External Trade and Food Security: The Case of CEMAC Countries

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Abstract   The aim of the study is to analyze the effect of external trade on food security in CEMAC countries during the period 1961-2017. In the early years of the independences, these countries have adopted a development model based on commodity production for export to industrialized economies. Foreign exchange from its exports should allow them to import the food products, while investing in food sector and in the others sectors needed for their development. Based on the instrumental variables method that corrects the problems of endogeneity and omitted variables, the result shows that external trade has a negative effect on food security in these countries. In fact, it has a negative impact on food production and household consumption. It also has a positive effect on the consumer price index. In addition, it does not lead to food imports. Thus, these results run counter of those of the existing literature based on the empirical studies in other developing countries that have found that foreign trade increased food security. In this context, the contribution of the study consists to providing a fresh look at the effect of foreign trade on food security. In fact, the results lead to not generalize the conclusions of the existing literature, notably in the countries of the sample. In this context, the CEMAC countries should diversify their productive structures by investing heavily in agriculture to achieve food security of their populations.

Keywords: trade openness, food security, Africa, CEMAC

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1. Introduction

To better understand the link between external trade and food security in Africa in general, in CEMAC [1] countries in particular, it is necessary to take an historical approach. Indeed, production structures were essentially alien to African economies and the predominance of export cultures over self-sufficiency had its origins in the colonial economy. Production in the periphery was essentially oriented for providing both agricultural and non-agricultural commodities to the metropolis. Under this arrangement, food self-sufficiency declined in the colonies as a result of exports to Europe on one hand and food imports rose substantially on the other hand [1]. Thus, in the early years of independence, many African countries continued with the colonial economic structures by adopting a development model based on commodity production for export to industrialized countries. However, almost twenty years later, the results were far from satisfactory. This is why African leaders adopted the Lagos Plan of Action in April 1980. This framework was to lead the continent towards more regional and pan-African integration. The ultimate goal was to achieve self-sufficiency at both national and collective levels. In essence, the plan was to strengthen inter-African trade. However, in the mid-80s, African countries in general, CEMAC countries in particular, facing economic difficulties had to adopt far-reaching reforms under the auspices of the Structural Adjustment Programs (SAPs). The embrace of reforms was a precondition to obtain loans especially from the World Bank and the International Monetary Fund. One key goal of the SAP was to liberalize the economies and thereby improve their international openness [2]. Based on this paradigm, food security could be achieved by increasing the capacity of African countries to generate enough exports earnings to finance their food imports. African countries have strengthened their food policy by joining in 1995 to the World Trade Organization (WTO).

In this context, the research program consists of verifying empirically the effect of external trade on food security in CEMAC countries. We have chosen to conduct the study in these African countries because of their insertion in international trade inspired to Heckscher-Ohlin-Samuelson theorem (HOS) of international trade based on their comparative advantage in the production of raw materials. The six countries of the region, five of them are oil exporters. Also, they have track records of continuous policy of trade liberalization and face challenges in their efforts at achieving food security objectives.

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[1] CEMAC Countries: Cameroon, Central African Republic, Chad, Republic of Congo, Gabon and Equatorial Guinea.

We use the panel data and the estimation is done by the instrumental variables method for correcting endogeneity and omitted variable problems. With regard to the contribution of the study, the link between food security and external trade is analyzed by integrating three dimensions of food security: the availability, access and stability. To our knowledge, no previous study has integrated all these dimensions to evaluate the effect of external trade on food security. The result shows that external trade has a negative effect on food security in CEMAC countries. In fact, external trade has a negative impact on food production and household consumption. He also has a positive effect on consumer price index. In addition, external trade does not lead to increase of food imports. Thus, these results run counter of those of the existing literature based on the empirical studies in other developing countries that have found that foreign trade increased food security. In this context, another contribution of the study consists of providing a fresh look at the effect of foreign trade on food security. In fact, the results lead to not generalize the conclusions of the existing literature, notably in the countries of the sample.

