POLICY BRIEF

Econometric Analysis of the Perception and Adaptation to Climate Change Risks Among Farmers in Congo-Brazzaville

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Abstract

This study analyzes the experience of farmers under Agri-Congo with regard to perception and adaptation to climate change. It is based on a field survey of 201 farmers, comprising 101 in Brazzaville and 100 in Pointe-Noire, the two largest cities in Congo. The statistical results show that most farmers perceive climate change (98.5% of responses) and practice adaptation (85.4% of responses). The high rates of perception and adaptation among farmers are due to their experience in farming activity, and due to their determination to maintain their farming business despite the current risks related to climate change. The problem coping index has shown that lack of experience, limited access to inputs and

credit facilities are the main constraints in terms of adaptation. Crop diversification, adjustment of the farm calendar and substitution of crops within the same farm area are the strategies most developed by farmers. The study identified the determinants of perception and adaptation to climate change through the application of the Probit model. Indeed, age, level of education and number of farm employees are the main variables that increase farmers' awareness of climate change, while input donations, farming experience, property rights, engagement in a subsidiary activity and membership in an organization are the key determinants of farmers' adaptation to climate change. Finally, special attention from Agri-Congo should be directed to training, enhancement of farm inputs, fertilizer and input subsidies and issuing of land titles to strengthen the adaptive capacity of farmers.

Introduction

Congo-Brazzaville is a country in the equatorial zone and enjoys an equatorial climate with a bimodal pattern whose dry season duration decreases from South to North. On average, the temperature oscillates around 25°C and varies only slightly during the year. However, the dry season is accompanied by a significant drop in temperature (temperature variations vary from 4° to 6°C). The air is always humid; the average rate of hygrometry (RH) is 80%. Total annual rainfall is generally more than 1,200 millimetres but its pattern, linked to the apparent rotation of the sun on either side of the equator, is the basis for the four seasons. Thus, from the North to the South of the country, the following climatic variations are observed:

- In the North of the country (Sangha, Likouala), it rains all year round, with only two seasons when the rains slowdown from December to February and in July. The dense forest cover contributes to the very high humidity.

- In the Central region (Cuvette and Plateaux), there is a sub-equatorial climate, intermediate between the weather of the North and that of the South-West. The closer one gets to the equator, the shorter and longer the dry season becomes. On the plateaus, the dry season lasts for two to three months, and 1,800 to 2,000 millimetres of rainfall is experienced annually. Elsewhere, in the central basin region, for example, the dry season lasts for two months, but in June and July, between 25 and 50 millimetres of rainfall is received each month;

- In the Southwest, the climate tends to be humid tropical. Total rainfall tends to be moderate (1,200 to 1,700 millimetres). However, the monthly distribution shows a large dry season of three to four months (June to September), followed by two rainy periods (October to December, then February to May). The shorter dry season (January or February) is only marked by rain showers and less violent thunderstorms.

Congo-Brazzaville is a developing country in Central Africa. Although it enjoys a favourable climate for agriculture, it is not immune to threats of climatic change. The active agricultural population, which is estimated at 498,000 in 2009, is mainly women (70%). Currently, only 2% of arable land is being exploited (i.e. nearly 2 million hectares). Food crops occupy 75% of cultivated land: cassava, maize, groundnuts, potatoes, beans, yams, and plantains. Only sugar cane through the SARIS-Congo company is currently recording a significant increase in production. The production of paddy and other cash crops (coffee, cocoa, and palm oil) has been declining, if they have not disappeared altogether.

The agricultural sector contributed only 4.5% to GDP in 2007 and 2011. According to the Agricultural Sector Study conducted in 2011, the sector's contribution was 27% in 1960, 12% in 1980 and 10% in 1997. Between 2000 and 2005, the average annual growth of agricultural GDP was around 1%, well below the demographic growth rate (2.5%). Despite the enormous potential for crop, animal, fisheries and forestry production that the Congo has, the population is virtually totally dependent on foreign food supplies, with annual imports estimated at an average of 130 billion CFA Francs per year. Thus, food insecurity affects more than a third of the population. Agriculture, a declining sector, is already suffering from the negative impacts of climate change. National climate change observation studies conducted by UNDP in 2010 showed that the entire Congolese territory has been warming at a rate of about 0.05°C per decade during the 20th century, with a slightly greater temperature rise from January to May. This rise in temperature is consistent with global climate change and affects human development. In fact, since the 1970s, Congo-Brazzaville has been experiencing the following climate changes:

- A general increase in maximum temperatures of about 0.76°C and 0.69°C for minimum temperatures with moderate variability in space and time. However, on a seasonal scale, the most marked rise in temperature occurs in the dry season (June to September) or southern winters. Spatially, the warming is more pronounced in the savannah zones in the central and southern parts of the country. It is exacerbated in the large cities (Brazzaville and Pointe-Noire) by an additional urban effect.

