the short term. It decreases by 0.35% when that of unskilled women only decreases by 0.05%. In the semi-skilled market, however, there is an increase in the demand for labour. This increase is more favourable for men (+ 0.03%) than for women (+ 0.02%). For skilled workers, there is also an increase in the demand for labour with an advantage for male workers (+ 0.04%) compared to women (+ 0.02%). In the long term, it is expected that the demand for labour is shrinking for all categories of the labour market. This contraction is more important for men than for women. In the case of export agriculture, there is an increase in the demand at short-term for all segments of the labour market. This increase in the agricultural labour market as a whole is more favourable to men

than to women. This is illustrated by the fact that the demand for agricultural labour for unskilled male labour increases by 10.51% compared with 10.49% for women with the same level of qualifications. The situation continues at the level of semi-skilled and skilled workers whose labour demands increase respectively 10.58% for men against 10.57% for women and 10.60% against 10.58%. In the long term, there is a reduction in the labour demand expressed by the industry for all segments of labour market in the same proportions. In view of these results, we should see a rise in gender inequalities related to access to jobs in the export agriculture sector in the short term. This trend is likely to stagnate in the long term as the sector reduces its labour demand in the same proportions for all workers. The analysis of the agricultural foreign trade makes it possible to observe that the realized policy has different effects according to the type of agriculture. As was the case for the effects noted on production, we note that the measure has a positive effect on the export agriculture sector. There is therefore an increase in exports of 8% in the short term and 0.46% in the long term. On the import side, there is a reduction in imports of products in the order of 3.74% in the short term and 0.20% in the long term. These results make it possible to assert that the agricultural subsidy policy allows the export agriculture sector to be more competitive. With regard to food crops, we realize that, as expected, the decline in production leads to a reduction in exports both in the short term (-0.10%) and in the long term (-0.007%). This reduction in exports favours an increase in imports of food crop products of 0.12% in the short term and 0.002% in the long term. The expansion of imports and the reduction of exports highlight a deterioration in the competitiveness of the sector. It also reinforces the hypothesis that the practice of subsistence agriculture, because of the low subsidies it receives in comparison with export agriculture, becomes less attractive to farmers.

Analysis of the output of other sectors shows that only seven of them experience an improvement in their production in the short term. These are livestock (+ 0.02%), forestry (+ 0.005%), food industry (+ 0.1%), water and electricity production (+ 0.01%), trade (+ 0.01%), training (+ 0.006%) and health (+ 0.13%). The increase in their production also leads to an increase in their labour demand of 0.02%, 0.08%, 0.11%, 0.007%, 0.01% and 0.18%, and 0.04% respectively.

The gender and skill comparison of changing labour demands in the growing sectors shows an increase for all segments of the labour market. In addition, the labour demand for male relatively more sought after than female. In sectors with declining production, there are two situations. In some cases, sectors reduce the use of capital much more. In return, they hire additional labour. This is the case in telecommunications, finance and real estate. In the other sectors, on the contrary, there is a reduction in the demand for labour and capital. In terms of foreign trade, exports are declining for all commodities while imports are rising for almost all sectors. There are only two sectors in which imports are shrinking, namely mining (-0.05%) and corporate services (-0.05%). This situation will lead to an increase in the trade deficit.

In the long term, the output of all non-agricultural sectors decreases. This contraction in production has mixed effects on labour demands. In forestry, the non-food industry, energy production, construction, transport, telecommunications, finance, real estate, corporate services, training, and health, the demand grows. In other sectors, however, there is a reduction in the labour demand.

The increase in the labour demand in crisis sectors can be explained by the fact that a proportionally greater reduction of the capital used by these sectors achieved. This decline in the use of capital stems from the increase in the user cost of capital, which makes the labour factor cheaper. Overall, we note that the evolution of labour demands is more beneficial to women than to men. With regard to foreign trade, it is noted that the latter continues to deteriorate in the long term. Indeed, exports continue to decline while imports continue to increase. It must be emphasized, however, that these changes are occurring in smaller proportions than those that prevailed in the short term.

