

Empirical Analysis of Agricultural Policy Impacts of Senegal for food Self-sufficiency: The Stochastic Frontier Production of Rice and Maize in Senegal River Valley

ARAME TOP^{1,2}

arametoptofa@yahoo.fr

KWANSOO KIM¹

1. Seoul National University/Department of Agricultural Economics/ SOUTH KOREA

2. KOPIA Senegal/ISRA/ SENEGAL

The stochastic production function estimates of rice and maize in Senegal River Valley demonstrate the possibility to reach self-sufficiency of rice in Senegal. Nonetheless, its fulfillment requires many accompanying measures in rice and maize production. These measures include all upstream and downstream activities related to agricultural production for their efficiency and sustainability in rice and maize production to maintain the country's comparative advantages and competitiveness. Then priorities should be given to agricultural infrastructure building, establishment of credit markets, and providing an easy access of production factors (e.g., improved land, fertilizers, improved and certified seeds, as well as agricultural machines). Furthermore, policy makers should provide a larger incentive in terms of producer price to encourage farmers to increase considerably their outputs, thereby farmers face smaller risk of having non-sold outputs. And during an early harvesting period, appropriate policy measures are in need to prevent farmers from dumping their products under severe social and economic pressures such as children schooling and loan payment, etc...

Keywords: Agricultural policies, Stochastic frontier production, Food Self-sufficiency, Senegal River Valley

Acronyms and Abbreviations

ANSD	National Agency of Statistics and Demography (Agence Nationale de la Statistique et de la Demographie)
DA	Agriculture Office (Direction de l'Agriculture)
FCFA	Africa Financial Community Franc (West Africa currency)
GOANA	Great Agricultural Offensive for Food and Abundance (Grande Offensive Agricole pour la Nourriture et l'Abondance)
IRRI	International Rice Research Institute
ISRA	Senegalese agricultural research institute (Institut Senegalais de Recherches Agricoles)
SAED	Senegal River Valley National Development Agency
SRV	Senegal River Valley
WARDA	West Africa Rice Development Association

Introduction

For several decades, many strategies and programs have been adopted to boost agricultural production in Africa (Svanidze, 1968) to no avail. In Senegal, taken decisions, from the liberalization of agriculture to special programs, did not harmonize the domestic production with the demographic pace and the rapid growth of urbanization (IPAR, 2010 and Ferrer, 2011). Many criticisms continue to be expressed concerning the development of agriculture in African countries. Some of them are targeting the principles of transparent management of public institutes (Africa rice, 2011) and the other ones are implemented mechanisms and strategies (Raymond and Fok, 1995 and Africa Rice, 2011) to boost agricultural production.

Many analysts noticed that Senegal, like many other Sub-Saharan African (SSA) countries, was and is still confronted to a host of challenges. The population of Senegal is currently amounted to about 13 567 338 inhabitants (ANSD, 2013) and is expected to reach approximately 20 million inhabitants by 2025 (IPAR, 2010). This increasing population essentially composed of young people is actually an asset of jobseekers in the labor market. For example, currently around 269,000 young people are entering the labor market annually, and this trend will increase to reach more than 350,000 within fifteen year (IPAR, 2012). Nonetheless, the economy of Senegal is not well prepared to receive all these young people in need of employment. Therefore, the problem of employment is triggered debates around the potential absorption (uptake) of job seekers of agricultural and non-agricultural activities in rural areas in order to enhance sustainably the economy of Senegal.

However, structures of job providers in rural area as well as the government structures are little or almost not enough efficient in delivering many jobs. There is consequently a challenging need to revamp rural economy. Actually, even though a small level of diversification is going on in agricultural activities, there is still a huge gap to fill (DA, 2010) as this diversification is simply a manifestation of adjusted process, planning of difficulties which are facing rural people rather than a well-defined or successful policy (Stads and Sene, July 2011). Therefore, it doesn't lead to a diversified employment carrier or creation.

