One People - One Goal - One Faith

MINISTRY OF ECONOMY AND FINANCE

DEPARTMENT OF FORECASTING AND ECONOMIC STUDIES

Study N°25

Agricultural Policy, Productivity and Long Run Economic Growth in Senegal

DPEE/DEPE @ August 2013
ABSTRACT

Senegalese agricultural sector appears to be unproductive in light of low performances over the last decades. This study attempts to assess and analyze the effects of Senegalese current agricultural policy on growth, particularly through an increase in productivity. A special attention is paid to newly-implemented agricultural programs in the Public Investment Triennial Plan (PITP), which estimated cost is FCFA 126 billion. To measure these effects, we set up an agricultural-based Computable General Equilibrium Model. Our main result shows that the agricultural sector activity could rise up to 10.7% per year in average, during 2014-2023. However, this outcome could be halved by ineffective investment spending or poor investment monitoring.

JEL Classification: Q11, Q18, H3, C68

Keywords: Agricultural policy, productivity, economic growth, CGE Model

---

1 We thank the researchers Alioune Dieng, DIA Djiby and Cheikh Sadibou FALL (Senegalese Institute of Agricultural Research) and the National Accountant Fode DIEME (National Agency of Statistics and Demography) for their distinguished contribution to the realization of this document.
I. INTRODUCTION

Since its independence, Senegal has successively identified several strategies for agricultural development in order to give the sector its importance due to economic growth, redistribution of income and food security. Thus, starting from a highly interventionist agricultural policy during the first two decades of independent Senegal, the Government has subsequently gradually withdrawn in favor of structural adjustment policies (SAP) signed with Brettonwoods institutions. This withdrawal took place through the New Agricultural Policy (NAP), whose implementation began in 1984.

The liberalization of agricultural sector has become more effective in the late 1990s, but it was from the 2000s that new guidelines have been established with the adoption in 2004 of the Framework “Loi Agro-Silvo-Pastoral” (LOASP) and its annexes programs. In addition, the state launched in 2006, the plan for the Return to Agriculture (REVA), hoping to stem migration of young Senegalese to Europe. Then, in 2008, Great Agricultural Offensive for Food and Abundance (GOANA) was implemented in response to the global food crisis of 2007-2008. Furthermore, Senegal has developed its National Agricultural Investment Program (NAIP), from a common vision established at the continental (through CAADP) and sub-regional (through ECOWAP).

Thus, the agricultural policy of Senegal is designed through several strategic documents that may cause a difficult implementation. In spite of all efforts for its development, Senegalese agriculture remains unproductive in terms of performances for decades. During the last fifteen years, its contribution to economic growth is almost null (0.1%), and its share in GDP increased from 10% in 1997 to less than 8% in 2011. Labor productivity in agricultural sector remains very low compared to secondary and tertiary sectors. It also shows a highly volatile growth rates.

However, hope for the emergence of a thriving agricultural sector is still allowed if one refers to the renewed political will of the Senegalese public authorities have placed agriculture at the heart of economic and social development process. Therefore, the issue of the relevance of the new direction of agricultural policy deserves special consideration, both on government than that of academic research. This study is in this perspective and seeks to assess and analyze the effects of the current agricultural policy of Senegal on growth, particularly through increased productivity. The paradox that agriculture concentrates 28% of the active population and provides only 7.8% of production, is sufficiently illustrative of productivity
issues submitted this sector. This study attempts to identify and levers and constraints of the agricultural policy of Senegal that govern the evolution of agricultural growth. Therefore, it will be possible to discuss the conditions under which agricultural policy could be consistent with the National Strategy for Economic and Social Development (SNDES) which expects a sustained growth in the medium and long term, 7-8%.

Moreover, in front of the plurality of agricultural policy documents, the study focuses on agricultural projects and programs outlined in the Triennial Public Investment Program (PTIP). Indeed, the PTIP is the convergence framework and implementation of all public projects and programs. It is implemented over a period of 3 years, according to a rolling program. However, it is important to note that only the additional spending on agriculture are are analyzed because other agricultural expenses are assumed to evolve according to the trend of the economy. Thus, new agricultural programs have been added to PTIP (2012-2014), while other programs, existing, recorded an increase in their allocation. Overall, the programmed budget in PTIP (2013-2015) increased 126.034 billion FCFA compared to the previous TIPI (2012-2014).

A dynamic CGE model is used to evaluate the sectorial and macroeconomic effects of additional expenditures envisaged in agricultural policy. Note that the CGE is designed to take into account a comprehensive agricultural sector at its most representative sectors. Using a CGE model is important in more ways than one, as it allows both to quantify the economic impact in the short and medium term of the increase in public spending (demand effects) and to assess the structuring effects of long-term (supply effects), which primarily affect the production function of agricultural units.

The rest of the paper is as follows. Section 2 traces the history of agricultural development strategies put in place since the early years of independence. Section 3 analyzes in detail the costs of additional investments to be implemented in 2013-2015. The stylized facts are presented in Section 4. Section 5 reviews the theoretical and empirical literature on the effects of agricultural policy on growth and productivity. Section 6 discusses the essential points of the CGE and explains how agricultural policy is supported by the model. The results and their interpretation are presented in Section 7. Finally, Section 8 is reserved for the conclusion.
II. REVIEW OF AGRICULTURAL DEVELOPMENT STRATEGIES IN SENEGAL

During the first two decades following Senegal's independence, the Government conducted an interventionist agricultural policy in order to intensify and diversify agricultural production. Thus, management structures, as the “Office de Commercialisation Agricole du Sénégal” (OCAS) were created to support farmers and disseminate farming methods and techniques. The OCAS had the privilege of purchasing monopoly on groundnut production from agricultural cooperatives and a limited number of approved private traders. Then, the Office sold the harvest to processing plants operating in Senegal or companies which organized the export of groundnut for its treatment in France.

An ambitious program of agricultural modernization had been set up, funded by the BSD (Senegalese Bank of Senegal), later BNDS (National Bank of Development of Senegal). It was supervised by the CRAD (Regional Centers for Development Assistance) and accessible to farmers through cooperatives which guaranteed borrowings, based on Groundnut sales produced by their members. Between 1966 and 1967 the CRAD and OCAS were dissolved and their functions were transferred to the « National Office of Cooperation and Assistance Development » (ONCAD), a newly created structure.

Faced with persistent imbalances that affected the senegalese economy in the late 70s and the vulnerability of public finances, the Government was obliged to adopt adjustment measures in the agricultural sector. Consequently, the Stabilization Program was implemented in 1979 and the Economic and Financial Recovery Program between 1980 and 1984. Thus ONCAD was dissolved in 1980 and its businesses acquired by the National Company of Commercialization of oleaginous of Senegal (SONACOS). The disengagement of the Government has been strengthened by the official end of the agricultural program and fertilizer credit. Instead, the Government tried to establish a restraint on Groundnut sales (the refund) for the repayment of fertilizer loans in 1984. During the same year, the Government has adopted the "New Agricultural Policy" (NPA) which further reduces its interventionist action in the agricultural sector. The NPA has sought to create conditions for the revival of production, in a framework that promotes effective participation and empowerment of the rural areas.

However, following the devaluation of the CFA and in order to correct the dysfunctions
observed in the implementation of the NPA, the Government has implemented the "Structural Adjustment Policy of Agriculture" (PASA), which setting execution is ensured via the Letter for Agricultural Development Policy (LPDA) in April 1995. The withdrawal of the Government, initiated in 1979, is widely deepened by the LPDA.

The willingness of the government to develop the agricultural sector can also be seen through the development and approval of the various sectorial policy documents, including the Development Policy Letter for the agricultural sector Institutional (LPI 1998), the Letter of Decentralized Rural Development Policy (LPDRD, 1999) and the Development Policy Letter from the Groundnut Die (2003).

The liberalization of the agricultural sector becomes more effective in 1997, but the results are inconclusive. In addition, the integration of the Senegalese agricultural sector liberalized in the world market and the greater autonomy of farmers, show a lack of training for agricultural professionals. In 1999, the National Strategy for Agricultural and Rural Training (SNFAR) was set up with the objectives to be achieved by 2015.

From the 2000s, the agricultural sector poor performance have succeeded, forcing the political authorities to implement a new, more comprehensive agricultural issues, in order to put agriculture at the heart of the strategy for high and sustainable growth. In particular, agricultural organizations, including the National Council for Dialogue and Cooperation of Rural (NCRC), requested a new farm bill. Thus, the Orientation Law Agro-Silvo-Pastoral (LOASP) of 2004 was enacted to give an overall strategic direction to Senegalese agriculture over a period of 20 years, based on the strengthening of family farms. This law is the basis for development of medium term operational programs, such as the National Agriculture Development Programme (NADP), the National Programme for Livestock Development (PNDE) and the Forestry Action Plan of Senegal (PAFS). LOASP has therefore replaced all sectorial agricultural policies in Senegal. It is supposed to be made operational by the agricultural component of the PRSP later became the SED, then SNDES.
The current state reveals an agricultural policy designed through several strategic documents that can cause a difficult implementation. Indeed, apart from the programs launched under the LOASP, the Government launched, in 2006, the Plan for Return to Agriculture (REVA) to deal with illegal immigration flows to Europe, Senegalese youth who, for lack of better, embarked in canoes to travel often marred by high seas drama. This program had, at once, two major objectives: revitalize agriculture and enable young emigrants to return to Senegal, investing in agriculture. Finally in 2008, the state launched the Great Agricultural Offensive for Food and Abundance (GOANA) in response to the global food crisis of 2007-2008. Its
aim was to meet the challenge of food sovereignty, to avoid any risk of famine or starvation, and produce for export.

In a spirit of coordination of national policies, sub-regional and regional, the african countries adopted the New Partnership for Africa's Development (NEPAD), which agricultural component is supported by the Comprehensive Development Programme Agriculture in Africa (CAADP). This is implemented in West Africa through the Agricultural Program of ECOWAS (ECOWAP) and nationally by the National Agricultural Investment Program (NAIP). Note finally that the objectives of the LOASP are supposed to put in harmony with those of the ECOWAP / CAADP.