5.2.3. Impact on agents

In terms of households, the results show an increase in their incomes of 0.12% for urban and 0.14% for rural in the short term. In the long term, the incomes of urban people increase by 0.009% against 0.008% for rural people. The rise in household incomes should lead to an increase in their consumption and savings. Our hypothesis confirmed by the results, which show an increase in consumption of 0.12% for urban versus 0.14% for rural people in the short term and respectively 0.008% and 0.009% in the long term. Household savings, on the other hand, grow in proportion to their income in both the short and long term. Companies also see their revenues increase 0.10% in the short term against 0.01% in the long term. This positive performance, which stems mainly from the very good performance of export agriculture, should enable them to increase their savings and thus contribute to the national investment effort. The evolution of corporate savings confirms our assumptions as savings are up 0.10% in the short term and 0.01% in the long term.

As far as the government is concerned, its resources should fall in the short term and increase in the long term. Indeed, since subsidies financed by a tax break, the tax revenues collected by the government are supposed to be reduced. In the long term, however, the rise in household consumption expected to increase fiscal resources and raise government revenue. The analysis of the results makes it possible to reinforce the various hypotheses insofar as there is a reduction in government revenues of 0.09% in the short term and an increase of 0.01% in the long term. The drop in government revenues in the short term led to a contraction in government savings of 0.31%. In the long term, higher incomes allow the government to reduce the deficit of its savings by increasing it by 0.02%.

5.2.4. Poverty impact

The analysis of poverty indicators shows that the incidence of poverty reduced by 0.11%, the depth of poverty decreases by 1.91%, and inequality decreases by 1.97%. The evolution of poverty and inequality indicators confirms the dynamics of macroeconomic results. The latter already highlighted the fact that household incomes were increasing, as was their consumption. Which allowed supposing an improvement of their well-being, which confirmed with the results in presence. In addition, declining unemployment rates for women and rising wages, which contribute to the reduction of inequalities in access to the labour market and in the distribution of income, made it possible to hope for a reduction in gender inequalities in the labour market. In addition, the relatively similar increase in household incomes, both urban and rural, suggested that the policy could reduce income inequality in geographic areas. In the long term, the number of poor increases by 1.43%, the gap between the incomes of the poor and the poverty

line increases by 2.66% and income inequality increases by 1.14%. These results are also in line with macroeconomic data, as unemployment is on the upswing, wage growth is much smaller than in the short term, as is the increase in household income.

6. CONCLUSION

Ultimately, it appears that increased investment in public agricultural infrastructure, and increased agricultural subsidies have different effects on the Senegalese economy. These two economic measures promote an increase in real GDP in the short and long term. In both cases, the good performance of GDP mainly based on the good performance of farming. If both policies lead to an overall increase in the incomes of employees, the first simulation obtains the lasting effects on unemployment. It leads to a reduction in unemployment in two out of four categories of the labour market in the short term, and in all segments of the labour market in the long term. The second scenario leads to a fall in unemployment for all workers in the short term, but in the long term, this trend not perpetuated, if not to a small extent, among skilled men. An analysis of data related to changes in wage rates and unemployment by gender shows that financing infrastructure is more conducive to promoting women's employment and improving their earnings. With regard to foreign trade, the first policy favours an improvement in the competitiveness of the agricultural sectors both in the short and long term. On the other hand, the second policy improves the performance of export agriculture in both the short and long term. With regard to other sectors of the economy, it appears that the two policies are incapable of creating a ripple effect on the latter. Thus, imports tend to increase and exports decrease.

Analysis of poverty indicators and the Gini index states that financing agricultural infrastructure has lasting effects in terms of reducing poverty and inequality rather than providing subsidies.