Households with an income per day and per head lower than FCFA 500 can be amounted to 20% of the population. This shows that poverty is practically generalized, mainly in rural areas where the rural exodus of young people with no other job qualification except agricultural activities, enhances the degradation of agricultural sector. This poses major challenges because, like in a vicious circle, to learn and launch a remunerative activity there is a need of a source of income and a person without income cannot launch an activity and is trapped by poverty.

The barriers of the development of agricultural production cannot be tackled without addressing closely related issues such as the structural and the socio-economic problems that Senegal is facing. Moreover, such challenges involve all the actors who are directly and/or indirectly linked to agricultural sector activities. Since the rural areas perform a crucial role in the process of achieving food self-sufficiency in Senegal, agricultural policies (land reform, direct subsidies, etc.) should be in line with the realities of the rural environment.

Motivation

Since 1980 years, after a series of poor harvest, Senegal agricultural sector experienced a steady decline with severe adverse effect on the socio-economic situation of rural areas. In a bid to revamp the agricultural production, many policies and strategies has been implemented vainly from the New Agricultural to the Great Offensive for Agriculture and Food Abundance. This failure motivated the creation of Senegal Emergence Program.

Purpose

Senegal is highly dependent on cereal import beside all agricultural policies implemented for food self-sufficiency, mainly on rice and maize. Then, the objective of this analysis is to demonstrate how rice and maize self-sufficiency can be achieved progressively according to the estimates of their stochastic production function.

Literature Review

Since more than two decades interest in agriculture sector is growing up because of the country huge dependency on imports (MEF, May 2008) and the 2008 food crisis which renewed concern on the improvement of local agricultural production (Niang and Ndiaye, 2010). Many agricultural policies have been vainly elaborated in order to adjust the agricultural production of Senegal contrary to China where agrarian reforms (1978~1984) were significant on agricultural growth (Lin, 1992). And according to many studies focus should be concentrated on two main and essential elements of production. Those are, improved and appropriate rice and maize seed use (WARDA/2004-2005 report, ISRA and BEZELGA And KEITA, 2006) and agricultural practices amelioration in order to secure the current and future generation needs by “reducing the gap between average and potential yields” (Lobell, Cassman, and Field, 2009). For that, priorities should be canalized on sustainable production and consumption through local resources and human capital valorization (GOANA, 2008), technical (itineraries: land tillage and agricultural intensification) and financial means improvement (MEF, May 2008) as well as processing and marketing systems amelioration (David Neven and Matty Demont, 2010). In fact, the combination of these instruments increased rice productivity by 18% in 2008 compared to 2007 and processing loss decrease between 15 and 25% compared to 40% before (IRRI, January-March 2011).

Methodology

The impacts of agricultural policies on production growth will be analyzed by estimating a stochastic production function with a focus on seed price and producer price to analyze the impacts of direct subsidies on RSV output. The producer price is the government buying price of rice and maize from farmers.

Data

The data collection in SRV necessitated divers' contacts from divers' institutes as there is not a centralized information system in Senegalese agriculture sector like in most of developing countries (all sector included). A number of adjustments are also done after main literature review to make the data suitable to an empirical analysis. The main sources of data in are from the Agriculture Office (DA), SAED and ANSD. The analysis relies on a yearly time series data from 1980 to 2011.

Limits of the study

The principal limitation of this study is detailed data availability. If there is more information on data, labor gender, education level, age...specific analysis would be happen.

Empirical Analysis**Model**

The production function defines the relationship between the output and used inputs for its realization. Used inputs act directly on production, except for those due to random shocks which are highly over farmers' control. The implemented model relies on stochastic frontier production function with focus on subsidized seed

price and producers' price. The frontier production function model is based on efficient stochastic model which is increasingly in use in farmers' efficiency analysis since 1977 with Aigner, Lovell & Schmidt, and Meeusen & Broeck research results.

$$(1) Y_{it} = f((X_{itn}, \beta) \varepsilon_{it}(u_{it}, v_{it})) + \alpha_{1it}P_{Farmit} + \alpha_{2it}P_{Seedit},$$

where:

$f((X_{itn}, \beta) \varepsilon_{it}(u_{it}, v_{it}))$: Cobb-Douglas function

i: rice or maize production (i= 1 or 2),

t: time (yearly observation starting from 1980 to 2011),

Y_{it} : rice or maize production at time t in ton,

X: vector of input (land (ha), fertilizers (ton), seed (ton), labor (person), investment (FCFA)),

P_{Farmit} : rice and maize producer price at time t (yearly farmer price),

P_{Seedit} : rice and maize seed price at time t (yearly seed price),

β : parameters to be estimated,

n: number of parameters

$\varepsilon_{it} = u_{it} + v_{it}$ stochastic disturbance error term consisting of two independents error terms,

v: a symmetric component randomness error term which accounts for random variation in output due to factors outside farmers' control, such as weather and disease. It is assumed to be independently and identically distributed as $N(0, \sigma_{v2})$,

u: one-sided component, where $u \leq 0$ reflects technical inefficiency relative to the stochastic frontier, $f(X; \beta)\exp(e)$.

Then $u = 0$ for a farm output which lies on the frontier production and $u < 0$ for one whose output is below the frontier production function at an individual level. U is independently and identically distributed and is a half-normal distribution function.

This approach has an advantage as it accounts for the presence of measurement error in the specification and the estimation of parameters of the production function. The stochastic frontier function differs from the traditional production function. For that, the former consists of two error terms (u and v). The first error term (u) accounts for the existence of technical efficiency and the second accounts for factors such as measurement error in the output variable, weather and combined effects of unobserved inputs on the production.

To ease the procedure of estimation, the frontier production function will be estimated under its logarithm form. Then the function (1) becomes:

$$(2) \ln Y_{it} = \beta_{0i} + \beta_{1i} \ln land_{it} + \beta_{2i} \ln lab_{it} + \beta_{3i} \ln fert_{it} + \beta_{4i} \ln seed_{it} + \beta_{5i} \ln inves_{it} + \alpha_{1i} \ln P_{Farm_{it}} + \alpha_{2i} \ln P_{Seed_{it}} + e_{it}$$

The annual amount of investment in rice and maize production is expected to include the amount of land layout and direct investment in rice and maize sectors. However, there are many amalgams and contractions in the amount of layout per hectare between service providers of private and public sectors, mainly between public policies makers and agricultural actors. Indeed main of land layout are made by private or semi-public foreign companies and prices vary between 3,000,000 FCFA/ha to 5,000,000 FCFA/ha according to agents of agricultural sector. Furthermore, the government bills in land preparation are always calculated on the base of the last amount which is very expensive in the opinion of many regulators of efficient agricultural production. For that agronomists think that land preparation service should be given to Asian service providers (China, Thai and Japan) instead of European and American companies as their provision of

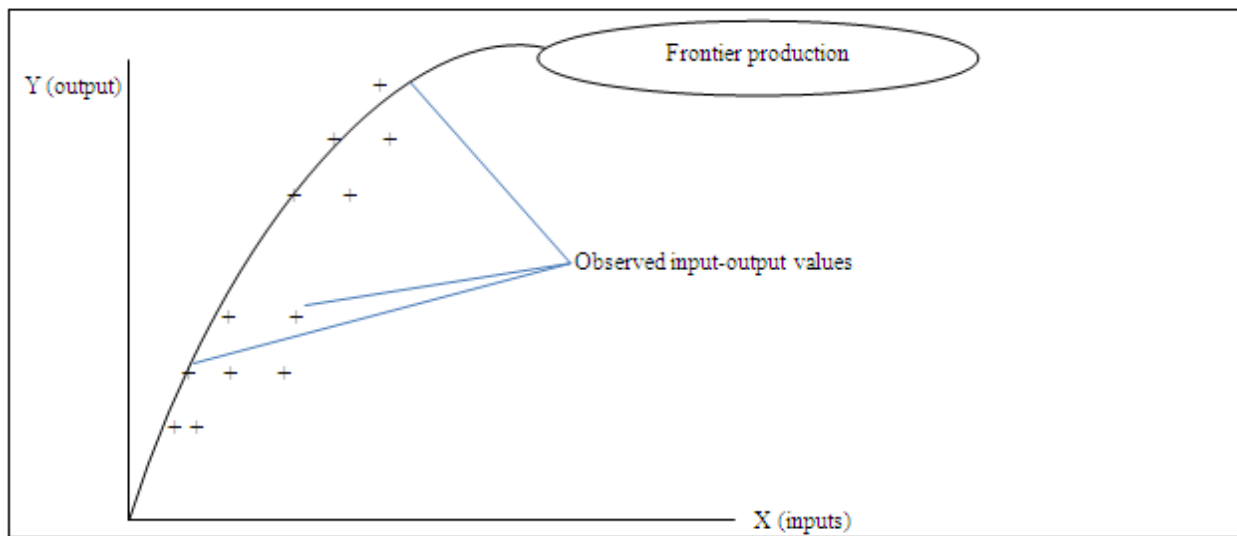
services are cheapest with the higher local labor hiring level. Then, because of imprecise details on the amount of land effectively concerned (improved land), the layout amount is excluded for efficient estimation of parameters.