III. FUNCTIONAL DISTRIBUTION OF ADDITIONAL EXPENSES

Senegal's agricultural policy is defined in several strategies formulated at regional, sub-regional and national levels. In front of the plurality of agricultural policy documents, it should focus on agricultural projects and programs written in the Triennial Public Investment Program (PTIP). Indeed, this document is the convergence and implementation framework of all public projects and programs. It is implemented over a period of three years following a rolling program. However, it should be noted that only the additional spending on agriculture must be subject to analysis because other agricultural expenses are assumed to evolve according to the trend of the economy.

Overall, the programmed budget in PTIP (2013-2015) increased 126.034 billion CFA francs, compared to the previous PTIP (2012-2014). Thus, new agricultural programs are added to PTIP (2012-2014), while other programs already existing recorded an increase of their allocation. These programs are listed in the following table
### Table III.1: Increased investment spending on agriculture (in millions Francs CFA)

<table>
<thead>
<tr>
<th>PROJETS/PROGRAMMES</th>
<th>Symbole</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>TOTAL</th>
<th>Financement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nouveaux Projets/Programmes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amélioration de la productivité agricole/WAPP-Phase II</td>
<td>prog1</td>
<td>2 500</td>
<td>4 500</td>
<td>8 500</td>
<td>15 500</td>
<td>BM/BCI-ETAT</td>
</tr>
<tr>
<td>Projet de développement inclusif et durable de l’agrobusiness</td>
<td>prog2</td>
<td>300</td>
<td>1 500</td>
<td>2 000</td>
<td>3 800</td>
<td>BM</td>
</tr>
<tr>
<td>Fonds d’entretien et de maintenance des infrastructures hydro-agricoles</td>
<td>prog3</td>
<td>1 285</td>
<td>1 500</td>
<td>1 715</td>
<td>4 500</td>
<td>BCI-ETAT</td>
</tr>
<tr>
<td>Appui à la sécurité alimentaire dans la région de Matam</td>
<td>prog4</td>
<td>800</td>
<td>3 650</td>
<td>6 150</td>
<td>10 600</td>
<td>EU-FED/AFD/BCI-ETAT</td>
</tr>
<tr>
<td>Appui à la sécurité alimentaire à Louga, Kaffrine et Matam</td>
<td>prog5</td>
<td>500</td>
<td>2 000</td>
<td>3 000</td>
<td>5 500</td>
<td>BAD-FAD</td>
</tr>
<tr>
<td>Appui au programme national d’investissement agricole</td>
<td>prog6</td>
<td>700</td>
<td>4 000</td>
<td>6 000</td>
<td>10 700</td>
<td>ITALIE</td>
</tr>
<tr>
<td>Appui à la production durable du riz pluvial à Kaolack, Kaffrine et Fatick</td>
<td>prog7</td>
<td>500</td>
<td>1 050</td>
<td>1 100</td>
<td>2 650</td>
<td>JAPON/BCI-ETAT</td>
</tr>
<tr>
<td>Fonds de Garantie des Investissements Prioritaires (FONGIP)</td>
<td>prog8</td>
<td>5 000</td>
<td>5 000</td>
<td>5 000</td>
<td>15 000</td>
<td>BCI-ETAT</td>
</tr>
<tr>
<td>Projet de construction et réhabilitation de pistes communautaires</td>
<td>prog9</td>
<td>500</td>
<td>2 000</td>
<td>3 000</td>
<td>5 500</td>
<td>BAD-FAD</td>
</tr>
<tr>
<td>Projet d’appui à la sécurité alimentaire (insertion des jeunes)</td>
<td>prog10</td>
<td>300</td>
<td>475</td>
<td>475</td>
<td>1 250</td>
<td>FONDS KOWEITIEN</td>
</tr>
<tr>
<td><strong>Projets/Programmes ayant bénéficié de crédits supplémentaires</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programme d’équipement du monde rural</td>
<td>prog11</td>
<td>3 667</td>
<td>3 667</td>
<td>3 667</td>
<td>11 000</td>
<td>BCI-ETAT</td>
</tr>
<tr>
<td>Programme de reconstitution du capital semencier</td>
<td>prog12</td>
<td>3 667</td>
<td>3 667</td>
<td>3 755</td>
<td>11 088</td>
<td>BCI-ETAT</td>
</tr>
<tr>
<td>Programme national d’insertion et développement agricole</td>
<td>prog13</td>
<td>2 200</td>
<td>2 567</td>
<td>938</td>
<td>5 705</td>
<td>BM/ESPAGNE/BCI-ETAT</td>
</tr>
<tr>
<td>Programme national d’autosuffisance en riz (réfection des aménagements hydro</td>
<td>prog14</td>
<td>2 933</td>
<td>4 906</td>
<td>4 400</td>
<td>12 240</td>
<td>BM/BCI-ETAT</td>
</tr>
<tr>
<td>agricoles)</td>
<td>prog15</td>
<td>2 567</td>
<td>4 033</td>
<td>4 400</td>
<td>11 000</td>
<td>BCI-ETAT</td>
</tr>
<tr>
<td><em>dont garantie</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BCI-ETAT</td>
</tr>
<tr>
<td><em>dort bonification</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>dort calamités</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL GENERAL</strong></td>
<td></td>
<td>27 419</td>
<td>44 515</td>
<td>54 100</td>
<td>126 034</td>
<td></td>
</tr>
</tbody>
</table>

*Source: PTIP*
Moreover, these investments are mainly used to increase the stock of capital and infrastructure, improve the productivity of factors and facilitate access to credit. At this level, assumptions were made to distribute, at best, the planned expenditure according to their attributes and objectives. Thus, the budget "equipment program of the rural area" should be allocated to the increase in equipment of agricultural chains, in proportion to the size of their capital stock. In addition, the Paddy Rice also benefit from an increase in equipment through the "supporting the sustainable production of upland rice in Kaolack, Fatick and Kaffrine" program. However, this program can increase both cultivable areas as infrastructure dedicated to the rice. Thus, its budget is divided in proportion to the size of each of these factors used in the production of paddy rice.

Table III.2 : Spending on the increase of capital stock (million CFA)

<table>
<thead>
<tr>
<th>CHAINS</th>
<th>INCREASE IN CAPITAL STOCK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Equipments</td>
</tr>
<tr>
<td><strong>FOOD AGRICULTURE</strong></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>302</td>
</tr>
<tr>
<td>Rice paddy</td>
<td>1 760</td>
</tr>
<tr>
<td>Millet</td>
<td>1 744</td>
</tr>
<tr>
<td>Other Food. Agr.</td>
<td>4 313</td>
</tr>
<tr>
<td><strong>INDUSTRIAL AGRICULTURE</strong></td>
<td></td>
</tr>
<tr>
<td>Groundnut</td>
<td>2 394</td>
</tr>
<tr>
<td>Coton</td>
<td>81</td>
</tr>
<tr>
<td>Tomatoe</td>
<td>291</td>
</tr>
<tr>
<td>Sugar cane</td>
<td>114</td>
</tr>
<tr>
<td>Others Ind. Agr.</td>
<td>516</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>11 515</td>
</tr>
</tbody>
</table>

*Source*: PTIP, authors' calculations

The increase in agricultural infrastructure stock is mainly supported by half of the budget of the "construction and community roads rehabilitation projects." The other part should be used for the rehabilitation of agricultural infrastructure that improves productivity. Overall, the additional expense allocated to the increase in inventory would be about 16.4 billion FCFA (13% of the supplementary budget).
Based on data in Table III.3, an amount of 83.6 billion FCFA (66% of the supplementary budget) should be invested to increase the productivity of factors of production. It is assumed that the programs of "improving agricultural productivity / WAPP-Phase II" and "supporting the national agricultural investment program," would increase the productivity of all factors in all agricultural sectors, because of their transversal character. For cons, the aims of prog2, prog4, prog5, prog10 and prog13 are to boost labor productivity in the long term, in the agricultural sector.

Cultivable areas are expected to improve their productivity through the "rebuilding program of the seed capital", while the "national rice self-sufficiency program (rehabilitation of irrigation schemes)" only affect the productivity of rice land.

In addition, the "maintenance fund and maintenance of irrigation infrastructure," serve to boost productivity infrastructure for all agricultural sectors.

\[\text{Source : PTIP, authors' calculations}\]
**Table III.4 : Dépenses allouées à l'accès au crédit**

( *en millions CFA* )

<table>
<thead>
<tr>
<th>CHAINS</th>
<th>ACCESS TO CREDIT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOOD AGRICULTURE</strong></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>713</td>
</tr>
<tr>
<td>Rice paddy</td>
<td>2945</td>
</tr>
<tr>
<td>Millet</td>
<td>4122</td>
</tr>
<tr>
<td>Other Food. Agr.</td>
<td>10195</td>
</tr>
<tr>
<td><strong>INDUSTRIAL AGRICULTURE</strong></td>
<td></td>
</tr>
<tr>
<td>Groundnut</td>
<td>5658</td>
</tr>
<tr>
<td>Coton</td>
<td>192</td>
</tr>
<tr>
<td>Tomatoe</td>
<td>687</td>
</tr>
<tr>
<td>Sugar cane</td>
<td>269</td>
</tr>
<tr>
<td>Others Ind. Agr.</td>
<td>1220</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>26 000</td>
</tr>
</tbody>
</table>

*Source : PTIP, authors' calculations*

Finally, an additional amount of $26 billion FCFA is intended to improve access to agricultural credit (Table III.4). This budget comes from the "guarantee fund priority investments (FONGIP)" and the "endowment fund to secure rural credit."

This allocation of additional budget could undoubtedly have a positive impact on agriculture. However, questions remain as to the magnitude of the expected effects. Also, the use of a CGE model allows it to provide a quantitative assessment of the impact of this agricultural policy, taking into account the potential risks associated with its implementation.
IV. STYLISTED FACTS ON SENEGALESE AGRICULTURE

IV.1. Background

IV.1.1. Analysis of agricultural growth

Senegalese agriculture is mainly composed of cash crops (groundnuts, cotton, sugar cane), food crops (rice, maize, millet, sorghum, cowpea, cassava) and horticulture (fruits and vegetables). The annuity business is largely dominated by the cultivation of groundnuts. Food agriculture products, mainly consisting of cereals, fall, in large part, to the final consumption of households.