REFERENCES

- Adelman, I. (2001): « Fallacies in development theory and their implications for policy ». In G. M. Meier, & J. E. Stiglitz (Eds.), *Frontiers of development economics: The future in perspective* (pp. 103–135). New York: World Bank
- Arndt, C., Jensen, H. T., Robinson, S., & Tarp, F. (2000): « Marketing margins and agricultural technology in Mozambique » In *Journal of Development Studies*, 37(1), 121-137.
- Arrow, K., (1973): « The Theory of Discrimination » in O. ASHENFELTER, A. REES (eds), *Discrimination in Labor Markets*, Princeton University Press.
- ANSD - Agence Nationale de la Statistique et de la Démographie (2013) : « Rapport définitif de la deuxième Enquête de Suivi de la Pauvreté au Sénégal (ESPS II - 2011) ». Ministère de l'Economie et des Finances, Dakar.
- ANSD- Agence Nationale de la Statistique et de la Démographie (2015): « Rapport national de l'Enquête Nationale Sur l'Emploi au Sénégal ».
- Baba, S. H., Saini, A. S., Sharma, K. D. and Thakur, D. R. (2010a): « Impact of investment on agricultural growth and rural development: Dynamics of public and private investment in Himachal Pradesh ». *Indian Journal of Agricultural Economics*, 65: 136-157
- Becker, G. (1957): "The Economics of Discrimination", Second Edition, the University of Chicago Press Economics.178-186 pp
- Benin, S., Nkonya, E., Okecho, G., Pender, J., Nahdy, S., Mugarura, S., Kato, E. & Kayobyo, G., (2007): « Assessing the impact of the national agricultural advisory services (NAADS) in the Uganda rural livelihoods », IFPRI Discussion Paper 00724. International Food Policy Research Institute (IFPRI), Washington, DC, viewed 27 August 2013, from <http://www.ifpri.org/sites/default/files/publications/ifpridp00724.pdf>.
- Blanchflower, D., & Oswald, A. (1994): «Estimating a Wage Curve for Britain 1973-90». *The Economic Journal*, 104(426), 1025-1043. doi:10.2307/2235062
- Boeters, S., Savard, L., (2011): « The labour market in CGE models » in *Handbook of CGE modeling*. CPB Discussion paper 201.
- Cavalcanti, T., et Tavares, J., (2007): « The Output Cost of Gender Discrimination: A Model Based Macroeconomic Estimate ». CEPR Discussion Papers 6477
- Cockburn, J., Corong, E., Decaluwé, B., Fofana, I., et Robichaud, V., (2010): « Case Study: The growth and poverty impacts of trade liberalization in Senegal ». *International Journal of Microsimulation* 3 (janvier): 109-13.
- Cockburn, J., Decaluwé, B., Fofana I., (2010) : « Libéralisation commerciale et pauvreté en Afrique ». *Les Presses de l'Université Laval*.
- Cuberes, D., et Teignier, M., (2014) : « Gender Inequality and Economic Growth: A Critical Review ». *Journal of International Development* 26 (2): 260 76. <https://doi.org/10.1002/jid.2983>
- Diao, X., Hazell, P., et Thurlow, J., (2010a.) : « The Role of Agriculture in African Development ». *World Development* 38 (10): 1375-83. <https://doi.org/10.1016/j.worlddev.2009.06.011>.
- Dollar, D., and Gatti, R., (1999): « Gender Inequality, Income, and Growth: Are Good Times Good for Women? » World Bank Working Paper, May 1999.
- Dumont, J.C., et Mesple-Somps, S., (2000) : « L'impact des infrastructures publiques sur la compétitivité et la croissance ».