The seeds price is a subsidized price which is determined by the government and there is also no detail on seed varieties. The level of the subsidy varies considerable among years from 50% to over 75% per year based on socio-economic conditions of each year. Thus, as direct investment on agricultural production incitement, subsidized seed prices will be used in the model instead of suppliers' prices. Then the model becomes:

$$(3) \ln Y_{it} = \beta_{0i} + \beta_{1i} \ln \text{land}_{it} + \beta_{2i} \ln \text{lab}_{it} + \beta_{3i} \ln \text{fert}_{it} + \beta_{4i} \ln \text{seed}_{it} + \alpha_{1i} \ln \text{PFarm}_{it} + \alpha_{2i} \ln \text{PSeed}_{it} + e_{it}$$

Where; Pseed_{it} is subsidized price of rice and maize seed.

If there was more detail on collected data, for example age, gender, credit accessibility, schooling...etc, their technical efficiency could be tested to determine their impacts on rice and maize production in Senegal River Valley.



Graph. Stochastic frontier production.

The annex graph shows the stochastic production function structure. And below the stochastic production function line, the inefficient error term (u) is inferior to zero. Furthermore, the variance of the model σ^2 and the ratio of the two standard errors are given by:

$$(4) \sigma^2 = \sigma_u^2 + \sigma_v^2$$

$$(5) \lambda = \sigma_u / \sigma_v$$

And if there is more information on different farmers in rice and maize production in Senegal River Valley, farmers efficiency at the individual level can be obtained from the error term ε which is given by the sum of the two error terms of the model ($\varepsilon = u + v$) and the technical efficiency of each farm can be evaluated as follow:

$$(6) \text{TE} = \text{Exp}(E(u/\varepsilon)) \text{ where } E(u/\varepsilon) = (\sigma_u \sigma_v) / \sigma$$

Estimation Results and Discussions

The rice sector. Estimated coefficients of the stochastic frontier production function of rice in Senegal River Valley are represented in the table 1. All the coefficients in the model have expected priori signs except the seed factor (Inseed). Estimates are all significant at 1% level of significance. This level of significance

confirms their huge impact in rice production.

The 0.7785 elasticity of land implies that a 1 percent increase in cultivated land area, while holding all other factors fixed would lead to an increase of 0.7785 percent in the output of rice and vice versa . This suggests that land is a significant factor associated with changes in rice output. Same positive impact is also observed in labor and fertilizers inputs. Then an increase of 1percent of their quantity, while holding fixed all other factors would increase rice output by 0.004 and 0.2258 percent respectively and vice versa.