This work will be organized as following: the review of literature is subject of Section 2. The empirical model and the results are the subjects of Section 3 and 4. Finally, in Section 5 concludes.

2. Brief review of Literature

At the World Food Summit in Rome in 1996, the various States and participating organizations concluded that food security exists when "at all times, all human beings have physical and economic access to safe and nutritious food for satisfying their dietary needs and food preferences necessary for an active and healthy life." Despite the fact that this definition had been recognized internationally, there are numerous studies that do not include all food security dimensions which are: availability, access, stability and utilization for analyzing the effect of external trade on food security in developing countries in general and African countries in particular.

The first dimension we discuss in this literature review is availability. This implies the proportion of stored food or the supply present on the national market. For this purpose, [3] notes that following a poor harvest in 1997 and a flood in 1998 in Bangladesh; the private merchants imported several million tons of rice from India. Thus, trade liberalization between India and Bangladesh in the early 1990s helped to increase domestic supplies and to stabilize the prices in this country. Imports from alternative sources also enhance food availability in the country if another production deficit takes place. But they would face higher transport costs; implying less importing companies, given the economies of scale of the shipments by sea. However, this positive contribution of trade liberalization to short-term food security in Bangladesh does not minimize the importance of increasing domestic agricultural productivity and rural economic growth to enable poor rural households purchase food. Nevertheless, the experience of Bangladesh shows that trade liberalization has potential benefits for national food security by allowing a rapid increase in food supply particularly when there is deficit in national production. Regarding Nepal, [4] show that among the South Asian countries, this country was a more liberalized economy in the 1980s and 1990s. The country took several measures to reduce the size of its public food distribution system and removed a multitude of agricultural subsidies. To measure the effects of these policies on food security, the authors' focused specifically on the evolution of availability per capita in Nepal. Due to the increased availability in the country, the authors' conclude on an improvement in the food situation in Nepal since the engagement of the liberalization process.

In focusing solely on availability, these studies lead to questionable results regarding the wider effects of external trade on food security. Indeed, the increased availability is certainly a necessary condition for achieving food security, but it is not sufficient. The increased availability can result not in an increase in domestic production, but in food imports. Very large increases in imports may exacerbate to some extent, the risk of food imports addiction. When the food dependency ratio exceeds 50%, people are exposed to potential external shocks in the event of sudden price increases for key consumption commodities. The poorest people see in these conditions, their food expenditures increase alarmingly. This is basically what happened during the recent food crisis (2007-2011) in African countries.

Similarly, the increased availability does not mean that people have access to food. There may be surplus in terms of production or in terms of food imports. However, it is also vital that the populations have the financial means to procure them. For all these reasons, we conclude that the results of previous studies do not actually reflect the effect of trade liberalization on food security in general.

The accessibility signifies the ability to access healthy and nutritious food in the country. For this purpose, [5] find a negative effect of external trade on inflation volatility using a dynamic panel model in a sample of developed and developing countries. Indeed, the results show that openness increases the volatility of growth of currency reserves and terms of trade. In other words, trade liberalization was not accompanied by an increase in the propensity of the State to finance food imports. On the contrary, due to the rise in inflation, the countries of the sample saw their import capacity deteriorate. This does not mean, however, that there is a decline in imports, but simply that the State must increase its debt to procure them or rely on food aid in order to increase the supply available in the country.

Moreover, such a situation can affect the populations of these countries who bear the brunt, in many cases, of the increase in food prices in the country in times of high inflation growth. Rising food prices inevitably reduces real household income (purchasing power) and the affordability of food. On this same perspective, [6] reach similar conclusions. However, studies of these authors appear fragile in some respects. In excluding the availability, the authors face a size limit in their reasoning.

In principle, external trade should, in accordance with our prior discussion, increase availability. However, increased availability should, through free competition, result in lower prices. This may, in some measure, adjust the import prices at the level of import capacity of States

or the actual income of the inhabitants. Thus, by excluding availability, the authors are not able to indicate whether the negative effect of openness on accessibility could, in this context, be annihilated by higher availability.

