POLICY BRIEF

Technical Efficiency of Small-Scale Maize Producers in Benin

Fawaz A. Adéchinan Aminou

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Abstract

Given the importance of maize as a food crop in Benin and the objectives of the country regarding this product in terms of food security and exports, a study on maize production is of primary importance. This study aims to analyse the way small-scale maize producers allocate their production factors and to identify the elements that are inherent to an efficient maize farming operation. The Cobb-Douglas Stochastic Frontier approach is used to estimate the level of technical efficiency of maize growers. The mean score in technical efficiency in maize production in the sample used is estimated at 65.40%, with

a minimum of 20.47% and a maximum of 93.46%. The results indicate that the sex of the farmer, use of enhanced seeds, the selling price of maize, the percentage share of non-agricultural income, contact with an Non-Governmental Organization (NGO), access to finance, and the production zone play a positive and significant role in the attainment of a production frontier. The results lead us to recommend that the government reduces its expenditure on agricultural extension services and instead emphasize the policy on distribution of improved seeds. Equally, constraints in the capital and labour markets contribute to the low efficiency of agricultural households.

Introduction

Benin is heavily dependent on its agricultural sector, which contributes to 32.4% of the Gross Domestic Product (GDP) and 80% of the official export revenues (World Bank, 2010). However, the sector is lagging in terms of modernization and diversification. Indeed, Benin's agricultural sector is dominated by the cotton sector, which represents between 25.0% and 40.0% of total exports and 34.7% of official export revenue (World Bank, 2010). These strong indicators in the sector are however undermined by problems of organization, climatic variations, and the continued use of outdated production tools. The crisis in the cotton sector that has become quite evident since the campaign of 1999-2000 has exposed the fragility of Benin's economy, as it relies on the export of a single commodity (PPAB[1], 2001). This fragility has been exacerbated by the various food and economic crises experienced by developing countries and especially the food crisis of 2006-2008.

Therefore, agricultural diversification and food production have become a priority for development actors in the agricultural sector. Benin is now promoting other promising sectors such as that of maize production. Indeed, maize is currently the leading food product in Benin, way ahead of rice and sorghum (EMICoV[2], 2011). This demonstrates the importance of this crop in terms of food security. The government has seen it as an important component in its Strategy for Growth and Poverty Reduction. In the policy document, the government clearly established an objective to increase maize production from 841,000 tonnes produced in 2005 to 1,100,000 tonnes, to attain a food balance sheet of at least 250,000 tonnes by the year 2011. Maize production is also an important aspect in the revitalization of the agricultural sector, whereby it was envisaged that by 2015, Benin would produce an average of 1,900,000 tonnes of maize per year, and the country would

1 Programme for the promotion of professionalism in the agricultural sector of Benin

2 An Integrated Modular Survey on the Living Conditions of Households

have sustainable engagements in terms of trade exchanges in the countries of the sub-region and further afield (SCRP[3], 2007).

Programmes for an increase in productivity and agricultural production have been put in place through distribution of fertilizer, making seeds available to farmers, and allocating land to farmers. However, these diverse policies have had a limited reach because by the end of the period 2011-2015, Benin's objective regarding an increase in maize production had not been attained since maize production was at 1,438,918 kilogrammes in 2015 (ONASA[4], 2016) and most of the economic potential of the sector has not yet been exploited. Indeed, just like production, the yields of maize have experienced an increase from 600 kg/ha on average in 1970 to 1,400 kg/ha in 2009 (ONS[5], 2010), then 1,103 kg/ha in 2010; 1,422 kg/ha in 2011; 1,251 kg/ha in 2012 and 1,346 kg/ha in 2013 (FAOSTAT, 2015). The yield from maize plantations is still low compared to other regions in the world such as Burkina Faso where the maize yield was 1,434 kg/ha in 2010; 1,536 kg/ha in 2011; 1,839 kg/ha in 2012 then 1,799 kg/ha in 2013 (FAOSTAT, 2015) and because farmers have poor control over the production costs. Despite this improvement in maize yields, it must be noted that this yield has been see-sawing, which leads to fluctuations in the food balance sheet that are sometimes in worrying proportions. This leads to threats both in terms of food security and in income of farmers and by extension to poverty levels. To reduce poverty in Benin, the income of workers actively involved in agriculture must increase by 70% (PEA[6], 2012). This is because any increase in agricultural productivity by 1% in Africa reduces poverty by 0.6%, and an increase in production by 1% leads to a decrease in number of people living on less than one dollar a day by 6 million (Thirtle et al., 2003).