- Estudillo, J.P., Otsuka, K. (2010): « Rural poverty and income dynamics in Southeast Asia. p. 3435-3468. Handbook of Agricultural Economics. P. Pingali et R. Evenson, éd. New York: Elsevier.
- FAO (1996). FAOSTAT. United Nations, Rome: Food and Agriculture Organization.
- Fan, S., Zhang, X., & Rao, N. (2004). Public expenditure, growth and poverty reduction in rural Uganda. DSG discussion paper no. 4. Washington, DC: IFPRI
- Fan, S.; P. Hazell, and S. K. Thorat (2000): « Government Spending, Growth and Poverty in Rural India » in American Journal of Agricultural Economics, Vol. 82, No. 4, pp. 1038-1051
- Fan, S. et Zhang, X. (2008): « Public expenditure, growth and poverty reduction in rural Uganda » In African Development Review, 20(3): 466-496.
- Gollin, D., (2010): « Agricultural productivity and economic growth. pp. 3825-3866. In Handbook of agricultural economics P; Pingali et R. Evenson, éd. New York : Elsevier.
- Havet, N. (2004): « Ecart salarial et disparités professionnelles entre les sexes : développement théorique et validité empirique », l'Actualité économique, vol. 80, n°1 pp 5-39.
- Irz, X., Lin, L., Thirtle, C. and Wiggins, S. (2001): « Agricultural Growth and Poverty Alleviation » in Development Policy Review 19 (4): 449-66.
- Klasen, S., (2003): « Low Schooling for Girls, Slower Growth for all? Cross-Country Evidence on the Effect of Gender Inequality in Education on Economic Development ». The World Bank Economic Review, 2003, 17 (2), pp. 315-333.
- Klasen, S., Lamanna, F., (2009): « The Impact of Gender Inequality in Education and Employment on Economic Growth: New Evidence for a Panel of Countries ». *Feminist Economics* 15 (juillet): 91-132. <https://doi.org/10.1080/13545700902893106>.
- L'Heritier J.L. (1992): « Les déterminants du salaire », Economie et statistique, n°257, septembre 1992. pp 9-21.
- Mellor, J.W., (1995): « Introduction. In Agriculture on the Road to Industrialization ». J.W. Mellor, éd. Baltimore: Johns Hopkins University Press for the International Food Policy Research Institute (IFPRI).
- Mellor, J.W., (1996): « Agriculture on the road to industrialization. In Development Strategies Reconsidered. J.P. Lewis ET V. Kallab. Ed. New Brunswick, N.J.: Transaction Book for Overseas Development Council.
- Mincer, J. (1974): « Schooling, experience and earnings » in Columbia University Press, New York.
- Mincer, J. (1993): « Human Capital, technology and the wage structure: What do Time Series Show? » In J. Mincer, the Collected Essays of Jakob Mincer, Chap. 13. Aldershot, England.
- Mogues, T., Yu B., Fan S. & McBride, L. (2012): « The impacts of public investment in and for agriculture. Synthesis of the existing evidence » (ESA Working paper No. 12-07). Rome: FAO. Retrieved from <http://www.fao.org/docrep/016/ap108e/ap108e.pdf>
- Phelps, E. (1972): « The statistical theory of racism and sexism » in American Economic Review, 62, pp. 659–661.
- Pinstrup-Andersen, P. & Shimokawa, S. (2007): « Rural Infrastructure and Agricultural Development ». In F. Bourguignon & B. Pleskovic (Eds.), Annual World Bank Conference on Development Economics – Global 2007: Rethinking Infrastructure for Development (pp. 175-203). Washington, D.C.: The World Bank.
- Savard, L., (2012) : « Pauvreté et distribution de revenus au Sénégal: une approche par la modélisation en équilibre général calculable microsimulé » in Academia.edu.

Savard, L., Boccanfuso, D., Cabral, F., Cissé, F., et Diagne, A., (2007) : « Stratégies de réduction de la pauvreté au Sénégal : une analyse par la modélisation en équilibre général calculable microsimulé* ». *L'Actualité Economique* 83 (janvier): 483-528. <https://doi.org/10.7202/019390ar>.

Seguino, S., (2000a): « Gender Inequality and Economic Growth: A Cross-Country Analysis. » *World Development*, 2000, 28 (7), pp. 1211-1230.

Seguino, S., (2000b): « Accounting for Gender in Asian Economic Growth » in *Feminist Economics*, 2000, 6 (3), pp. 27-58.

Sennoga E., Matovu JM., (2013): « Public Spending Composition in Uganda and its Implications for Growth and Poverty Reduction » in *Public Finance Review*.

Tiberti, L., Cicowiez, M., Cockburn, J., (2017): « A top-down behaviour (TDB) microsimulation toolkit for distributive analysis: A manual ». *In pep website*.