Table 1

Maximum likelihood estimates of parameters of the stochastic frontier production of rice

Variables	Descriptions	Parameters	Coefficients	St. errors
Cons	Constant	β_{10}	3.2762***	0.0002
Inland	Log of land	β_{11}	.7785***	0.0001
Lnlab	Log of labor	β_{12}	.0004***	3.83e-06
Infert	Log of fertilizers	β_{13}	.2258***	0.0001
Inseed	Log of seed	β_{14}	-.0619***	0.0000
Lnpr	Log of producer price	α_{11}	.0619***	0.000
Lnps	Log of seed price	α_{12}	-.2059***	0.000
sigma_v			7.38e-09	1.54e-06
sigma_u			.2861	.0357
Log likelihood = 16.8167				

*** 1% level of significance

Contrary to the expected result, production elasticity with respect to seed factor input is negative. This significance of seed in rice production for example diverts from the fact that seed, more precisely its quality, is an important factor in rice yield improvement. Indeed, improved and certified seed use provides better quality of output than withheld seeds. However as farmers are almost low income producers, there is a tendency to withhold seed from present crop year for the next one. This negative estimated coefficient may refer to a high quantity use of uncertified seeds which is usually frequent in subsistence rice farming. Then 1 percent increase in seed quantity while holding fixed all other factors would decrease rice output by 0.0619 percent and vice versus.

For producer price and subsidized seed price, their elasticity's to the production are respectively positive and negative like expected. It means that an increase (decrease) of 1 percent of producer price (subsidized seed price) while holding fixed all other factors would increase rice output by 0.0619 percent (0.2059percent) and vice versus.

The maize sector. Estimated coefficients of the stochastic frontier production function of maize in Senegal River Valley are represented in the second table. The model coefficients do not have expected priori signs. Among them only seed factor and producer price are significant respectively at 5% and 1% level of significance.

However, unlike in rice sector, maize production elasticity with respect to seed is positive like expected. This positive impact can be explained by the professionalization of maize production in Senegal River Valley. Therefore, its positive elasticity of 0.5641 involves that a 1 percent increase in its used quantity while holding fixed all other factors would increase maize output by 0.5641 percent and vice versa.

The coefficient of maize producer price is positive as expected. This suggests that, the increase of

producer price will induce farmers to enhance their production to gain more income at the farm gate. Thus 1 percent increase in producer price of maize while holding fixed all other inputs would lead to an increase of 0.4243 percent in maize production and vice versa.

Table 2

Maximum likelihood estimates of the stochastic frontier production function of maize

Variables	Descriptions	Parameters	Coefficients	St errors
Cons	Constant	β_0	-7.5751	28.4374
Inland	Log of land	β_1	-6.8846	23.829
Lnlab	Log of labor	β_2	6.6417	22.8712
Infert	Log of fertilizers	β_3	1.0155	2.8469
Inseed	Log of seed	β_4	.5641**	.2295
Lnpf	Log of producer price	α_1	.4243***	.0869
Lnps	Log of seed price	α_2	-.05454	.2384
sigma_v			.0773	.0358
sigma_u			.1206	.0715
Log likelihood = 26.669552				

***1% level of significance; **5% level of significance

Conclusion and Recommendations

The analysis of rice and maize model shows that land factor is the higher factor associated with changes among inputs in rice sector. Contrary to the maize sector in Senegal River Valley, in rice sector all parameters influence positively rice output except the seed factor. The impact of seed in rice and maize production is negative and positive respectively in rice and maize farming as well as respectively significant at 1 percent and 5 percent level of significance. Then the quality of seed should be improved in order to use less quantity of high yielding seed by strengthening established seed policy. Due to seed production complexity and requirement, the production of certified and improved seed must be encouraged and supported for policy sustainability and efficiency.

Fertilizers utilization has a major impact on sustainable and improved crop production. But for better result it should be used efficiently by respecting recommended norms by hectare as well as by applying them at real-time. Then subsidized fertilizers must be distributed on time to producers.

In rice sector, the estimate of labor input factor is positive and statistically significant at 1%. But its value is approximately nil. Therefore farmers training should be reinforced to increase their skill. And as young rural people desert rural areas to cities, sustainable policy for young reverse to agriculture should be implemented to slow down rural exodus as well as to build up a strong and skilled labor.