Despite considerable efforts by public authorities to promote Senegalese agriculture, the sector is slow to take off (see Chart IV.1). In general, the agricultural growth rate is, on average, relatively weak and erratic. That situation causes a vulnerable agricultural sector. Compared to the secondary and tertiary sectors, the agricultural sector shows the average growth rate lower as shown in the following table IV.1.

<table>
<thead>
<tr>
<th>SECTORS</th>
<th>Agriculture</th>
<th>Secondary</th>
<th>Tertiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average growth rate</td>
<td>2.5%</td>
<td>4.1%</td>
<td>4.6%</td>
</tr>
</tbody>
</table>

*Source*: ANSD/Authors’ calculations

Furthermore, it should be noted that agricultural growth remains well below its medium-long term goal (7%), as defined in the National Strategy for Economic and Social Development (SNDES).

The following graph shows the evolution of growth rate, from 1997 to 2011, of the added value of the agricultural sector consists of subsistence farming and industrial agriculture.
After a decline in 1997, the agricultural value added registered a positive growth that was maintained until 2000, before declining in 2001 and further deteriorate to a record level of -34.5% in 2002. Indeed, 2002 coincided with the decline in agricultural production due, in large part, to the off-season rains and flooding along the Gambia River.

As usual, after a drastic decline, agricultural value added has returned to growth in 2003, also supported by good rainfall and implementation of programs, especially for corn.

In 2004, year of the LOASP’s adoption, there has been a slight increase in agricultural value added (4.1%), driven by industrial agriculture (25.8%), despite a decline in food crops (-5%). Exogenous factors, including the locust threat and rainfall deficit, have, in fact, characterized the 2004/2005 crop year, causing the decline of food crops. Thus grain production declined by 25.3%, while groundnut production rose by 36.7%.

Agricultural value added grew by 16% in 2005. This performance can be explained by a good distribution of rainfall in time and space, the renewal of agricultural equipment, subsidized price to the availability of good quality inputs and a good plant health monitoring.
However, agricultural growth was negative for 2006 and 2007. The underperformance is mainly due to lower plantings and yields, the late implementation of fertilizers and seeds, to unfavorable climatic conditions and difficulties related to previous commercialization campaigns.

In 2008, strong growth was recorded, due to what may be called the "green revolution." This revolution has been materialized by the creation of the Great Agricultural Offensive for Food and Abundance (GOANA). However, the various stimulus plans of Senegalese agriculture did not allow a continuation of agricultural performance. Indeed, from 2009, the sector has gradually deteriorated peaking at a negative growth rate of 27.8% in 2011. This decrease is equivalent to a loss of 113 billion of value added in 2011 compared to 2010.

IV.1.2. Volatility of agricultural sector

The evolution of agricultural value added, previously analyzed (see Chart IV.1), reported a high volatility. This can be an impediment to private investment and ask at the same time, productivity problems. Table IV.2 compares the volatility of the agricultural sector to those of the secondary and tertiary sectors, over the period 1997-2011.

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Food agriculture</th>
<th>Industrial agriculture</th>
<th>Secondary Sector</th>
<th>Tertiary Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatility</td>
<td>17.5%</td>
<td>32.0%</td>
<td>2.5%</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

**Note**: The volatility is measured by the standard deviation

**Source**: ANSD/Calculs des auteurs
Industrial agriculture is more volatile (32%) than subsistence farming (17.5%). Indeed, Groundnut, which is the main speculative industrial agriculture, is heavily dependent on rainfall. However, Senegal has suffered severe climatic irregularities during the fifteen year period.

IV.1.3. Evolution of the share of the agricultural sector

Despite the fact that 30.6% of the employed population change in the farming community, its share in GDP remains low, at up to 8.68% on average over the period 1997-2011. Table IV.3 shows the evolution of the share of agriculture compared to other sectors of the Senegalese economy.

**Table IV.3 :** Average share of agriculture in GDP (1997-2011)

<table>
<thead>
<tr>
<th>SECTORS</th>
<th>Agriculture</th>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997-2001</td>
<td>10,10%</td>
<td>19,90%</td>
<td>22,58%</td>
<td>57,50%</td>
</tr>
<tr>
<td>2002-2006</td>
<td>8,06%</td>
<td>16,36%</td>
<td>23,10%</td>
<td>60,52%</td>
</tr>
<tr>
<td>2007-2011</td>
<td>7,86%</td>
<td>15,76%</td>
<td>22,00%</td>
<td>62,26%</td>
</tr>
</tbody>
</table>

*Source*: ANSD/Calculs des auteurs

It emerges a gradual decline in the share of agriculture in GDP. On average, it rose from 10.10% between 1997 and 2001, to 7.86% between 2007 and 2011. This situation prevailed despite the adoption of the LOASP and NIPA one hand, and the implementation implementation of the plan and the REVA GOANA the other.

IV.1.4. Contribution of the agricultural sector to growth

In the period under review, contributions to GDP growth of the branches "subsistence farming" and "industrial agriculture", were low. If the intake of food production growth has been fairly stable (0.1%), that of industrial agriculture has remained erratic.
**Table IV.4**: Contribution of the agricultural sector to growth (1997-2011)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Food agriculture</td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Industrial agriculture</td>
<td>0.3%</td>
<td>-0.3%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Primary</td>
<td>0.5%</td>
<td>-0.1%</td>
<td>0.5%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Secondary</td>
<td>0.9%</td>
<td>0.8%</td>
<td>0.7%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Tertiary</td>
<td>2.4%</td>
<td>3.1%</td>
<td>2.1%</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

*Source*: ANSD

The negative contribution noted for industrial agriculture, during the second period (2002-2006) is mainly due to the 2002 performances against previously analyzed. Also, the sector has not experienced the expected recovery in the following years, with zero contribution. Between 2007 and 2011, the overall contribution of agriculture was extremely low (0.1%), while the primary sector, as a whole, contributed nearly 0.5% to GDP growth.
IV.1.5. Agricultural labor's contribution

The role of agricultural workforce also deserves emphasis, which simultaneously raises questions about productivity. Indeed, the agricultural population is very important and represent 28% of the working population in 2011. The graph below shows the evolution of labor parallel to that of the added value.

GRAPHIV.2: Value added and labor in the agricultural sector (1997-2011)

The growth of the agricultural labor force in the fifteen years (1.9%) has been slow, compared to that of the working population (3%). Indeed, labor migration has become a reality in Senegal, causing the exodus of the rural farm population to urban areas.

These movements are due, among other things, to resources scarcity and rural drought. This translates, mechanically, by a slightly positive growth in agricultural labor productivity. Indeed, all things being equal, growth in agricultural value added (3.2%), combined with weak growth in agricultural labor, suggesting a trend increase in agricultural labor productivity.

Source: ANSD
IV.2. Analysis of key sectors

IV.2.1. Maize

Corn became, in 2003, the second grain speculation after millet, thanks to the special program, launched by the Senegalese Government, which permitted to achieve a growth rate of 399% (Multiple Appearance by ...) compared to 2002. However, performance waned from 2006 when production fell by 54.6%. Despite a substantial recovery observed in 2008 (151.1%), with the establishment of the GOANA, production has recovered to decrease from 2010.

Difficulties in the sector are mainly related to low price incentives, soil fertility, climatic hazards and dilapidated farm equipment. These constraints pose damaging productivity problems in the sector. They lead to the failure of the industry to meet local demand, leading to a rise in imports.

**GRAPH IV.3**: Maiz imports (en tons)

The volume of maize imports has consistently believed. However, periods of decline were recorded in 2004, due to the corn program, and in 2009 and 2010, after the launch of GOANA.

IV.2.2. Rice

Rice is the staple food consumption in Senegal. However, a huge gap exists between domestic demand and local production.

The government, keen to develop the rice sector, created in 1965, the National Development Corporation and exploitation of River delta lands Senegal and Falémé (SAED). This company had the facilities to work and management of irrigation and also worked for inputs and agricultural advice. Thereafter, the rice sector was liberalized in 1996. This liberalization has
also affected rice imports because the domestic rice production only allowed to cover between 20 and 30% of domestic demand. However, in 2008, the national rice self-sufficiency (RAN) was launched in order to reduce dependency on the outside.

The constraints of rice in Senegal are related to important bird invasions, especially in the Senegal River Valley, the dilapidated processing plants that alter the quality of the rice husking, difficulties in marketing of local rice, the low level of use mineral fertilizers and quality seeds, inputs access problems on time, credit access difficulties and land issues.

To these various constraints in the sector, add the high and growing amount of rice imports, as indicated in the chart below.

**GRAPHIV.6** : Broken rice imports (tons)

Rice imports ranged, on average, to 729,021 tons over the period, against 288,497 tons for local production. However, they dropped from 2008, due to the performance recorded in rice caused by the REVA plan and the GOANA. Unfortunately, like corn, rice imports have returned to growth in 2011.
IV.2.3. Groundnuts

Groundnut is the major source of income for the rural world. This sector is also one of the first four Senegal's export products, with fishery products, phosphates, and tourism. The Groundnut production activity in Senegal has a significant ripple effect on other sectors (the collection, industrial processing and marketing of products).

However, the groundnut sector faces the constraints of climate disruption, degradation of soils, deficiencies in inputs supply, especially seeds, of lack of renewal and maintenance of equipment park, the lack of support / advice to producers and access to credit. To these are added the difficulties of groundnut marketing.

In 2013, Chinese traders arrived on the Senegalese market Groundnuts, proposing a producer price which approximates 250FCFA kilo, different from the official price of 190FCFA. The arrival of China on the groundnut market brought a financial windfall for producers who think they can make a decent living from selling their produce at this price. However, this situation is detrimental to local mills (SUNEOR, NOVASEN) likely to suffer from a lack of supplies in [removed].