Concerning stability (the stability of food prices), [7], show that external trade increases the volatility of grain prices in the markets of Yaoundé and Douala (Cameroon). Indeed, they found the elasticities of transmission of international price volatilities on the national prices to be 94.71% and 70% respectively for the two markets. [8] found the same results by using a wider range of domestic products. [9] analyzed the effect of trade on food security by calculating an indicator of "bilateral imports' penetration" which measures the dependence of a country on imports of food from its trading partners. The results suggested that measures aimed at diversifying the supply sources reduced the vulnerability to partners' food shocks, and therefore improved food security. However, these results do not seem robust enough, because of the narrow focus on stability alone. It is true that volatility remains a concern for the most dependent on the imports of food, because of its potential impact on food prices, therefore the accessibility to food in times of crisis. However, the effect of trade liberalization on food security should also be assessed in terms of other dimensions of food security. It would have been more relevant had the authors analyzed how price volatility may negatively impact food availability in the country, as well as household income. Furthermore, the authors do not consider that utilization remains an important dimension in the assessment of food security status. The utilization is the ability of households to use nutritious foods without interruption. To evaluate the effect of openness on food security, it would be important to view whether the openness is accompanied by an improvement of living population conditions and decrease in existing inequalities. In fact, access to a decent income allows people to obtain a richer and more varied diet.

Thus, [10] find a negative impact of agricultural liberalization on food security in Nigeria. They noted that the number of under-nourished people, and therefore vulnerable, has sharply increased despite the liberalization policies initiated since the 80s.

Despite the fact that all studies that have been cited in this literature review have relevant results, they can be easily challenged especially on the grounds of their arbitrary choice of a food security dimension and deliberate exclusion of others. To avoid such bias, we chose to introduce as part of our comparative study, all four dimensions of food security to yield more robust findings on the impact of trade liberalization on food security.

3. Theoretical Framework and Empirical Model

The food strategies in Africa, particularly in CEMAC countries, were initially implemented in terms of self-sufficiency just after the 1973/1974 crisis before being oriented towards exports in the early 80s. The debt crisis and the adoption of the SAPs officially marked the liberalization of the agricultural sector in CEMAC countries [11]. Thus, the theoretical framework is the Heckscher-Ohlin-Samuelson (HOS) model of international

trade. The countries of these countries have a comparative advantage in the production of raw materials. This is why the implementation of the HOS theory of international trade in CEMAC countries led to their specialization in the exports of raw materials and the imports of food products through export earnings. Thus, we make the hypothesis that this specialization has a significant effect on food security in these countries. In this context, the purpose of this empirical study is to see whether this effect is positive, negative or zero. To this end, we verify empirically whether the export revenues were used for financing public expenditures in order to achieve food security during the period 1961-2017. The data used are from the World Bank databases (online data catalog). Defined as "the permanent access of all to the food necessary for a healthy and active life" [12], food security is measured at FAO level by the indicators that follow four dimensions: availability, access, stability and utilization. We have retained three dimensions, taking into account the availability of data. So for availability, we have the index of food production (*IPA*) and food imports as a percentage of merchandise imports (*FOODM*). For stability, we have the consumer price index (*CPI*). Finally for accessibility, we have the household consumption expenditure (*DCM*). With regard to external trade, we retain an interaction variable (*GX*) that combines the effect of export revenues and public expenditures. The objective is to verify empirically whether the export revenues were used to finance public expenditures in order to achieve food security for the population. We also have the control variables that are most often used in the studies on food security: the food exports in percentage of merchandise exports (*FOODX*), rural population (*RPOP*) and urban population (*UPOP*). Their inclusion puts into perspective the link between agriculture, food security and population movement in developing countries. The infantile mortality (*MORTALITY*) variable permits us to approximate the state of health system. We also have private and public investment (*INV*).