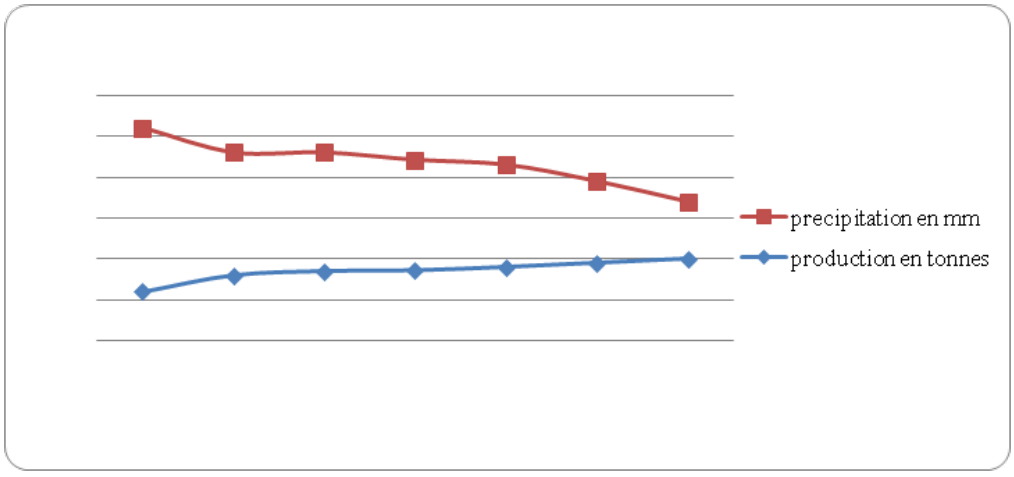
- An overall decrease in annual rainfall throughout the country with some spatial variability. This decrease was exacerbated during the 1980s, even in areas with high rainfall. This rainfall deficit is common across humid regions of Africa.

- There has been a general decline in the flow of the Oubangui-Congo rivers (+19% to -9%) and their tributaries since the 1970s. Similarly, in Southern Congo, the flow of the Kouilou-Niari is decreasing. This trend is similar to the annual rainfall pattern. The rate of evaporation has increased at the same time. Often, in the southern part of the Republic of Congo, evaporation exceeds rainfall over the entire Congo Basin.

The basic assumption of this study is that in Congo, climate is an important explanatory factor for agricultural production. This can be explained by the fact that agriculture is essentially dependant on rainfall due to the very weak irrigation system. Thus, low or excessive rainfall can hinder the growth of crops, thereby limiting productivity. In recent years, this rainfall has been unstable, leading to disruption of the agricultural calendar and a drop in the farmers' or market gardeners' productivity. Figures 1 and 2 below show the evolution of the main crops according to current rainfall. Indeed, it appears from these graphs that the country's main crops such as potatoes and groundnuts have a downward trend, except for rice due to the decrease in rainfall.

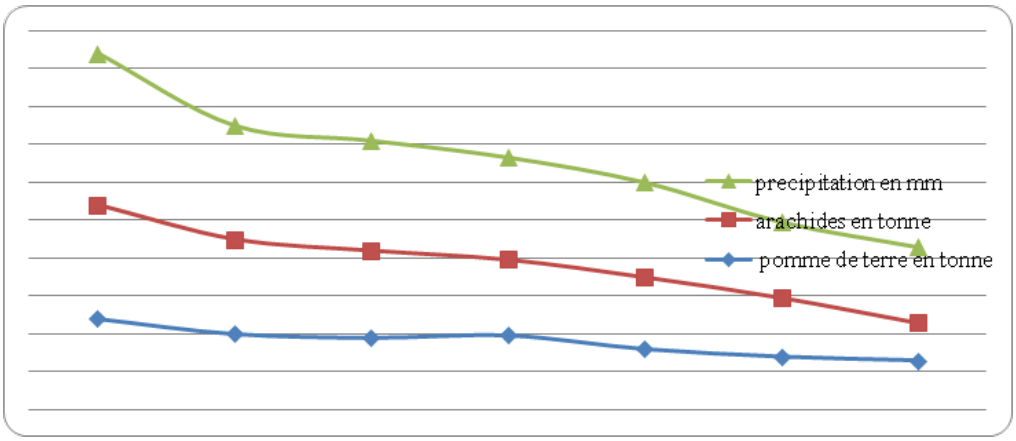
Based on this hypothetical situation, the crops grown on the various Agri-Congo farms, which are considered as the country's breadbasket, will suffer more from the effects of climate change, with a corresponding drop in yield. By studying the correlation between future climatic conditions and agricultural production in Benin, Paeth et al. (2008) predicted yield decreases ranging from 5% to 20%, with a higher risk of food insecurity as a result. This situation is already apparent to farmers in the country, forcing them to devise adaptation strategies to meet the challenges posed by climate change and preserve their livelihoods.