Production elasticity with respect to producer prices (rice and maize) and subsidized price of seed (rice) show that they are main factors of output improvement. Then, even though producers can sold sometimes their output in daily or weekly markets at a price higher than the guaranteed price of the government, leaders should set up more incentive price to motivate farmers to increase their productions.

Thus, according the results of analysis of rice and maize models, we can say that food sufficiency in rice is reachable in Senegal if all necessary conditions are gathering. Leaders and farmers should seize these two crops opportunities, huge comparative advantages, to boost efficiently and sustainably rice and maize production in the extent of the country. Then in order to solve the country huge dependency on rice and maize imports and

match the increasing demand of the population to the domestic production, it must have an efficient use of inputs and more appropriate measures to incentive and sustain crop production. Furthermore with an ascendant population growth rate which is combined to a rapid urbanization, agriculture intensification is imperative to satisfy the local demand. For that, priorities should be made on efficient use of inputs (mainly for fertilizers and improved seeds), plant protection and activities mechanization. And as Senegal River Valley area is suitable to double crop due to the availability of water along year, irrigation systems must be also improved and generalized for continual crop production in order to increase farmers' income and reverse people toward land cultivation.

The estimates of the stochastic production of rice in SRV show that self-sufficiency in rice can be achieved theoretically. However, practically there are a number of prior conditions that need to be met before the improvement of the domestic production and the achievement of self-sufficiency in rice. And the major factors in meeting these conditions whether it is land, labor, fertilizer, seed or policy planning and management, is related to the accessibility and the availability of financial resources. Then, the straightening of cereal production relies firstly on the mobilization of necessary financial resources from both domestic and foreign institutes and secondly on factors of production and policy improvement.

Even though land factor is a significant factor associated with changes in rice output, the accent should be on intensive agriculture rather than on extensive agricultural production in a context of sustainable management of natural resources. Policy makers and authorities should establish and ensure continuity in the creation and the rehabilitation of improved hydro-agricultural planning (layouts) in order to maintain soil fertility and manage soil acidity and salinity as well as soil erosion. Thus, agricultural plots must be equipped with sophisticated irrigation and draining systems. This investment in land improvement, soil fertility restoration, agricultural productivity increasing as well as efficient use of inputs of production, is necessary to overcome positively changes in weather conditions and address the decreasing self-sufficiency of Senegal.

Labor factor elasticity in rice production is close to zero. This slack, close to zero impact of labor factor is due to the excessive number of people working in agriculture and to the rudimentary quality of the stock of capital fix. Then, the quality of labor factor must be improved while mechanizing agricultural production. For this reason training of farmers should be general and consistent with targeted objectives and producers' education level. In that sense, there is a necessity of efficient training of monitors in order to satisfy adequately the improvement of farmers' skill according to their culture and believing. Indeed during the World Conference on Agrarian Reform and Rural Development in 1979, many analysis and training methods were elaborated to support projects of development in developing countries where the percent of the illiterate is usually very high. However, those methods were neglected by policy makers and authorities. And since year 2000, rural institutes and sub-regional organization like AfricaRice are activated in the same direction positively. Among them, the leading used one in West Africa, mainly in Senegal is the MARP (Methode Accélérée de Recherche Participative: Rapid Rural Appraisal) diagram. The MARP diagram methods of dealing with farmers are easy as it just designs or characterizes each component of the training by using things which are very familiar to farmers. For example, in agricultural production the tree diagram is highly in use in the improvement of agricultural practices. The importance of agricultural practices is graduated from tree roots to its leaves. Roots represent all sine qua non (prerequisite) conditions and factors or actions in agricultural production. After roots comes successively the stem, branches and leaves. This method improved obviously farmers' skill and productivity in many local specific training programs. Then, the government should focus on this method while

encouraging children enroll and stay at school as rural children stop their study earlier than urban children.