IV.2.4. Cotton

Cotton cultivation began in Senegal after gaining independence, thanks to the French Textile Development Company (CFDT), and highly dependent agriculture diversification sake of Groundnut.

Sodefitex (textile fibers Development Corporation), which was created in 1974, adopted a strategy for intensifying cotton cultivation. She contributed to the development of the sector, in distributing free inputs to cotton producers and putting in place in the early 80s, a functional literacy policy for the training of village technical relays.

However, cotton production has fallen particularly from 2008. The difficulties of the cotton crop are often related to irregular rainfall, the weakness of production, price volatility of the fiber, the traffic of subsidized inputs by the State, pest pressure and over-indebtedness of cotton farmers (about 1, 8 billion FCFA in 2011) following the crisis of 2000-2010.
IV.2.5. Garden products: tomato and onion

IV.2.5.1. Tomatoes

Tomato is the second horticultural speculation after onion. It is a diversified culture for the Senegal River Valley specialized in irrigated rice. The elements that benefit tomato growers in this area are the existence of processing plant and irrigation schemes.

However, the constraints of collective dependence vis-à-vis the credit, the obsolescence of agricultural machinery, evacuation of production to factories, competition from growing imposed by importing triple tomato paste and the high cost of some agricultural inputs, including fertilizer, affect the sector.

IV.2.5.2. Onions

The onion had its emergence through agricultural production diversification policy of Senegal in the early 70. Like other horticultural products, it also was an alternative to the nutritional balance of the population was threatened by drought. The proceeds from the sale of onion was also additional income for farmers and a reduction component of the balance of trade deficit.

The problems in the sector mainly concern the degradation of groundwater, the little reassuring land situation, lack of resources, difficulties in access to credit, lack of storage facilities and marketing competition from imported onion.

IV.3. Agricultural productivity

Agricultural productivity seems to be the best barometer of agricultural development as measuring the effectiveness of agricultural practices. However, it remains low in Senegal, due to constraints related to land degradation, climate irregularities, locust invasions, the low quality seeds, outdated farming equipment and lack of training of farmers.

The major factor in agricultural production is largely made up by the earth. The graphs below put in relation the growth rate of productivity with that of acreage for food crops and industrial agriculture.
The negative slopes indicate that the productivity moves in the opposite direction relative to the surface. Thus, the land extension policy does not necessarily lead to higher productivity. This observation can probably help explain why GOANA was not a great success, although it has attracted an extension of more than 40% of the cultivated area. However, it is important to qualify this, because of the limitations of the single-factor productivity.

In terms of labor productivity, it provides information on the ability of farmers to optimize production. The graph below compares labor productivity of the agricultural sector to other sectors.
Labour productivity in the agricultural sector seems extremely low compared to those of the secondary and tertiary sectors. The National Competitiveness Report of Senegal (SNCR) of 2011 says that weakness by the preponderance of informal actors. Indeed, labor productivity in the informal agricultural sector was ten times lower than in the formal agricultural sector. In addition, between 2000 and 2009, the productivity of labor in the formal agriculture has increased ten times faster than the agricultural informal sector. This results from the fact that the agricultural sector is still mainly composed of small family farms that rely heavily on outdated production techniques.

Source: ANSD
V. THEORETICAL AND EMPIRICAL LITERATURE REVIEW

Agricultural productivity refers to the efficiency with which farmers combine inputs to produce outputs. This is an important factor in profitability and competitiveness of the agricultural sector. Solow (1957) growth in production is largely due to an increase in productivity. Furthermore, Hayami and Ruttan (1985) showed that agricultural production can increase in two ways. First, the output growth may be due to an increase in the use of land, capital, labor and intermediate consumption. Second, the growth of agricultural production can be brought about by advances in production techniques. The following paragraphs explain the main determinants and the different methods of measuring agricultural productivity. Empirical work on the impact of productivity improvements in agricultural production, are also discussed.

V.1. Determinants of agricultural productivity

The literature on the determinants of agricultural productivity, provides information on the levers that public authorities must take action to increase agricultural performance. Overall, agricultural productivity can be improved for inputs that enter directly into the production process, but also through an environment conducive to the development of the sector.

In a study of soil quality, agricultural productivity and food security, Wiebe (2003) showed that land degradation does not threaten food security globally, but there are serious problems in areas where the soils are fragile, insecure property rights and farmers' access to information and markets, limited. In most cases, soil quality varies agro-ecological zones and geographical conditions. So Gisselquist (1999) highlighted the geography and agricultural productivity in India. His analysis shows that differences in grain yield between the northern states of central and southern India, are strongly linked to the regional geographic variation. It has some effect on productivity, all other things being equal. The authors show also that precipitation and temperature in tropical and dry states influence yields higher food grains.

In addition, the analysis of the effects of migration on agricultural productivity is attracting more and more attention of researchers. As such, Rozelle et al. (1999) attempted to establish links between remittances, migration and the Chinese agricultural productivity. Labor migration is, indeed, an important phenomenon that affects economic development and modernization. The study showed, through a simple econometric regression that migration has a negative impact on agricultural productivity, the influx of rural population to urban areas greatly reducing agricultural labor. Nevertheless, the negative effects of this phenomenon on
productivity are mitigated by remittances of migrants who contribute significantly to mitigate food insecurity.

The development of agriculture needs a good framework that allows farmers to produce in optimal conditions, feeding decently and market in the best part of their production. Antle (1983), concerned about the agricultural practice environment, showed the importance of the development of infrastructure in increasing agricultural productivity. As expected, the impact of infrastructure on agricultural productivity was positive. The development of agriculture in a country is largely dependent on the existence of good infrastructure, especially in transport and communication. Also, it is important to modernize and develop agricultural practices. In this sense, Alston (2010) conducted a comprehensive review of the literature on the role of innovation and R & D in the growth of agricultural productivity. It concludes that the investment rate of return on R & D is generally high. For its part, Kussa (2012), was interested in the effects of the health of farmers on agricultural productivity in Ethiopia. Patients farmers, on average, a score of 33.5% in terms of technical efficiency, against 48.9% in healthy households. The author shows, and that the establishment of an adequate health system helps to increase the productivity of farmers.

V.2. Measures of agricultural productivity

The measurement of agricultural productivity is the subject of much controversy. The accuracy and precision in the definition of agricultural productivity and in the designation of its determinants, in theory, are most obvious when it comes to empirical cases. Indeed, the constraints related to the availability of statistical invite themselves very often in this exercise. An index of production on a particular input is often used to measure the partial productivity of a factor. This type of indicator used to measure the time course of the unit production of a given input. For example, the yield per hectare is used to measure the productivity of the land, while output per worker quantifies the productivity of labor. However, partial productivities measures factors have shortcomings when it comes to capture technology. Indeed, they do not reflect changes in input use.

In contrast, total factor productivity (TFP) is a ratio that relates the aggregation of all the outputs with the aggregation of all inputs. It measures in a simple way, the efficiency with which inputs are transformed into outputs. However, different methods of aggregation of inputs and / or outputs can lead to different estimates, each consistent with the production function under - lying specified. TFP indices used in the literature are generally Laspeyres, Paasche, Fisher, Törnqvist-Theil and Elteto-Köves-Szulc (EKS).
TFP offers many advantages, in that it is clearly defined, easily measurable and offers possibilities for comparison over time and across different studies. It also constitutes a privileged tool for the analysis of the effectiveness of policies designed to increase the economic well-being, even if the effects of government policies on agricultural productivity can be offset and that other factors influence productivity. Thus the MFP generic term is often preferred to that of TFP that some input and/or output are necessarily excluded from the analysis, according to the availability of statistics. Without loss of generality, the TFP growth has three components (Coelli et al., 2005): technological change, changes in technical efficiency and changes in scale efficiency. In this sense, Darku, Malla and Tran (2012) measured the changes in total factor productivity of Canadian agriculture, using the approach of the stochastic frontier. The results of the decomposition of TFP in technological development, scale effect and changes in technical efficiency, showed that productivity changes are primarily driven by technological change.
V.3. Application of CGE model in agriculture

According Savard (1995), originally mainly two reasons justified the use of CGE models in agriculture. The first is related to the pressure in favor of liberalization of agricultural policies in the context of the GATT multilateral negotiations, with the consolidation of trading blocs such as the EU and NAFTA. The second is, in turn, related to the reappraisal of the interventionist role of the States, imposed by budget constraints. So many CGE were built to analyze the impact of the proposed agricultural liberalization in the Uruguay Round. Other models have, for cons, analyzed agricultural policy changes on the overall economy and the well-being.

Burniaux, Waelbroeck et al. (1988) use a model called RUNS (Rural / Urban / North / South) to assess the impact of the Common Agricultural Policy (CAP) of the European Union. This model differs in each regional economy, the agricultural sector from the rest of the economy and leads to a positive impact of the CAP to rural populations in developing countries, thanks to the increase in agricultural production and price the likely drop in prices of intermediate goods, which would result in increased revenue. Furthermore, the model WALRAS (World Agricultural Liberalization Study) OECD studied the interactions between agricultural and non-agricultural and evaluated in terms of well-being, the effects of OECD policies on member countries. The agricultural sector is not included in this model in detail; two products are explained: livestock and everything else. In addition, this model does not individualized developing countries (Burniaux et al., 1990).

The types of models (called global models), such as those described above, have extensively used the price transmission equations to represent the policies. This approach is probably simplistic in policy illustration. Thus, the slowness of market adjustment factors make it difficult to determine the net effect of attracting public policy resources on the marginal product of factors to world prices (Hertel, 1990). In addition, the inclusion of developing countries in these global models designed to enable correct recognition of the global supply and demand in a global perspective rather than from the point of ... those countries themselves (DE Janvry and Sadoulet, 1990). Finally, these models suffer from significant deficiencies in the disintegration and completeness of the agricultural sector.

In contrast, the models per country are directly focused on the impact of changes in international prices on economic performance. Emphasis is placed on the detailed interactions between the different branches of the economy and the specification of the characteristics of the different socio-economic groups. In sum, the CGE country applied to the agricultural
sector include two variants. In a first approach the agricultural sector is modeled as other sectors of the economy while a second approach models the agricultural sector in isolation, first multimarket model before integration into a general equilibrium framework.