The first step is to choose the model adapted to our data. To this end, we conduct a test of presence of the individual effects using the modified version of the Lagrange multiplier test of [13] developed by [14]. The result led to reject the assumption of no individual specific effects. Thus, we formalize the individual effects in fixed and random effects. The choice between fixed and random effects models is made based on the Hausman test [15]. We observe that the "p-value" is greater than 5% for the four estimations. In this context, the random effects models are not biased. In this study, we use the simplified modeling where it is supposed that the disruption of the model is only composed of α_i, an individual specific effect, and $e_{i,t}$, a random disruption. According to [16], this presentation is often used in empirical works that use panel data with individual dimension. Also, the sample is often incomplete regarding the population studied (this is the case of this study). We use the logarithm for interpreting the results in terms of elasticities. In this context, we have:

$$\log(IPA)_{i,t} = a + b_1 \log(GX)_{i,t} + b_2 \log(FOODX)_{i,t}$$
$$+ b_3 \log(RPOP)_{i,t} + b_4 \log(UPOP)_{i,t} \quad (1)$$
$$+ b_5 \log(MORTALITY)_{i,t} + b_6 \log(INV)_{i,t} + \varepsilon_{i,t}$$

With $i = 1, ..., N$, $t = 1, ..., T$ and $\varepsilon_{i,t} = \alpha_i + e_{i,t}$. $\varepsilon_{i,t}$ is composed by α_i, individuals factors that are not taking into account in the model, and $e_{i,t}$, a random perturbation. They are independently and identically distributed: $\alpha_i \sim i.i.d.(0, \sigma_\alpha^2)$ and $e_{i,t} \sim i.i.d.(0, \sigma_e^2)$.

Note that we have four variables explained (*IPA*, *GOODM*, *IPC* and *DCM*). Thus, we estimate four different models with the same explanatory variables. However, to simplify the presentation, we only represent equations involving *IPA* (cf. equation (1)). Also, the question concerning the existence of the rolling gap (because we have incomplete panels) is discussed. For this, we use the method of Nijman and Verbeek [17]. The idea is to compare the results of estimates of cylindered and incomplete samples. If there is a significant difference, one concludes that there is a rolling gap and retains the result of incomplete panel; which we did in our study. In addition, the question concerning the existence of the obvious issues related to endogeneity (two-way causality) is discussed. For this, we perform the [18] endogeneity test. Also, we use Sargan over-identification test and Basmann test to verify the validity of the instruments. The test procedure of [19] is as follows: the endogeneity variable suspected (*GX* in our case) is regressed on the exogenous variables and its instruments. Then, the residues are recovered and included in the initial model where the food security variables are explained. If the coefficient of the residues is significant, there is endogeneity. In all estimations, this coefficient is significant. Thus, the estimations are done by the instrumental variables method that corrects this problem of endogeneity and omitted variables. Note that [20] argues that many instruments can weaken the Hansen test. Thus, we used the following instrumental variables: raw material endowment and imports of goods and services (in the equation where the index of food production is the explained variable), raw material endowment, imports of goods and services, and terms of trade (in the estimation with household consumption expenditures as the explained variable). Finally, we use raw material endowment and costs to import as instrumental variables in the estimation where the consumer price index is the explained variable.

4. Results and Interpretations

The probabilities of the Sargan and Basmann tests are all greater than 10%. In this context, we cannot reject the hypothesis H0 of the validity of the instruments.

The results show that external trade has a negative effect on food security in the CEMAC countries. Indeed, the interaction variable between the value of the exports and the public expenditures (*GX*) has a negative impact on food production and food imports (*FOODM*). Thus, these results run counter of those of the existing literature based on the empirical studies in other developing countries, notably the studies of [21] in Bangladesh and [22] in Nepal. Indeed, the latter have found that foreign trade increased availability of foods in these countries. This study provides a fresh look at the effect of foreign trade on food availability. In fact, the results lead to not generalize the conclusions of the existing literature, notably in the countries of the sample. In addition, contrary to [23] study, the external trade has a negative effect on household consumption, and a positive effect on the consumer price index. In this context, it can be concluded that export revenues have not been used to achieve food security for the population. Thus, it seems necessary for these countries to find a new development model that is more inclusive for social welfare.