United Nations Development program. (2015): «Human Development Report 2015: Work For Human Development: Main report (English) ». United Nations Development program.
http://hdr.undp.org/sites/default/files/2015_human_development_report.pdf

World Bank. (2011): «World development report 2012: gender equality and development: Main report (English) ».World development report. Washington, DC: World Bank Group.
<http://documents.worldbank.org/curated/en/492221468136792185/Main-report>

Zidouemba P., Gérard F., (2015) : « Investissement public et sécurité alimentaire au Burkina-Faso : une analyse en équilibre général calculable dynamique ». *Revue d'Etudes en Agriculture et Environnement*, 96 (3) : 411-437.<https://ideas.repec.org/a/rae/jourae/v96y2015i3p411-438.html>

Appendix

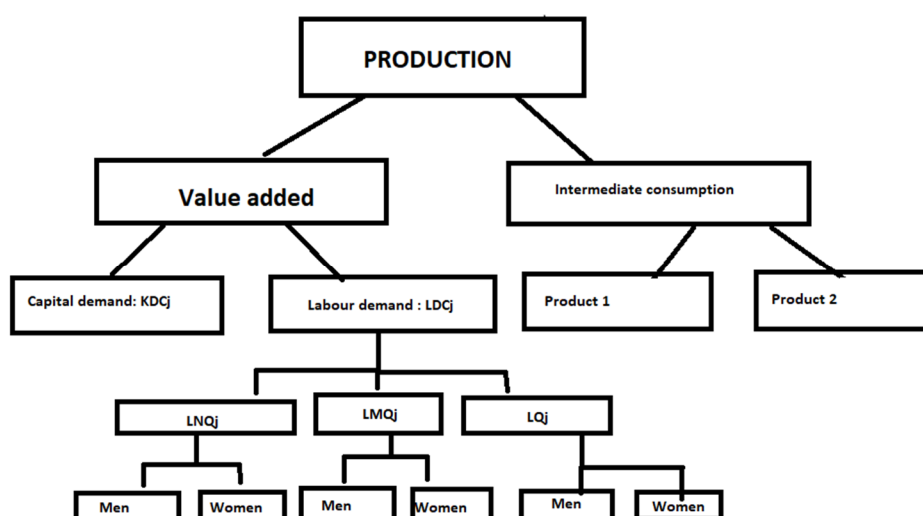


Figure 1: Structure of production

Table 1: GDP Growth % (sim1)

Short term	Long term
0.13	0.26

Table 2: Evolution of unemployment rate % (sim1)

	MSSK	FSSK	MSK	FSK
Short term	0.053	0.171	-0.126	-0.03
Long term	-0.095	-0.156	-0.638	-0.57

Table 3: Evolution of wage rate % (sim1)

	MUSK	FUSK	MSSK	FSSK	MSK	FSK
Short term	0,00442769	0,02137063	0,09543279	0,09718979	0,1270931	0,11788987
Long term	0,112001	0,15415431	0,22048518	0,22661555	0,27519303	0,26891407

*Musk: unskilled men; *Fusk: unskilled women; *Mssk: semi-skilled men; Fssk: semi-skilled women

*Msk: skilled men; *Fsk: skilled women

Table 4a: Evolution of non-agriculture labour demand % (sim1, short term)

Sectors	MUSK	FUSK	MSSK	FSSK	MSK	FSK
Livestock	0.08	0.06	0.008	0.006	-0.01	-0.006
Forestry	0.49	0.47	0.41	0.41	0.39	0.40
Fisheries	-0.007	-0.02	-0.08	-0.08	-0.10	-0.09
Extractive activities	-0.08	-0.10	-0.15	-0.15	-0.18	-0.17
Food Industry	0.51	0.49	0.43	0.43	0.41	0.42
Non-food industry	0.005	-0.01	-0.06	-0.07	-0.09	-0.08
Water, electricity and gas	0.25	0.23	0.17	0.17	0.15	0.16
Construction	0.19	0.17	0.12	0.12	0.09	0.10
Trade	0.05	0.03	-0.02	-0.02	-0.04	-0.03
Reparation	0.04	0.02	-0.03	-0.03	-0.05	-0.04
Hotel business	0.04	0.02	-0.03	-0.03	-0.06	-0.04
Transport	0.07	0.04	-0.005	-0.007	-0.03	-0.02
Telecommunications	0.57	0.55	0.49	0.49	0.46	0.48
Finance	0.57	0.55	0.49	0.49	0.50	0.48
Housing	0.60	0.58	0.53	0.53	-0.11	0.51
Services	-0.01	-0.03	-0.08	-0.09	-0.23	-0.10
Public administration	-0.13	-0.15	-0.21	-0.21	-0.002	-0.22
Education	0.09	0.07	0.02	0.02	-0.002	0.008
Health	0.20	0.18	0.13	0.13	0.10	0.11
Personal activities	0.01	-0.001	-0.05	-0.05	-0.08	-0.07