In the first approach, we find the work of Loo and Tower (1990) who study the effects of agricultural trade liberalization in developing countries by, inter alia, focus on public sector funding and the allocation resources. On the effects on public finances, they lead to the conclusion that the increase in world agricultural prices combined with that of the value of imports and exports translates into a gain in terms of budget revenues. They conclude, also, increased earnings, following the reallocation of resources protected areas to the competitive sectors.

For their part, the CGE models built by De Janvry and Sadoulet (1987), including Korea, Mexico, Egypt, India, Peru and Sri Lanka studied the sectoral and inter-temporal effects of certain economic policies as a production increase of prices under different regimes (fixed and flexible), the price incentives, investments in agriculture than in industry, food subsidies. They have led to different results depending on how the economy is modeled. For Tanzania and Malawi, Lopez, Ali and Larsen (1991) analyzed the impact of macroeconomic policy, trade, price and exchange rate on agriculture, the sector is disaggregated into tradable and non property exchangeable. The main result of their work is in Tanzania, export agriculture is highly sensitive to price incentives and changes, in particular, the relative price of agricultural goods imports relative to non-traded agricultural.

More recently, the work of Thirtle et al. (2001) have shown that in developing countries, economic growth depends heavily on the productivity of the agricultural sector. The effects of an increase in productivity would be direct and positive on poor households in rural areas, while for the urban poor, the positive effects would be through the channel of the lower prices.

In Mali, in the context of the implementation of CAADP, Berthé and Keita (2009) show from a CGE model, based on that of IFPRI, that the increase in rainfed cereal productivity would be of great importance to reduce poverty, and that agricultural productivity is the most correlated with the nutritional status of rural households variable. They show also that the effect would be broadly positive for the poorest people who self-consume a significant portion of their production.

In the same vein, using a CGE model, sequential dynamics over the period 2009 -2019 (implementation period of the strategic plan for agricultural development, PEDSA), applied to
the Mozambican economy, Pauw, and Thurlow al. (2012) conclude that the increase in agricultural productivity in the PEDSA would result in a gain of 1.2 percentage point of growth, relative to the baseline scenario.

As for Nigeria, the IFPRI researchers, Diao et al. (2010) arrive through a recursive dynamic CGE in to the conclusion that if the targets set by the government for certain agricultural branches are met, then the agricultural sector and the economy as a whole would reach respective growth rates of 9%, 5% and 8% over the coming years.

Regarding Senegal, Dansokho (2000) analyzes the effects of Adjustment Plan for Medium and Long Terms through a static CGE. In his paper, he concluded that agriculture is the preferred route if in addition to the objective of reducing the public deficit, the authorities want to boost economic growth and increase the income of urban and rural households from the perspective of national policy against poverty. According to the author, the interdependent effects on the injection of the economy of a monetary unit in the agriculture sub-branches are significantly higher than those of non-agricultural sectors.

In total, the lessons of literature, especially in developing countries, show that the increase in agricultural productivity leads to higher economic growth.
VI. METHODOLOGY

VI.1. Statement of the problem
A dynamic CGE model is used to assess the macroeconomic and sectoral impacts of additional activities envisaged in agricultural policy.

As we know, a CGE connects firms with production decisions of economic agents consumption decisions, taking into account technological and budgetary constraints that apply to each of them. Thus constructed, the model is then used to analyze the one hand, exogenous shocks to the economic environment and, secondly, the economic policies that affect these agents. The architecture of the model and the equations that make up are presented in appendices.

To assess the impact of agricultural policy, two model usage levels can be considered.

1- the model can be used to quantify the short and medium-term economic benefits of increased public spending (demand effects) for the implementation of various activities.

2- the model can also be used to assess the structural effects of long term (supply effects), effects of the implementation of the programs and changes in the institutional environment.

These two levels of analysis are fundamentally different and credibility of the results relies heavily on the quality of the information collected.

VI.2. Impacts of public expenditure program in the short and medium term
To analyze the economic impact of public expenditure program, it is necessary to have a certain amount of information necessary for the proper conduct of simulations.

The budget is it in addition to or other alternative allocations already in the state budget? It is difficult to answer this question. However, it is reasonable to assume the occurrence of these two situations in simulations. If agricultural expenditures are in addition to other expenses, it is possible to examine four cases as they are financed by taxes, donations, domestic debt and external debt.

What is the sectoral composition of spending program? As part of a project to create a new plant, the promoter has a fairly accurate assessment of all the expenses that must be performed to develop the project. He will know, for example, the expenditure budget in construction, purchase of equipment, study in land development, etc .. Regarding agricultural policy, knowledge of expenses vector associated with each investment project, calculates the
impact on suppliers of goods and services sectors for the implementation of the program. This should contribute to assess the impact of capital expenditures on other sectors and measure the impact on job creation, production branches, imports, etc.. The detailed review of projects and programs provided helps to have an idea a priori of the sector that will provide the service requested by the activities included in the PICTs.

What is the timing of the public expenditure program over time? Information on the timing of spending several years allow the dynamic CGE model to predict, with some accuracy, the speed of implementation of agricultural policy. The PICTs is part of a vision for the medium term, taking into account the possibility of postponement offered rolling programming. It is implemented over a period of 3 years and the annual amounts are clearly indicated. However, some activities could be postponed while others are advocated. Also, what assumptions should be formulated after the expiry of the period of 3 years of PICTs? Should we assume that the additional expenses will end? This would mean a return flow of public expenditure in the baseline scenario. Should we, instead, consider continuing the effort in future years?

VI.3. Impacts of long-term agricultural program

The implementation of agricultural policy, through the PICTs essentially to change the environment of the agricultural sector in order to promote investment and production. With this in mind, the assessment of long-term structural impacts, using the model requires, first, identify the transmission channels of the proposed measures. Considering the projects and programs presented in Table III.1 and the characteristics of the model, agricultural policy should affect a number of components, namely:

- an increase in the capital stock (equipment, land);
- increased infrastructure in the agricultural sector;
- efficiencies or productivity in the use of inputs (labor, equipment, land);
- of efficiency or productivity gains in the use of agricultural infrastructure
- a good promotional campaign / marketing of agricultural products.
- improved access to credit

VI.4. Mathematical formalization

The equations grafted in CGE to translate the effects of short and medium term (demand effects) and structural effects long term, can be presented as follows:

VI.4.1. Demand effects

It is first important to remember the following three equations to account for the interrelations between public finances and the rest of the economy:
- The equation of the budget balance resulting from the difference between government revenues and expenditures

\[ SB_t = RFISC_t + RAUT_t + DON_t - \sum_i P_{i,t} G_{i,t} - \sum_i P_{i,t} DINVG_{i,t} - TRANSF_t \]

With : \( SB_t \) the budget balance ; \( RFISC_t \) tax revenues ; \( RAUT_t \) non-tax revenues, \( DON_t \) donations ; \( P_{i,t} \) price demand of good \( i \); \( G_{i,t} \) current expenditure (volume) of good \( i \); \( DINVG_{i,t} \) public investment expenditure in volume of good \( i \); et \( TRANSF_t \) government transfers to households.

- The balance equation between savings and investment

\[ \sum_i P_{i,t} DINV_{i,t} = EPARG.INT_t + SB_t + SCC_t \]

With : \( DINV_{i,t} \) the private investment expenditure (volume) of good \( i \); \( EPARG.INT_t \) private domestic savings ; et \( SCC_t \) the current account balance.

- The resource-employment equilibrium equation.

\[ XTD_{i,t} = C_{i,t} + G_{i,t} + DINV_{i,t} + DINVG_{i,t} + \sum_j INT_{i,j,t} \]

With : \( XTD_{i,t} \) the total demand (volume) in good \( i \); et \( INT_{i,j,t} \) intermediate consumption good \( i \) of industry \( j \).

VI.4.1.1. The new equations related to the demand effect of the agricultural program

The demand effect due to the increase in public spending to agriculture. Each program or project of agricultural policy is represented separately.

either:

\( VAG_{prog,t} \) : The annual expenditure by program (exogenous)

\( DAG_{prog,i,t} \) : The annual volume demand of good and for the execution of the program \( prog \) (endogeneous variable)

\( \theta_{prog,i,t} \) : The distribution parameter of the budget of a program by application well \( i \)

\[ prog = \{prog1, prog2, \ldots, prog14, prog15\} \]
Thus, the annual volume demand of good i for the execution of the program is linked to the annual cost of the program as follows:

\[ P_{i,t}DAG_{prog,i,t} = \theta_{prog,i,t}VAG_{prog,t} \]

This new demand results in a change in the resource-employment equilibrium equation:

\[ XTD_{i,t} = C_{i,t} + G_{i,t} + DINV_{i,t} + DINVG_{i,t} + \sum_{j} INT_{i,j,t} + \sum_{prog} DAG_{prog,i,t} \]

The budget balance is also altered in this way:

\[ SB_t = RFISC_t + RAUT_t + DON_t - \sum_{i} P_{i,t}G_{i,t} - \sum_{i} P_{i,t}DINVG_{i,t} - TRANSF_t - \sum_{prog} VAG_{prog,t} \]

**VI.4.1.1.1. If the expenditure is in substitution for other expenses**

If the expenses of the agricultural program are substituting other expenses, while the same amount should be subtracted from the other common items of expenditure or capital expenditure. To do this, the budget deficit should be fixed (or exogenous) and an expenditure becomes endogenous stations to be able to adjust.

**VI.4.1.1.2. If the expenses are in addition to other expenses**

If the expenses of the agricultural program are in addition to other expenses, results may vary, according to the four options below:

- if financed by an increase in tax revenue, while the fiscal balance remains exogenous as well as all other income and expenditure. Thus, only the tax revenue will have to adjust;
- if they are funded by donations, while the deficit remains exogenous and proxy donations becomes endogenous;
- if they are financed by domestic borrowing, while the deficit is deteriorating while the current account balance is exogenous. In this case, the stock of domestic debt increases;
- if they are financed by external debt, while the deficit is deteriorating but the current account balance becomes endogenous, while domestic savings is fixed. In this case, the stock of external debt also increases.