These mixed results regarding the diverse programmes undertaken could be explained through the fact that the programmes are undertaken in a general manner throughout the country without taking into account the specificities linked to each region in terms of constraints, and the conditions of production faced by the producers. Equally, production factors that are linked to sub-optimal agricultural practices could also partly contribute to the situation. Furthermore, maize is still cultivated under conditions linked to constant soil degradation, characterized by the persistence of traditional practices and lack of knowledge on the use of improved processing equipment, coupled with low education levels of actors in the sector

3 Strategy for Growth and Poverty Reduction

4 National Bureau of Food Security

5 National Farmer Income Support Bureau

6 African Economic Outlook

(ONS, 2010). This situation translates into a weak valorisation of the economic potential of this sector given the demand regarding poultry farming, brewing, the production of infant cereals, which remain unsatisfied in relation to neighbouring countries.

Moreover, several countries on the continent, including Benin, are importers of food products, which include maize, at an import level of 1,058.3 tonnes and 1,272.55 tonnes in 2013 and 2014, respectively (INSAE, 2016). Thus, focusing on efficiency in the production of maize would have the potential of addressing questions not only about food security but also about the unreasonably high volume of importation of food products. It is therefore important to know whether the various production units of maize in Benin are efficient in their use of available resources. Indeed, an increase in the production volume through an increase in the productive resources (sown area in this case) is not a sustainable option. An increase in production does not necessarily suggest an overall increase in productive resources but could also arise from changes in the way existing resources are managed. This study will allow for the identification of elements that could improve production given the idiosyncrasies of each region, recommendations that will target farmers in the region, and the authorities responsible for implementation of agricultural policies.

Research objectives

This study proposes an analysis of the technical efficiency of small-scale maize farmers in Benin. More specifically, the study aims to: (1) Determine the level of technical efficiency of small-scale maize farmers; (2) Break down the levels of technical efficiency of maize farmers according to agro-ecological zones, the variety of seeds used; and (3) Identify socio-economic and technical variables that characterize efficient farms. The paper aims to test the following hypotheses: (i) Maize producers could increase their level of efficiency by changing their combinations of production factors; (ii) The degree of efficiency differs according to the agro-ecological zone and according to the seeds used; (iii) The socio-economic and technical variables such as access to finance, age, education, contact with extension officers, use of enhanced seeds, the selling price of maize and climate determine the efficiency of producers.

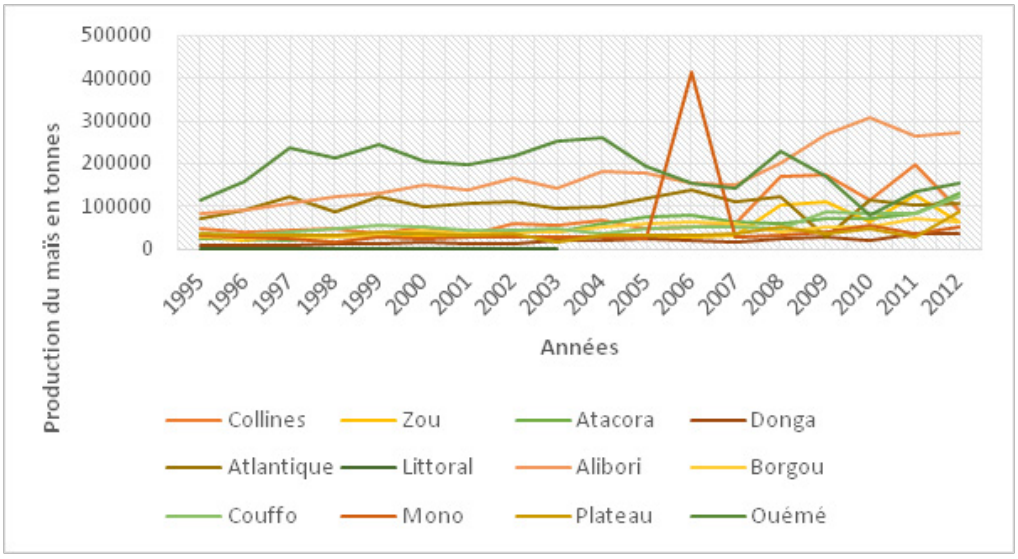
Statistics on maize production in Benin

The illustration in Figure 1 allows us to observe that maize production at the regional level just like production at the national level has been see-sawing over the period 1995 to 2012. Figure 1 shows that the regions which contribute by the highest mean to the national production of maize in Benin are Ouême, Alibori,

and Atlantic, respectively, with an average contribution of 55.91% over the period 1995-2012. Their highest contribution was noted in 1997 with a percentage of 67.22% and their lowest contribution was in 2006 with a percentage of 37.82%. These performances can be justified through the fact that these regions are in a zone where the climate is Sudano-Guinean with two rainy seasons and with very fertile alluvial soil. Furthermore, the crop systems in these regions are dominated by maize.