Table 4b: Evolution of non-agriculture labour demand % (sim1, long term)

Sectors	MUSK	FUSK	MSSK	FSSK	MSK	FSK
Livestock	0.17	0.12	0.08	0.07	0.04	0.04
Forestry	0.60	0.55	0.51	0.50	0.46	0.47
Fisheries	-0.04	-0.09	-0.13	-0.13	-0.17	-0.16
Extractive activities	-0.24	-0.29	-0.33	-0.34	-0.38	-0.37
Food Industry	0.73	0.69	0.65	0.64	0.60	0.61
Non-food industry	0.008	-0.04	-0.08	-0.09	-0.12	-0.12
Water, electricity and gas	0.50	0.45	0.41	0.40	0.36	0.37
Construction	0.22	0.17	0.13	0.13	0.08	0.09
Trade	0.11	0.06	0.01	0.01	-0.02	-0.02
Reparation	0.13	0.07	0.03	0.03	-0.006	-0.001
Hotel business	0.13	0.08	0.03	0.04	-0.007	-0.004
Transport	0.18	0.13	0.09	0.09	0.04	0.05
Telecommunications	0.53	0.47	0.43	0.43	0.38	0.39
Finance	0.51	0.46	0.42	0.42	0.37	0.38
Housing	0.51	0.45	0.41	0.41	-0.02	0.37
Services	-0.01	-0.03	-0.08	-0.09	-0.23	-0.10
Public administration	-0.35	-0.40	-0.45	-0.45	0.07	-0.48
Education	0.21	0.16	0.12	0.11	0.07	0.08
Health	0.41	0.37	0.33	0.33	0.28	0.28
Personal activities	0.02	-0.02	-0.06	-0.07	-0.10	-0.10

Table 5: Evolution of non-agriculture production % (sim1)

Sectors	Short term	Long term
Livestock	0.03	0.04
Forestry	-0.10	-0.13
Fisheries	-0.01	-0.06
Extractive activities	-0.12	-0.33

Food Industry	-0.03	-0.04
Non-food industry	-0.07	-0.21
Water, electricity and gas	-0.07	-0.15
Construction	0.05	-0.005
Trade	0.01	0.03
Reparation	-0.03	-0.07
Hotel business	-0.05	-0.09
Transport	-0.02	-0.05
Telecommunications	-0.10	-0.10
Finance	-0.05	-0.06
Housing	-0.09	-0.09
Services	-0.09	-0.28
Public administration	-0.04	-0.08
Education	-0.04	-0.10
Health	-0.04	-0.08
Personal activities	-0.01	-0.03

Table 6a: Evolution of importation % (sim1)

Products	Short term	Long term
Food agriculture	-0.08	-0.10
Export agriculture	-3.90	-8.24
Livestock	0.05	0.21
Forestry	0.21	0.36
Fisheries	0.01	0.07
Extractive activities	-0.01	-0.07
Food Industry	0.06	0.14
Non-food industry	0.04	0.09
Transport	0.02	0.08
Telecommunications	0.10	0.17
Finance	0.14	0.19
Services	0.16	0.41
Education	0.16	0.43
Health	0.23	0.56
Personal activities	0.12	0.32

Table 6b: Evolution of exportation % (sim1)

Products	Short term	Long term
Food agriculture	-0.08	-0.10
Export agriculture	-3.90	-8.24
Fisheries	-0.03	-0.14
Extractive activities	-0.11	-0.32
Food Industry	-0.07	-0.13
Non-food industry	-0.09	-0.27
Hotel business	-0.09	-0.18
Transport	-0.03	-0.09
Finance	-0.12	-0.15
Services	-0.15	-0.45
Education	-0.12	-0.31
Health	-0.16	-0.36
Personal activities	-0.06	-0.16

Table 7: Consumer price index % (sim1)

Short term	Long term
------------	-----------

0.08	0.21
------	------

Table 8: Evolution of capital demand by sectors % (sim1)