The positive elasticity of fertilizer factor in rice production confirms its importance in rice production. But its availability and accessibility is not enough desirable even it is subsidized at a rate of 50% of the market price. And as subsidy policy cannot be continuous in a system of open market, incentive policies on fertilizers should be formulated to make farmers progressively less dependent on government credits. Policy makers must work on the empowerment of farmers to help them to ensure their future expenditure in agricultural production. Furthermore, as most of them have volatile income related to the nature of farming activities, farmers should work on their own credibility building toward financial institutes. As financial institutes are just intermediate between savers and borrowers, producers should support the sustainability of their activities by saving their money in those institutes. Indeed most of rural people don't want to save their resources in banks and keep them in their houses.

In term of fertilizers use, subsidized fertilizers must be distributed on time in all agro-ecological zones and applied appropriately at real time according crop needs to increase efficiently crop productivity and quality. Farmers should also be aware of the toxicity of fertilizers and take the necessary measures for livestock, environment and human being protection.

The estimate of seed factor is respectively negative and positive in rice and maize production in Senegal River Valley. It emphasizes that seed issues in rice sector are more severe than in maize one. This negative impact of seed in rice production can be highly related to the quality or to the quantity of seed used per hectare (overuse of seed). As seed productivity is also highly related to the density of plants per hectare (AfricaRice, 2011), the appropriate quantity of seed per hectare as well as the required space between seedling according seed variety should be respected to ease plant growth. Then, in order to address the impacts of seed in rice production and improve its productivity as well as to boost its positive effect in maize sector, farmers should use improved and certified seed to increase quantitatively and qualitatively their output. For that, some farmers must be specialized in improved and certified seed production. And as improved and certified seed yield and resistance to parasitic infestation and climate changing are higher than the withheld seed ones, the use of improved and certified seed must be generalized to increase progressively domestic production in order to achieve self-sufficiency in cereal in a near future.

Furthermore, the negative price elasticity of subsidized seed in rice production emphasizes the importance of certified and improved seed use in rice sector. This negative estimate supports the necessity of scale of production of rice seed to cut down seed price. Seed production should be totally liberalized and boosted to drive down its price. Indeed, the decrease of seed price should provide an opportunity to support small farmers as well as to strengthen family farming. And if the productivity and the production of family farming farmers are boosted, rice import will decrease considerably.

References

- BEZELGA Sébastien And KEITA Sabou (2006), "Nerica evaluation in the Republic of Guinea", March 2006.
- David B. Lobell, Kenneth G. Cassman, and Christopher B. Field (2009), "Crop Yield Gaps: Their Importance, magnitudes, and Causes", *Annu. Rev. Environ.*, July2, 2009.34: 179-204.
- David Neven and Matty Demont (2010), "West Africa rice markets and the global food crisis: Value chain and consumers perspectives on response strategies", Boston June 19, 2010.
- Gert-Jan Stads and Louis Sène, July 2011, Private-Sector Agricultural Research and Innovation in Senegal: Recent Policy, Investment, and Capacity Trends.

- I.A. Svanidze, "The African struggle for agricultural productivity", *The Journal of Modern African Studies*, 6, 3 (1968), pages 311-328.
- IPAR, "Le cas de la filière maïs".
- IRRI/Rice Today, January-March 2011.
- Justine Yifu Lin (1992), "Rural Reforms and Agricultural Growth in China", *The American Economic Review*, VOL.82 NO.1 March 1992.
- Mouhamadou Ndiaye et Moussa Niang (2010), "De l'étude sur la transmission des fluctuations et le calcul des prix de parité à l'importation/exportation dans la sous-région : Cas pratique du Sénégal", janvier 2010.
- Paula Bianca Ferrer, "Maize gradually comes out of rice and wheat's shadows to offer its own set of benefits to farmers in Bangladesh", *Rice Today* October-December 2011.
- Raymond, G and M.Fok, "Relations entre coton et vivriers en Afrique de l'Ouest et du Centre. Le coton affame les populations: une fausse affirmation? *Economies et sociétés. Série de développement agroalimentaire* 22(34) 221-234, 1995.
- WARDA, Annual report 2004-2005.