**VI.4.2. Supply effects**
VI.4.2.1. Increase in capital stock

The new capital is added exogenously to investment by sector of destination:

\[ IND_{j,t} = \alpha_j \left[ R_{j,t} / CU_t \right]^{\sigma_{ind} j} K_{j,t} + \sum_{prog} OAG^K_{prog,j,t} \]

With: \( OAG^K_{prog,j,t} \) volume d’accroissement du stock de capital financé par le programme \( prog \) et destiné à l’industrie \( j \); \( IND_{j,t} \) la demande annuelle d’investissement de l’industrie \( j \); \( R_{j,t} \) le taux de rendement du capital de l’industrie \( j \); \( K_{j,t} \) le stock de capital de l’industrie \( j \); \( \sigma_{ind} j \) l’élasticité de demande d’investissement de l’industrie \( j \); \( \alpha_j \) le paramètre d’échelle de la fonction de demande d’investissement de l’industrie \( j \); et \( CU_t \) le coût d’usage du capital.

Note that the same principle is applied to assess the increase in arable land:

\[ INDL_{j,t} = \alpha_l \left[ RL_{j,t} / CU_t \right]^{\sigma_{ind} l} LAND_{j,t} + \sum_{prog} OAG^LAND_{prog,j,t} \]

With: \( OAG^LAND_{prog,j,t} \) le volume d’accroissement de la terre financé par le programme \( prog \) et destiné à l’industrie \( j \); \( INDL_{j,t} \) la demande annuelle d’investissement en terre de l’industrie \( j \); \( RL_{j,t} \) le taux de rendement de la terre de l’industrie \( j \); \( LAND_{j,t} \) la superficie de la terre utilisée par l’industrie \( j \); \( \sigma_{ind} l \) l’élasticité de demande d’investissement en terre de l’industrie \( j \); et \( \alpha_l \) le paramètre d’échelle de la fonction de demande d’investissement en terre de l’industrie \( j \).

VI.4.2.2. Increased infrastructure in the agricultural sector

A l’instar du capital privé, les nouvelles infrastructures viennent s’ajouter à l’investissement public comme suit:

\[ INDG_{j,t} = \alpha_g \left[ RG_{j,t} / CU_t \right]^{\sigma_{ind} g} KG_{j,t} + \sum_{prog} OAG^K_{prog,j,t} \]

With: \( OAG^K_{prog,j,t} \) le volume d’accroissement du stock de capital financé par le programme \( prog \) et destiné à l’industrie agricole \( j \); \( INDG_{j,t} \) la demande annuelle d’investissement en infrastructure pour l’industrie \( j \); \( RG_{j,t} \) le taux de rendement de l’infrastructure pour l’industrie \( j \); \( KG_{j,t} \) le stock d’infrastructure utilisé par l’industrie \( j \); \( \sigma_{ind} g \) l’élasticité de demande d’infrastructure; et \( \alpha_g \) le paramètre d’échelle de la fonction de demande d’investissement en infrastructure.

VI.4.2.3. Increase in factor productivity
It is difficult to measure the effects of growth policy factor productivity, since they act indirectly on production. Moreover, the literature is somewhat verbose about it. However, the assumption made in this exercise is that on a given time horizon, the present value of the increase in productivity is the amount invested today. In other words, it can be admitted that the government hopes to increase long-term productivity of the same amount injected today as part of its policy. Thus, using the factor demand functions, the effect of increase in productivity can be considered as follows:

- **Increased labor productivity**

  \[ \text{VA}_j = A_j K_T^{\alpha_k} \left[ \left( 1 + \sum_{\text{prog}} OAG^{PRD,LD}_{\text{prog},j,t} \right) LD_{j,t} \right]^{\alpha v_j} \]

  With: \( OAG^{PRD,LD}_{\text{prog},j,t} \) l’augmentation (en pourcentage de la demande initiale de travail) de la productivité du travail financée par le programme \( \text{prog} \) et destinée à l’industrie agricole \( j \); \( LD_{j,t} \) la demande de travail de l’industrie \( j \); \( PV\text{A}_j \) le prix de la valeur ajoutée de l’industrie \( j \); \( VA_j \) le volume de la valeur ajoutée de l’industrie \( j \); \( W_{j,t} \) le taux de salaire payé par l’industrie \( j \); et \( \alpha v_j \) la part de la demande de travail sur la valeur ajoutée.

- **Increase the productivity of capital**

  \[ KP_j = A_j \left[ \left( 1 + \sum_{\text{prog}} OAG^{PRD,K}_{\text{prog},j,t} \right) K_{j,t} \right]^{\alpha k_j} \cdot \text{LAND}_{j,t}^{(1-\alpha k_j)} \]

  With: \( OAG^{PRD,K}_{\text{prog},j,t} \) l’augmentation (en pourcentage de la demande initiale d’équipement) de la productivité du capital financée par le programme \( \text{prog} \) et destinée à l’industrie agricole \( j \); \( K_{j,t} \) le stock de capital (équipement) de l’industrie \( j \); \( RP_j \) le rendement du capital (équipement et terre); \( KP_j \) le stock de capital (équipement et terre); \( R_{j,t} \) le rendement du capital (équipement); et \( \alpha k_j \) la part du stock capital (équipement) sur le stock total de capital (équipement, terre) de l’industrie \( j \).

- **Increased productivity of land**
\[ KP_j = A_k K_{j,t}^{\alpha_k j} \left[ \left( 1 + \sum_{ prog } OAG_{prog,j,t}^{PRD,LAND} \right) LAND_{j,t} \right]^{(1-\alpha_k j)} \]

With: \( OAG_{prog,j,t}^{PRD,LAND} \) l’augmentation (en pourcentage de la demande initiale de terre) de la productivité de la terre financée par le programme \( prog \) et destinée à l’industrie agricole \( j \); et \( RL_{j,t} \) le rendement de la terre pour l’industrie \( j \).

- Increased productivity of agricultural infrastructure

Improving the productivity of agricultural infrastructure is mainly due to road rehabilitation programs and production runs. Like that of labor or capital or land, increasing the productivity of public capital is taken into account as follows:

\[ KT_j = A_j \left[ \left( 1 + \sum_{ prog } OAG_{prog,j,t}^{PRD,KG} \right) KG_{j,t} \right]^{\alpha_k g_j} K_{j,t}^{(1-\alpha_k g_j)} \]

With: \( OAG_{prog,j,t}^{PRD,KG} \) increase (as a percentage of the initial request for public capital) in the productivity of public capital financed by the program \( prog \) et destinée à l’industrie agricole \( j \); \( KG_{j,t} \) le stock d’infrastructure publique utilisée par l’industrie \( j \); \( RT_j \) le rendement total du capital (équipement, terre et infrastructure) ; \( KT_{j,t} \) le stock total de capital (équipement, terre et infrastructure) utilisé par l’industrie \( j \) ; et \( \alpha_k g_j \) la part des infrastructures sur la stock total de capital (équipement, terre et infrastructure) utilisé par l’industrie \( j \).

VI.4.2.4. Recovery / marketing of agricultural products

The value of agricultural products mainly due to investments to increase production factors stocks and improve their productivity. Thus, the valuation component of agricultural products may be taken into account by the supply effects described above.

VI.4.2.5. Access to credit
Better access to credit allows to stimulate investment. Thus, it is assumed that the loans granted bonifient investment demand industries that benefit. Formally, the investment function by function can be rewritten as follows:

\[
IND_{j,t} = \alpha_j \left[ \frac{R_{j,t} + crd_{j,t}}{CU_t} \right]^{\sigma_{ind_j}} K_{j,t}
\]

with \( crd_{i,t} \) the credit access level \textit{(as a percentage of the initial investment demand) for the agricultural industry \( j \).}
VII. RESULTS AND INTERPRETATION

VII.1. Demand effects of expenditure agricultural policy

The analyzed results below outline the short-term macroeconomic effects from financing modes additional agricultural spending PICTs (2013-2015). This exercise seems essential although Table III.1 has the sources of financing. The reason is that in considering the principle of fungibility of budgetary resources, it may be unrealistic to expect, for example, that the contributions of donors necessarily in addition to existing expenditures. Indeed, portfolio constraints can bring a landlord to increase its agricultural funding and reduce other types of financing. In this case, additional agricultural spending would be to replace other budget expenditures.

The following tables show how the results can be different depending implementing fiscal policy.

Table VII.1: If agricultural spending coming in replacement of current expenditure (change compared to baseline)

<table>
<thead>
<tr>
<th>AGREGATS MACROECONOMIQUES</th>
<th>YEARS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2013</td>
</tr>
<tr>
<td>Consumer price</td>
<td>-0,33%</td>
</tr>
<tr>
<td>Volume of Current expenditure</td>
<td>-2,19%</td>
</tr>
<tr>
<td>Value of Current expenditure</td>
<td>-2,46%</td>
</tr>
<tr>
<td>Ratio budget balance / GDP</td>
<td>0,00%</td>
</tr>
<tr>
<td>GDP</td>
<td>-0,26%</td>
</tr>
</tbody>
</table>

Source: Authors

Table VII.1 shows that if the CAP is funded through a reduction in current spending, the economy would experience a decline of 0.3% to 0.5%. The explanation is that, to maintain constant budget balance, current expenditures are expected to decline beyond the level required to offset the revenue losses caused by lower prices.

In terms of funding from tax revenues (Table VII.2), we assume that the adjustment was made through indirect taxes on consumer goods. This process is actually the most used when it comes to increasing tax revenues. However, this measure would also recessive though, compared to the first option, the GDP decline should be smaller in scale.

Table VII.2: If agricultural expenditure is financed by an increase in tax revenues (taxes on consumption) (change compared to baseline)
Lower prices, excluding taxes, is also noted in relation to that of the economy. However, the change in the effective tax rate on goods consumed result in higher consumer prices. Current expenditures are maintained exogenous value in this simulation while spending volume would increase slightly, due to lower prices.