Sectors	Short term	Long term
Food agriculture	0.71	1.51
Export agriculture	26.64	69.12
Livestock	-0.11	-0.35
Forestry	-0.12	-0.16
Fisheries	-0.10	-0.37
Extractive activities	-0.09	-0.34
Food Industry	-0.10	-0.13
Non-food industry	-0.10	-0.28
Water, electricity and gas	-0.11	-0.25
Construction	-0.41	-0.35
Trade	-0.11	-0.41
Reparation	-0.11	-0.39
Hotel business	-0.11	-0.37
Transport	-0.12	-0.38
Telecommunications	-0.11	-0.13
Finance	-0.13	-0.13
Housing	-0.13	-0.13
Services	-0.09	-0.31
Public administration	-	-
Education	-0.12	-0.35
Health	-0.13	-0.29
Personal activities	-0.11	-0.41

Table 9: Distribution of public investments over the period **2018-2020**

Years	Amount in billions of FCFA
2018	1345
2019	1490.9
2020	1652.3

Source: MEFP 2017

Table 10: GDP Growth % (sim2)

Short term	Long term
0.10	0.009

Table 11: Evolution of unemployment rate % (sim2)

	MSSK	FSSK	MSK	FSK
Short term	-0.171	-0.268	-0.049	-0.225
Long term	0.017	0.023	-0.01	0.003

Table 12: Evolution of wage rate % (sim2)

	MUSK	FUSK	MSSK	FSSK	MSK	FSK
Short term	0,00442769	0,02137063	0,09543279	0,09718979	0,1270931	0,11788987
Long term	0,112001	0,15415431	0,22048518	0,22661555	0,27519303	0,26891407

*Musk: unskilled men; *Fusk: unskilled women; *Mssk: semi-skilled men; Fssk: semi-skilled women

*Msk: skilled men; *Fsk: skilled women

Table 13a: Evolution of non-agriculture labour demand % (sim2, short term)

Sectors	MUSK	FUSK	MSSK	FSSK	MSK	FSK
Livestock	0.01	0.002	0.08	0.07	0.09	0.08
Forestry	0.03	0.02	0.11	0.10	0.12	0.10
Fisheries	-0.08	-0.10	-0.01	-0.02	-0.005	-0.02
Extractive activities	-0.25	-0.26	-0.18	-0.19	-0.17	-0.20
Food Industry	0.06	0.04	0.13	0.12	0.14	0.12
Non-food industry	-0.17	-0.18	-0.10	-0.11	-0.11	0.003
Water, electricity and gas	0.01	0.001	0.08	0.08	0.09	0.07
Construction	-0.18	-0.19	-0.11	-0.12	-0.10	-0.12
Trade	0.001	-0.01	0.06	0.06	0.07	0.05
Reparation	-0.05	-0.07	0.01	0.003	0.02	-0.003
Hotel business	-0.08	-0.09	-0.01	-0.02	-0.005	-0.02
Transport	-0.05	-0.06	0.02	0.01	0.03	0.01
Telecommunications	0.001	-0.01	0.07	0.06	0.08	0.06
Finance	-0.05	-0.06	0.01	0.004	0.02	0.007
Housing	-0.02	-0.04	0.03	0.03	0.05	0.03
Services	-0.31	-0.32	-0.24	-0.25	-0.23	-0.25
Public administration	-0.22	-0.23	-0.15	-0.16	-0.14	-0.16
Education	-0.05	-0.06	0.01	0.007	0.02	0.01
Health	-0.01	-0.03	0.05	0.04	0.06	0.04
Personal activities	-0.04	-0.05	-0.02	-0.02	0.04	0.02

Table 13b: Evolution of non-agriculture labour demand % (sim2, long term)