The regions that contribute the least to national production of maize are Littoral and Donga with an average contribution over the period 1995-2012 of 2.13%. The highest contribution from these regions is at 2.97% in 2011 and their lowest contribution is 1.37% in 1997. This could be partly justified through the fact that the Cotonou is part of the Littoral region and, therefore, land for agricultural use is practically inexistent especially for maize growing. Furthermore, land in the region is not very fertile. In the Donga region, climate is of the Sudano type with a single rainy season with iron-rich tropical soils that are of variable fertility. The crop system in this region is dominated by sorghum and yams.

Figure 1: Evolution of maize production (in tonnes) per region from 1995 to 2012

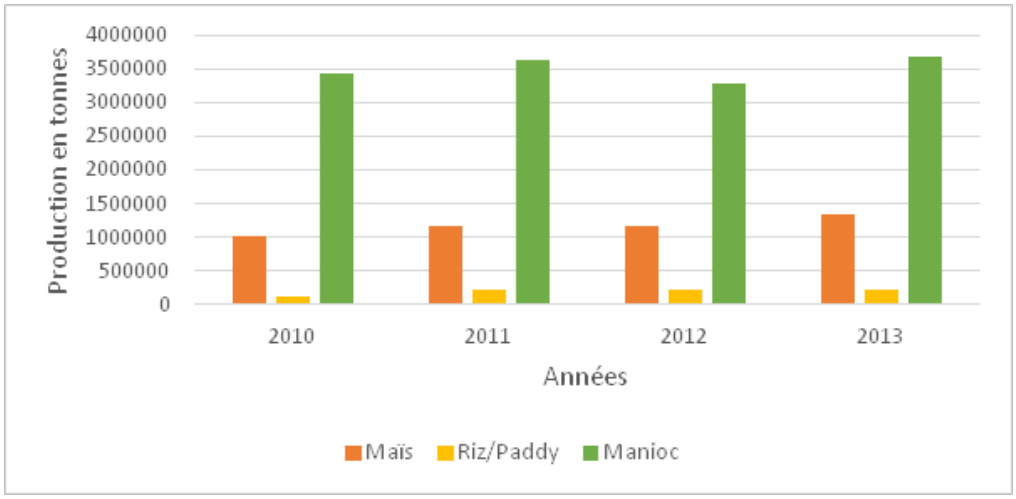


Source: Plotted by the author using data derived from ONASA (2014)

An analysis of the comparative evolution of maize production, rice/paddy, and cassava in Benin between 2010 and 2013 (Figure 2) shows that production of maize experienced a regular increase over the period compared to other crops whose production experienced a see-saw evolution over the same period. This performance is due to the steps taken by the government through acquisition and

implementation in good time of agricultural inputs of sufficient quantities, and through the hiring of new extension agents and the setting up of institutions at the grassroots level to improve the productivity of this crop, which is still the leading food crop in Benin. Nevertheless, the average growth rate of maize production between 2010 and 2013 is of 10.15% against 23.32% and 2.79% for rice/paddy and cassava, respectively.