**Table VII.3:** If agricultural expenditure is financed by an increase in donations (change compared to baseline)

<table>
<thead>
<tr>
<th>MACROECONOMIC AGGREGATES</th>
<th>YEARS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2013</td>
</tr>
<tr>
<td>Consumer prices</td>
<td>0,32%</td>
</tr>
<tr>
<td>Volume of Current expenditure</td>
<td>-0,19%</td>
</tr>
<tr>
<td>Value of Current expenditure</td>
<td>0,00%</td>
</tr>
<tr>
<td>Ratio budget balance / GDP</td>
<td>0,00%</td>
</tr>
<tr>
<td>Ratio Donations / GDP</td>
<td>0,35%</td>
</tr>
<tr>
<td>GDP</td>
<td>0,58%</td>
</tr>
</tbody>
</table>

*Source*: Authors

However, the adjustment by donations (Table VII.3) would benefit the economy, with an annual increase of around 0.75% on average. To do this, the ratio of donations to GDP is expected to grow by more than half a point per year during the three years of implementation of agricultural policy. However, other expenses are expected to decline in volume due to rising prices and exogenous spending value.

**Table VII.4:** If agricultural expenditure is financed by domestic borrowing (in change compared to baseline)
If the additional agricultural expenditure is financed by domestic savings (Table VII.4), it would follow a systematic deterioration of the fiscal balance. Private investment also suffer a simultaneous decrease if part of domestic savings by households and businesses is transferred to the public sector. Thus, the option of financing by domestic borrowing would result in a contraction in activity and higher public debt.

Table VII.5: If agricultural expenditure is financed by external borrowing (change compared to baseline)

<table>
<thead>
<tr>
<th>MACROECONOMIC AGGREGATES</th>
<th>YEARS</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumer prices</strong></td>
<td></td>
<td>0,28%</td>
<td>0,47%</td>
<td>0,58%</td>
</tr>
<tr>
<td><strong>Volume of Current expenditure</strong></td>
<td></td>
<td>-0,17%</td>
<td>-0,28%</td>
<td>-0,35%</td>
</tr>
<tr>
<td><strong>Value Current expenditure</strong></td>
<td></td>
<td>0,00%</td>
<td>0,00%</td>
<td>0,00%</td>
</tr>
<tr>
<td><strong>Ratio budget balance / GDP</strong></td>
<td></td>
<td>-0,37%</td>
<td>-0,60%</td>
<td>-0,73%</td>
</tr>
<tr>
<td><strong>Ratio of current account / GDP</strong></td>
<td></td>
<td>-0,31%</td>
<td>-0,53%</td>
<td>-0,65%</td>
</tr>
<tr>
<td><strong>GDP</strong></td>
<td></td>
<td>0,51%</td>
<td>0,70%</td>
<td>0,75%</td>
</tr>
</tbody>
</table>

Source: Authors

Regarding external debt financing (Table VII.5), it would cause a simultaneous deterioration in the budget balance and the current balance. At the same time, an increase in GDP and a slight inflationary pressure would be noted.
In general, the effectiveness of the impact demand from increased agricultural investment is not necessarily guaranteed, and depends heavily on financing options. The use of internal financing (alternative spending, domestic tax or loan) is just a way to transfer the request of the public or private sector to the public sector. By cons, funding based on a combination of grants and external borrowing would cause a positive reaction in activity, despite a slight pressure on prices.

VII.2. SUPPLY EFFECTS OF AGRICULTURAL POLICY

If the demand effects is only visible in the implementation period of PICTs, the expected supply effects are part of the long term through increased investment, improved productivity factors and better access to credit.

The simulations indicate that the increase of production factors stocks only slightly improves the agricultural GDP (Table VII.6). On average, it is expected to increase by 0.48% per year compared to trend over the period 2014-2023. The increase in value is mainly due to the effect of increased equipment (0.36%) and, to a lesser extent, the effect of the increase in arable land (0.10%). The increase in agricultural infrastructure is largely through part of the budget of the proposed construction and rehabilitation of community roads (see table in section III) estimated at less than three billion CFA francs. It is then not surprising that its long-term effect remains marginal. Rice-paddy sector expected to grow faster than others, mainly because of the increase in land.
Table VII.6: Effects of increased capital stock value added agricultural sectors (on average over the period 2014-2023) 
the effects are measured by change from the baseline

<table>
<thead>
<tr>
<th>Effet de l’accroissement du stock du facteur :</th>
<th>AGRICULTURE</th>
<th>maize</th>
<th>rice paddy</th>
<th>millet</th>
<th>other agr. viv.</th>
<th>groundnut</th>
<th>cotton</th>
<th>tomato</th>
<th>sugar cane</th>
<th>autres agr. ind.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equipment</strong></td>
<td>0,36%</td>
<td>0,39%</td>
<td>0,39%</td>
<td>0,27%</td>
<td>0,39%</td>
<td>0,29%</td>
<td>0,20%</td>
<td>0,48%</td>
<td>0,20%</td>
<td>0,58%</td>
</tr>
<tr>
<td><strong>Land</strong></td>
<td>0,10%</td>
<td>0,07%</td>
<td>0,39%</td>
<td>0,05%</td>
<td>0,07%</td>
<td>0,05%</td>
<td>0,03%</td>
<td>0,08%</td>
<td>0,03%</td>
<td>0,10%</td>
</tr>
<tr>
<td><strong>Infrastructures</strong></td>
<td>0,03%</td>
<td>0,03%</td>
<td>0,03%</td>
<td>0,02%</td>
<td>0,03%</td>
<td>0,02%</td>
<td>0,02%</td>
<td>0,03%</td>
<td>0,02%</td>
<td>0,04%</td>
</tr>
<tr>
<td><strong>TOTAL EFFECT</strong></td>
<td><strong>0,48%</strong></td>
<td><strong>0,49%</strong></td>
<td><strong>0,81%</strong></td>
<td><strong>0,34%</strong></td>
<td><strong>0,48%</strong></td>
<td><strong>0,37%</strong></td>
<td><strong>0,26%</strong></td>
<td><strong>0,60%</strong></td>
<td><strong>0,26%</strong></td>
<td><strong>0,72%</strong></td>
</tr>
</tbody>
</table>

*Source*: Authors

Table VII.7: Effects of increased productivity on the added value of the agricultural sector (on average over the period 2014-2023) 
the effects are measured by change from the baseline

<table>
<thead>
<tr>
<th>Effect of the increase in the productivity of factors :</th>
<th>AGRICULTURE</th>
<th>maize</th>
<th>rice paddy</th>
<th>millet</th>
<th>other agr. viv.</th>
<th>groundnut</th>
<th>cotton</th>
<th>tomato</th>
<th>sugar cane</th>
<th>autres agr. ind.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Labor</strong></td>
<td>1,79%</td>
<td>2,06%</td>
<td>1,60%</td>
<td>1,39%</td>
<td>2,02%</td>
<td>1,46%</td>
<td>0,94%</td>
<td>2,48%</td>
<td>0,95%</td>
<td>3,02%</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td>0,20%</td>
<td>0,22%</td>
<td>0,17%</td>
<td>0,15%</td>
<td>0,22%</td>
<td>0,16%</td>
<td>0,10%</td>
<td>0,27%</td>
<td>0,11%</td>
<td>0,33%</td>
</tr>
<tr>
<td>Land</td>
<td>2.05%</td>
<td>1.88%</td>
<td>4.98%</td>
<td>1.28%</td>
<td>1.84%</td>
<td>1.37%</td>
<td>0.88%</td>
<td>2.31%</td>
<td>0.88%</td>
<td>2.80%</td>
</tr>
<tr>
<td>--------------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Infrastructures</td>
<td>0.39%</td>
<td>0.44%</td>
<td>0.35%</td>
<td>0.30%</td>
<td>0.44%</td>
<td>0.32%</td>
<td>0.21%</td>
<td>0.54%</td>
<td>0.21%</td>
<td>0.66%</td>
</tr>
<tr>
<td>TOTAL EFFECT</td>
<td>4.49%</td>
<td>4.67%</td>
<td>7.19%</td>
<td>3.15%</td>
<td>4.58%</td>
<td>3.35%</td>
<td>2.14%</td>
<td>5.78%</td>
<td>2.15%</td>
<td>7.03%</td>
</tr>
</tbody>
</table>

**Table VII.8:** Access to credit effects on the added value of the agricultural sector (on average over the period from 2014 to 2023) the effects are measured by change from the baseline

<table>
<thead>
<tr>
<th>Effect of a better access to credit</th>
<th>AGRICULTURE</th>
<th>maize</th>
<th>rice paddy</th>
<th>millet</th>
<th>other agr. viv.</th>
<th>groundnut</th>
<th>cotton</th>
<th>tomato</th>
<th>sugar cane</th>
<th>autres agr. ind.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL EFFECT</td>
<td>5.48%</td>
<td>6.42%</td>
<td>4.55%</td>
<td>3.72%</td>
<td>6.39%</td>
<td>4.25%</td>
<td>1.84%</td>
<td>8.81%</td>
<td>1.85%</td>
<td>10.83%</td>
</tr>
</tbody>
</table>

**Source:** Authors

<table>
<thead>
<tr>
<th>EFFET TOTAL</th>
<th>AGRICULTURE</th>
<th>maize</th>
<th>rice paddy</th>
<th>millet</th>
<th>other agr. viv.</th>
<th>groundnut</th>
<th>cotton</th>
<th>tomato</th>
<th>sugar cane</th>
<th>autres agr. ind.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in stocks factors</td>
<td>0.48%</td>
<td>0.49%</td>
<td>0.81%</td>
<td>0.34%</td>
<td>0.48%</td>
<td>0.37%</td>
<td>0.26%</td>
<td>0.60%</td>
<td>0.26%</td>
<td>0.72%</td>
</tr>
<tr>
<td>Increase in the factor productivity</td>
<td>4.49%</td>
<td>4.67%</td>
<td>7.19%</td>
<td>3.15%</td>
<td>4.58%</td>
<td>3.35%</td>
<td>2.14%</td>
<td>5.78%</td>
<td>2.15%</td>
<td>7.03%</td>
</tr>
</tbody>
</table>

**Table VII.9:** Total effects of agricultural policy on the added value of the agricultural sector (on average over the period 2014-2023) the effects are measured by change from the baseline

**Source:** Authors
<table>
<thead>
<tr>
<th>Better access to credit</th>
<th>5.48%</th>
<th>6.42%</th>
<th>4.55%</th>
<th>3.72%</th>
<th>6.39%</th>
<th>4.25%</th>
<th>1.84%</th>
<th>8.81%</th>
<th>1.85%</th>
<th>10.83%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Global Effects</strong></td>
<td>10.7%</td>
<td>11.9%</td>
<td>12.7%</td>
<td>7.3%</td>
<td>11.7%</td>
<td>8.1%</td>
<td>4.1%</td>
<td>16.1%</td>
<td>4.2%</td>
<td>19.7%</td>
</tr>
</tbody>
</table>

*Source*: Authors
The weakness of the effects of the increase in capital stock is explained by the fact that they cause, simultaneously, reduced workload. Indeed, the increase in these stocks leads to rise in the relative price of labor, reducing its request. This substitution effect reduces the expected effect of the increase in stocks factors.