Figure 1: Rainfall and rice production



Source: Author using data from CNSEE (2010)

Figure 2: Rainfall, groundnut, and potato production



Source: Author using data from CNSEE (2010)

There are three key facts that justify the consideration of this research. One, climate change poses a threat to agricultural output and food production in many African countries in general and particularly in Congo-Brazzaville. Two, because of this perceived threat by some farmers, adaptation strategies to climate change risks become necessary because of the role that agriculture plays in fostering sustainable economic growth and achieving food security. There is thus a need for in-depth studies on climate change so that it does not hinder the green revolution envisaged in Africa, including in Congo-Brazzaville. Third, there is currently no study on agriculture and climate change in Congo. This study bridges this knowledge gap. It therefore focuses on the perceptions, adaptation strategies and socio-economic determinants of climate change at the level of farmers. The opinions collected from farmers are fundamental to the development of a national strategy for adaptation to climate change at the farmers' level.

Methodology

This study was conducted in Brazzaville and Pointe-Noire, the two main cities of Congo-Brazzaville, and more specifically targeted farmers established by the Agri-Congo agricultural company. The choice of these two cities was based mainly on the fact that climate forecasts in recent years indicate that they are the most vulnerable cities in the country regarding climate change.

Agri-Congo is a public company created in 1986 with the aim of developing and promoting urban and rural agriculture in Congo-Brazzaville. It is an institution that assures the support of market garden producers so that they become efficient and autonomous. This company tries to improve the supply to consumption centres and

to create jobs for young people in agriculture. The aim of this institution is also to set up farmers in agricultural land purchased or reserved by the State. These established farmers can benefit from supervision, training, support and advice thanks to the company's expertise. Farm premises become the property of the farmers following a long period of practice or experience in farming. A distinction is therefore made between those who own the land and those who do not. According to data from the latest 2013 census to monitor the number of operators, there are 550 farm operators established by Agri-Congo throughout the country. Agri-Congo operates in four departments of Congo, each with one or more production sites.

Conclusion and recommendations

The study on perception and adaptation to climate change that we carried out on the farmers established by Agri-Congo revealed that almost all the farmers have a good perception of climate change of recent years and are developing adaptation strategies. The rate of perception of climate change is 98.50% and the rate of adaptation to climate change is 85.35%. The high rates of perception and adaptation recorded among farmers are attributable to their experience in agricultural activity and to their determination to preserve their farming activities despite the current risks related to climate change.

The study also shows that climate change is a source of concern for farmers, as three out of five major crops at the time of the survey have been on a downward trend in recent years, accounting for 60% of the crops. These crops are: tomatoes, cabbages and eggplants. For most farmers, climate change is mainly explained by decrease in rainfall, disruptions in the duration of the seasons and the increase in temperature. Comparisons with meteorological data confirmed farmers' perceptions and led to the conclusion that climate change is an undeniable reality in Congo-Brazzaville.

The study identified several adaptation strategies, but the most common ones practiced by farmers are: crop diversification, adjustment of the agricultural calendar and crop substitution within the same farm site. The Problem Coping Index (PCI) calculated showed that lack of experience, limited access to inputs and agricultural credit are the main constraints to adaptation. To this end, training in adaptation techniques, support in the form of donations of inputs and fertilizers, facilitation of access to credit and improvements in agricultural equipment were the main expectations cited by farmers from Agri-Congo and its partners to enhance their adaptive capacity.

Finally, the study pinpointed the determinants of perception and adaptation to climate change through the application of the Probit model. In the case of our study, age, education level and the number of farm workers are the main variables that

increase farmers' perception of climate change, while input donations, experience in agriculture, property rights, engaging in a secondary activity and membership in an organization are the determining factors influencing farmers' adaptation to climate change.

To strengthen farmers' experiences in perceiving and adapting to climate change, the study makes the following recommendations:

- Agri-Congo should encourage farmers to join producer organizations to receive appropriate advisory services and training to strengthen their capacity to perceive and adapt to climate change through a mechanism of close collaboration;

- The Ministry of Agriculture in partnership with Agri-Congo should set up a capacity building programme for farmers in the field of perception and adaptation to climate change through targeted training;

- The Ministry of Agriculture should provide input grants and especially equip farmers with the agricultural equipment they need to help them scale up their technical efforts to adapt to climate change; and

- The Ministry of Agriculture should reflect on the creation of a future agricultural bank through a public-private partnership to facilitate farmers' access to bank credit.

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