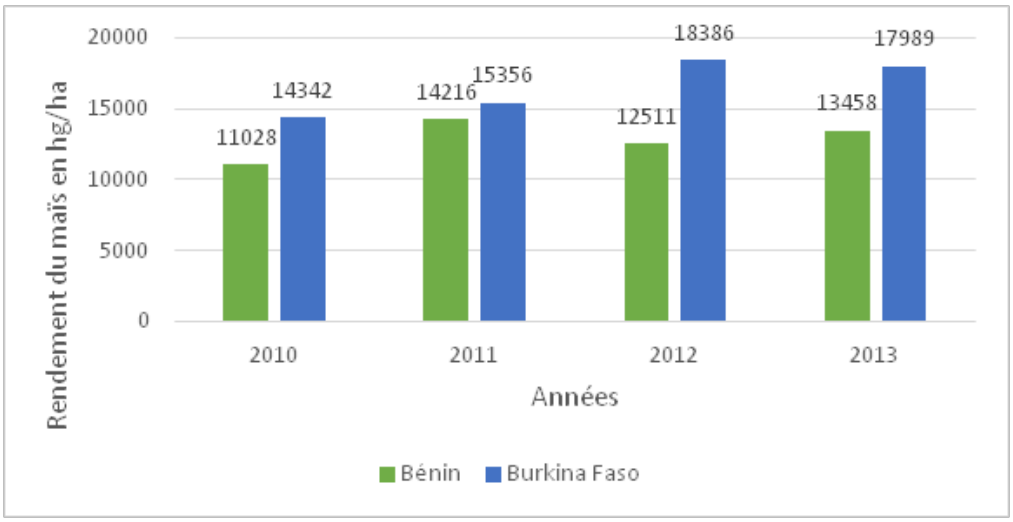
Figure 2: Comparative evolution of maize, rice paddy and cassava production in Benin



Source Plotted by the author using data from FAOSTAT (2015)

By observing the evolution of maize yields in Benin compared to those of Burkina Faso between 2010 and 2013 (Figure 3), we note that maize yields in Burkina Faso experienced a positive evolution over the period whereas that of Benin has been see-sawing, just like was the case in production. However, the rate of average growth rate of maize yields in the two countries is practically similar over the period, with 8.16% for Benin and 8.21% for Burkina Faso. These trends are unacceptable in so far as the climatic and geographic conditions are more favourable towards production in Benin than in Burkina Faso. However, they could be explained through the fact that Burkina Faso has put in place strategies that allow them to overcome climatic and geographic constraints (for example the implementation of irrigation systems) unlike Benin. This allows them to have good control over their production system and to have full-time production.

Figure 3: Comparative evolution of maize yields in Benin and in Burkina Faso



Source: Plotted by the author using data from FAOSTAT (2015)

Conclusion and policy implications

Despite the importance of maize in Benin's economy, and in the feeding of the population, there has been practically no study on the efficiency of maize producers in Benin. This study uses the production frontier to estimate the levels of technical efficiency of farmers using input and output data from 203 maize farmers from six districts of Benin, namely: Collines, Couffo, Mono, Ouémé, Plateau and Zou. The results demonstrate that the average level of technical efficiency is 65.40%. Among the farmers sampled, 61.08% are technically efficient. A breakdown of efficiency scores according to agro-ecological zones shows that farmers in the Dépression zone are more technically efficient than those from other zones. The results also indicate that farmers who use enhanced seeds are statistically more efficient than the rest.

In terms of policy implication, the results show that the policy of distribution of improved seeds and fertilizer by the government helps farmers to be more efficient contrary to that of using extension agents. Indeed, this distribution policy involves: (i) the development and supply of more performant and adaptive seed varieties; (ii) the production of pre-basic and basic seeds and distribution of certified seeds; (iii) the formulation and implementation of incentive provisions (exoneration, subsidies) for the importation and distribution of fertilizer; (iv) allocating distribution points for seeds and fertilizer in each community; (v) providing information for farmers on the availability of specific fertilizers and seeds; and (vi) the improvement of the stockage and conservation systems for seeds at the distribution points (palettes, refrigerators, thematic training, etc). These results lead us to recommend that the government

should reduce the resources used for extension services and instead focus on policies of distribution of enhanced seeds and invest more in research on improved seeds. This assumes that sufficient resources will be made available to research centres specialized in the production of enhanced seeds to allow farmers to access them at reasonable costs.

A policy for the improvement of agricultural extension services, therefore, becomes indispensable and this could for example entail hiring extension agents on two-tiered employment contracts which at one level is that of a fixed wage and the other on the performance of the level of productivity of the farmers that they support. Thus, the constant quest for higher earnings would lead them to work harder in their support and monitoring of farmers. A sensitization of farmers is also necessary to create an atmosphere of confidence between extension agents and farmers.

The government should also create incentives at the institutional level that would increase credit supply. An agricultural credit fund would allow farmers to have access to agricultural credit at preferential rates and at the opportune, correct the imperfections in the capital and/or labour markets.

Other actions that allow an improvement of the efficiency level of farmers should also be implemented, for example investment in the education and training of farmers. Policies related to price stabilization for selling price of maize and the maintenance of rural roads should also be developed to provide a guarantee to farmers in terms of the transport of their produce. Policies of adaptation to effects of climate change should be strengthened, for example through the practice of irrigation.

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