Sectors	MUSK	FUSK	MSSK	FSSK	MSK	FSK
Livestock	0.0005	0.0005	-0.004	-0.003	-0.007	-0.005
Forestry	0.01	0.01	0.008	0.008	0.005	0.007
Fisheries	-0.004	-0.004	-0.009	-0.009	0.01	-0.01
Extractive activities	-0.005	-0.008	-0.01	-0.009	-0.01	-0.01
Food Industry	0.002	0.002	-0.003	-0.002	-0.005	-0.004
Non-food industry	0.003	0.004	-0.001	-0.004	-0.004	-0.002
Water, electricity and gas	0.01	0.01	0.005	0.006	0.002	0.004
Construction	0.01	0.01	0.01	0.01	0.007	0.009
Trade	-0.002	-	-0.005	-0.004	-0.007	-0.005
Reparation	-0.0008	-0.0007	-0.006	-0.005	-0.008	-0.006
Hotel business	0.006	0.005	0.0007	0.001	-0.001	-
Transport	0.003	0.003	-0.002	-0.008	-0.004	-0.002
Telecommunications	0.02	0.03	0.02	0.02	0.02	0.02
Finance	0.03	0.03	0.03	0.03	0.02	0.03
Housing	0.03	0.03	0.02	0.02	0.02	0.02
Services	0.05	0.05	0.04	0.04	0.04	0.04
Public administration	-0.01	-0.01	-0.02	-0.02	-0.02	-0.02
Education	0.01	0.01	0.006	0.007	0.003	0.005
Health	0.01	0.02	0.01	0.01	0.01	0.01
Personal activities	-0.007	-0.005	-0.005	-0.005	-0.008	-0.006

Table 14: Evolution of non-agriculture production % (sim2)

Sectors	Short term	Long term
Livestock	0.02	-0.001
Forestry	0.005	-0.007
Fisheries	-0.07	-0.005

Extractive activities	-0.10	-0.02
Food Industry	0.01	-0.003
Non-food industry	-0.07	-0.01
Water, electricity and gas	0.01	-0.009
Construction	-0.09	-0.005
Trade	0.01	-0.002
Reparation	-0.02	-0.008
Hotel business	-0.02	-0.006
Transport	-0.01	-0.006
Telecommunications	-0.001	-0.007
Finance	-0.008	-0.007
Housing	-0.005	-0.008
Services	-0.04	-0.03
Public administration	-0.03	-0.004
Education	0.006	-0.006
Health	0.13	-0.005
Personal activities	-0.02	-0.002

Table 15a: Evolution of importation % (sim2)

Products	Short term	Long term
Food agriculture	0.13	-0.002
Export agriculture	-3.74	-0.20
Livestock	0.19	0.002
Forestry	0.16	0.009
Fisheries	0.11	-0.001
Extractive activities	-0.05	-0.006
Food Industry	0.11	0.002
Non-food industry	0.01	0.001
Transport	0.04	-
Telecommunications	0.06	0.006
Finance	0.04	0.007
Services	-0.05	0.05
Education	0.15	0.02
Health	0.17	0.02
Personal activities	0.22	0.01

Table 15b: Evolution of exportation % (sim2)

Products	Short term	Long term
Food agriculture	-0.10	-0.007
Export agriculture	8.00	0.46
Fisheries	-0.14	-0.007
Extractive activities	-0.09	-0.02
Food Industry	-0.03	-0.006
Non-food industry	-0.09	-0.02
Hotel business	-0.06	-0.01
Transport	-0.02	-0.006
Telecommunication	-0.03	-0.01
Finance	-0.02	-0.01
Services	-0.02	-0.05
Education	-0.07	-0.02
Health	-0.07	-0.01
Personal activities	-0.11	-0.009

Table 16: Consumer price index % (sim2)

Short term	Long term
0.07	0.01

Table 17: Evolution of capital demand by sectors % (sim2)

Sectors	Short term	Long term
Food agriculture	-0.002	-0.01
Export agriculture	0.55	1.34
Livestock	0.002	-0.004
Forestry	-0.002	-0.008
Fisheries	-0.004	-0.02
Extractive activities	-0.01	-0.04
Food Industry	0.003	-0.004
Non-food industry	-0.02	-0.03
Water, electricity and gas	-0.002	-0.12
Construction	-0.02	-0.04
Trade	-0.0004	-0.002
Reparation	-0.004	-0.02
Hotel business	-0.008	-0.03
Transport	-0.005	-0.02
Telecommunications	-0.005	-0.009
Finance	-0.01	-0.01
Housing	-0.007	-0.01
Services	-0.03	-0.04
Public administration	-	-
Education	-0.007	-0.02
Health	-0.005	-0.01
Personal activities	-0.003	-0.02