Table 1. Estimation Results

	log (IPA)	log (FOODM)	log (IPC)	log (DCM)
log (GX)	-0.37***	0.11	0.13*	-2.05***
	(0.103)	(0.462)	(.07)	(0.204)
log (FOODX)	-0.14***	1.06***	0.02	-0.01
	(0.017)	(0.244)	(0.017)	(0.041)
log (RPOP)	0.11*	-2.14*	-0.79***	1.25***
	(0.076)	(0.132)	(0.08)	(0.186)
log (UPOP)	-0.51***	5.76***	1.04***	0.89***
	(0.079)	(0.206)	(0.125)	(0.181)
log (MORTALITY)	-0.79***	0.53	-1.74***	-3.38***
	(0.317)	(0.43)	(0.303)	(0.678)
log (INV)	0.13	1.65*	0.12**	0.55***
	(0.083)	(0.899)	(0.053)	(0.16)
CONSTANTE	8.31***	16.65	15.34***	-13.33***
	(0.000)	(0.062)	(0.206)	(0.411)
R^2	0.73	0.72	0.89	0.94
Sargan test	0.64	0.45	0.18	0.11
Basmann test	0.65	0.54	0.31	0.12

Models: random effects (RE) panel, correction of heteroscedasticity (Huber-White), using observations: 1961-2017. Variables explained: the food production index (API), food imports (FOODM), the consumer price index (CPI) and household consumption expenditure (DCM). Explanatory variable: the interaction variable (GX). Control variables: food exports as a percentage of merchandise exports (FOODX), rural populations (RPOP) and urban populations (UPOP), infant mortality (MORTALITY), private investment (INV) and public expenditure (G). Standard deviation in parentheses, *, ** and *** correspond to a significance of the variable at the respective thresholds of 10, 5 and 1%.

For control variables, the increase of the rural population has a positive effect on food production, while that of the urban population has negative impact. As CEMAC producers are essentially rural, like those in other developing countries [24], an increase in this population has a positive impact on food production. This allows them to produce the bulk of consumer goods and, as a result, pulls *CPI* and *FOODM* down, while increasing *DCM*. The urban population naturally has adverse effects on the selected food security indicators. It decreases *IPA*, while increasing *CPI* and *DCM*. Indeed, the rural exodus has a negative effect on the production of rural people. People working in the city buy the consumer goods necessary for their livelihood. This conducts to increasing *IPC* and *DCM*. Mortality also has a negative effect on production. Thus, countries need to place special emphasis on health, because a sick person cannot work on the farm. Investment is not significant. This means that investment is oriented to other activity sectors other than agriculture. The countries of the sample should therefore encourage firms to invest in agricultural production.

5. Conclusion

The purpose of the study was to analyze the effect of external trade on food security of the CEMAC countries. Indeed, like other developing countries, they have adopted a development model based on commodity production for export to industrialized economies. The six countries of the region, five of them are oil exporters. Based on the instrumental variables method that corrects the problems of endogeneity and omitted variables, the result shows that external trade has a negative effect on food security in these countries. In fact, the interaction variable between the value of exports and the public expenditures (*GX*) has a negative impact on food production and household consumption. It also has a positive effect on the consumer price index. In addition, it does not lead to food imports. Thus, these results run counter of those of the existing literature based on the empirical studies in other developing countries that have found that foreign trade increased food security. In this context, the contribution of the study consists of providing a fresh look at the effect of foreign trade on food security. In fact, the results lead to not generalize the conclusions of the existing literature, notably in the countries of the sample. In this context, the countries of the sample should diversify their productive structures by investing heavily in agriculture to achieve food security of their populations.

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