As for the investment in improving productivity, they are expected to generate, on average, an increase of 4.49% per annum of agricultural value added (Table VII.7). The productivity of the land contributes significantly to 2.05%, mainly because of the recovery of the seed capital programs and rehabilitation of irrigation schemes. Improving labor productivity also seems to give good results (1.79% of agricultural GDP) due to additional investments CFAF 34 billion spread across several programs.

Finally, investments through better access to credit can generate an annual increase of 5.48% of agricultural GDP and appear more productive than previously simulated. This performance can be explained by the simple fact that the strengthening of the guarantee system of rural credit by the State reduces the user cost of capital, which promotes, in turn, investment to agriculture. However, from a macroeconomic perspective, such performance is to qualify when the incentive to invest in agriculture suggests disinvestment in other sectors of the economy.

**Graph VII.1: Decomposition of the annual change in agricultural GDP**

Graph VII.2: Annual change in GDP

Source: Authors
Overall, the new direction of agricultural policy, implemented through the PICTs, should generate an average annual increase of 10.7% of agricultural GDP. VII.1 The graph shows the growth dynamics of agricultural GDP between 2014 and 2023, with a breakdown of the different supply effects. The graph shows a gradual increase in production during the first years of agricultural policy is implemented. Mature, investments continue to boost production, but lose more and more effective, due to their depreciation over time. Consequently, agricultural policy should stimulate economic activity and allow the GDP to increase by 1% on average relative to trend.

**Graph VII.3 : Change in ratio of imports to GDP**

Furthermore, the economic performance raised by agricultural policy should help reduce imports (Figure VII.3). This reduction is made possible by the import substitution of agricultural products and other food products present in the secondary sector. The decrease in the ratio of imports to GDP would be maintained in the long term, due to the sustained increase in economic activity.
VII.3. THE RISK FACTORS RELATED TO THE AGRICULTURAL POLICY

The expected results of the agricultural policy, presented above, are obtained under the assumption of efficiency in the use of capital expenditure. In other words, the goal of the state, expressed through an increase of 126 billion FCFA of agricultural expenditure, provides a sustained increase of nearly 11% of the agricultural activity. This can then form the optimistic scenario of the study.

However, the occurrence of risks related to the implementation of programs is not ruled out. Potential risks that moderate efficiency of expenditures are numerous, but can be summarized in two main points. First, it is likely that some of the planned investments will not reach its destination, and second, it is possible that the process of monitoring and maintenance of investments is faulty.

VII.3.1. Decrease in the volume and effectiveness of planned investments

The finding of non-effectiveness of agricultural public investment is real and many reasons help explain this phenomenon. The Public Expenditure in the agricultural sector highlighted the many pitfalls related to the effective implementation of agricultural investments.

On the one hand, the institutional framework remains relatively weak due to the many institutions involved in the sector, and which are subject to constant changes in their organization and functions.

Moreover, almost all of the projects are strained through technical failures noted in the selection process and project / program preparation, budget preparation, budget execution and budget monitoring. These difficulties are inefficiencies in the allocation of budgetary resources and reducing the volume and performance of agricultural investments.

Moreover, there is a relatively large gap between the allocated expenses and those executed. Based on the review of agricultural expenditure, the rate of implementation of agricultural investments stood at 80% on average between 2005 and 2010.

For all these reasons, it is desirable to perform simulations that take into account the possibility of non-effective or not effective spending. To do this, we assume that the non-effective investments are between 20% and 40% of planned investments.

Graph VII.4: Annual change in agricultural GDP with a loss of efficiency between 20% and 40%
In this case, the graph VII.4 shows that the increase of agricultural GDP is significantly lower than referring to completely expenditures made (red curve). The annual difference could be between 3 and 5 percentage points. The lack of effectiveness of agricultural investments would increase agricultural GDP between 6.2% and 8.5% on average over the period 2014-2023. The GDP growth would be between 0.6% and 0.9% on average.

**VII.3.2. Failure of the monitoring system, maintenance and maintenance investments**

When monitoring, servicing and maintenance is not properly in place, the tangible and intangible investments depreciate faster than expected. In particular, an accelerated reduction in the yield of physical factors stocks can be seen due to their premature deterioration. In addition, investments oriented towards increasing the productivity of factors can not be effective if the desired level is not maintained after the implementation phase. Finally, poor management of agricultural credit guarantee fund may result in a significant number of problem loans and non-repayments that jeopardize
the sustainability of the system.

Risk factors, mentioned above, is likely to lead to a rapid depreciation of public investment. To assess the consequences of these risks, it can be assumed that the depreciation is three to four times faster than in the optimistic scenario.

**Graph VII.5: Annual change in agricultural GDP with a rapid depreciation of public investment**

The graph shows that the increase of agricultural GDP follows a different path from that of the optimistic scenario. Thus, the investment value added effects disappear in an accelerated manner, inducing a rapid return to trend situation. The change in agricultural value added could even become negative in case of high depreciation. On average, the increase of agricultural GDP would be between 5.7% and 7.4% over the analysis period. As for GDP, the increase would average between 0.5% and 0.8%.
VIII. CONCLUSION

For decades, Senegalese agriculture has experienced many difficulties related to low factor productivity and highly fluctuating production. Consequently, it has less and less participated in the creation of national wealth, causing suddenly a massive migration from rural to urban areas. This study investigated whether the new strategic directions of the Government's agricultural policy are likely to stimulate a real momentum for change in the industry. In particular, the study focused on new projects and programs written in the PICTs whose fiscal cost is estimated at just over 126 billion FCFA.

The stylized facts highlighted the fact that in addition to its high volatility, the contribution of agriculture to the GDP has declined significantly over the last fifteen years. Indeed, the share of agriculture in GDP has decreased from 10.10% between 1997 and 2001 to 7.86% between 2007 and 2011. This modest contribution to GDP, associated with significant weight of labor (nearly 30% of the working population), gives fairly accurate indication of the low productivity of agricultural labor which is five times less than the non-agricultural sector one. The agricultural sector's difficulties are linked in particular to the obsolescence of agricultural equipment, the degradation of infrastructure, seed quality, lack of storage units and inadequate agricultural credit. As a result, the output gap remains critical, resulting in a high level of imports of agricultural products.

A general equilibrium model integrating the agricultural sector, was used to measure the short-term effects (demand effects) and those of long term (supply effect) of new agricultural projects and programs.

The results show that the effectiveness of the demand effect resulting from the increase in public spending agricultural investment, is not necessarily guaranteed, but depends mainly on financing options. The use of internal financing (alternative spending, domestic tax or loan) is just a way to transfer the request of the public or private sector to the public sector. By cons, funding based on a combination of grants and external borrowing would cause a positive reaction in activity, despite a slight pressure on prices.

If the effects application is only visible during the period of the investment's implementation, the expected supply effects are part of the long term through increased physical capital, improvements in factor productivity and better access to credit. The supply effects therefore entail a change in farm production function.

The simulations indicate that the increase of production factors stocks would improve slightly the agricultural GDP. On average, it is expected to increase by 0.48% per year compared to trend over
the period 2014-2023. The weakness of the effects of the increase in capital stock is explained by the fact that these physical investments simultaneously cause a decrease in the volume of work, the cost is relatively higher. However, investments in improving the productivity of factors are expected to generate, on average, an increase of 4.49% per annum of the agricultural value added. Finally, investments through better access to credit appear more productive, judging by the annual increase of 5.48% of agricultural GDP they can generate.

Overall, the new direction of agricultural policy, implemented through the PICTs, should generate an average annual increase of 10.7% of the agricultural activity over the period 2014-2023. This increase corresponds to a gain of almost 1% of GDP per year. However, these results are obtained under the assumption that capital expenditures are used effectively. Indeed, the occurrence of risks related to the implementation of programs is not ruled out. First, it is assumed that the implementation of agricultural investment is accompanied by losses in volume and efficiency. These losses would bear the increase in agricultural GDP between 6.2% and 8.5% on average over the period 2014-2023. The GDP growth would be between 0.6% and 0.9%. Secondly, it is likely that failures are noted in the monitoring process, service and maintenance of investments. This would result in accelerated depreciation of tangible and intangible investments. In this case, the increase of agricultural GDP would be reduced between 5.7% and 7.4% over the analysis period. As for the GDP growth rate would average between 0.5% and 0.8%.
**Bibliographie**


Dansokho M. (2000), "Essai de Simulation de L'ajustement Structurel dans le Sector Agricole au Sénégal à l'aide d'un Modèle Calculable d'Equilibre Général (MEGC)", *Thèse de Doctorat d'Etat és Sciences Economiques, Université Cheikh Anta DIOP de Dakar*.


Thirtle, Colin et al (2001), "Relationship between changes in agricultural productivity and the incidence of poverty in developing countries"


53
Ministère de l'économie et des finances (2012), "Programme Triennal d'Investissements Publics (PTIP)", Direction de la Coopération Economique et Financière, PP.18-21.


