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Climate change, agricultural production and international trade: a CGE analysis

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Abstract

The main objective of this study is to analyze the implications of climate change on agricultural production and international trade in Cameroon. Specifically, in order to study the effects of strategies or policies for adapting to climate change that could be implemented by the policy, we are looking through a static computable general equilibrium model to break the conditional logic combos coming from climate change on agricultural production and agricultural exports from Cameroon. So, after using the SAM of Cameroon in 2007, the basis for the ECAM III micro simulation and data from the 2013 Statistical Yearbook on climate change in Cameroon are studied in the context. The impact of climate change is introduced on the basis of pessimistic and optimistic hypotheses drawn from a literature review and expert consultation. The results show that 40% of shock on climate change leads to negative effects on production and agricultural exports. A variation is observed (-7.97)% of agricultural production and (-32.79)% on agricultural exports from Cameroon.

Keywords :Climate change, agricultural production, international trade, CGE.

Context

Agriculture in Cameroon is the main source of currency for the rural population. Indeed, according to the Third Cameroonian Household Survey (ECAM III), the primary sector activities such as agriculture employ nearly 63% of workers. And it is among those working in this sector that reports the highest proportion of poor population. Agriculture is the activity of the rural world most practiced. Indeed as we have mentioned, 63.7% of households engaged in it. These households are mostly poor (90.7%) and to a lesser extent using modern equipment (12%).

Cameroonian households cultivate the majority of the food products. In order of importance but mainly (42.7%), peanut (29.9%), cassava (28.3%), bean / cowpea (27.8%), the macabot / taro (26.8%), okra (26.3 %) and plantain (22.6%). As for cash crops, there is overall a small proportion of households grows: Cocoa (6.6%), palm oil (5.5%), cotton (5.4%), coffee (4.9%), tobacco (1.3%) and rubber (0.1%). Unlike food products, a clear specialization of these products is observed between regions. We note that agriculture in Cameroon is majority subsistence agriculture.

However, if agricultural production in Cameroon is for local consumption and export. These exports contribute about 21.3% of GDP. Note that the main partners in international trade of food products is Africa (16.6%), while for annuity products, it is the industrialized countries of Europe (58.7%), Asia (18%) and of America (7.2%) (UNCTAD, 2013). Agricultural production is declining. One is tempted to think like Fomekong and Ngono, (2010), this would be the fact of the negative impacts of climate change on agricultural production, on the deteriorating food security. Moreover, three-quarters of African countries are located in areas where a small reduction in rainfall is likely to produce significant reductions in overall availability.

Questions for analyzing impacts or effects of climate change are today at the center of proxies researchers and policy makers. Such effects are felt to be on forest production, agricultural yields or human health. Sub-Saharan Africa, for example, the negative impact of climate change is becoming more pronounced: because indeed, they are a major concern in the world today not only because of their potential impacts on the environment, but also for their negative impact on agricultural production and hence food security.

Indeed, in this region, agriculture plays a social and economic leadership role. It contributes to food security in households, to create jobs and wealth and the maintenance of social peace. It is for this reason that Boccanfuso, D. et al. (2014) argue that changes from climate directly affects all branches whether forestry, agriculture or industry, and by the same throughout the economy. Significant climate changes are expected, globally, due to the increased concentration of carbon dioxide and other greenhouse gases in the atmosphere.

Problem and research question

As demonstrated that climate change affects agricultural production and exports, **what are the implications of climate change on agricultural production and international trade in Cameroon?**

Specifically, to study the effects of strategies or policies to adapt to climate changes that could be implemented by the policy, we are looking through a static computable general equilibrium model to break the conditional logic combos from a climate change on agricultural production and agricultural exports from Cameroon.

Assumptions

-The Climate change significantly reduces agricultural production in Cameroon.

-The Climate change brings a negative change of agricultural exports in Cameroon.

Review of the literature

This refers to an overview of the various studies already made on the assessment of at least one aspect of climate change, agricultural production and international trade.

First, many studies on the issues of climate change and these pose that climate change negatively impact the poor. Thus, It is in fact the low-income populations or means likely to be most affected by climate change if it results in an increase of extreme events are likely to increase the volatility of food prices (CIRAD/GICC, 2002). Later as it is accepted that the poor are dependent on fuelwood, any changes in forest production is therefore an impact on the level of production of these branches, according to their structure of production, and thereby the rest of the economy (Boccanfuso, D.et al.,(2014).

Significant climate change are expected, globally, due to the increased concentration of carbon dioxide and other greenhouse gases in the atmosphere. They are likely to have significant effects on forests and forestry (Ciesla, 1997). These changes eventually alter the thermal amplitude and length of seasons. With climate change, there will also be a shift and a change of forest fires by region. The influence of temperature or season length will be on growth, regeneration and migration of species (Weber and Flannigan, 1997). The scientists suggested that future climate change will have a significant impact on the distribution, status, species composition and productivity of forests (Aber et al., 2001; Dale et al., 2001; Hansen et al. 2001; McNulty and Aber, 2001).

For Cameroon, the agricultural sector is very important since the 1980 in the stability of this country. This is justified by the writings of Nembot Ndeffo et al. (2009). Following the fall in prices of cash crops followed by deteriorating terms of trade, macroeconomic indicators have gradually degraded from the 1985/1986 financial year. There has been a decline in export earnings, the imbalance in the balance of payments, the fall of budget

revenues, the inability of the State to ensure the regular payment of external debt service, etc. No longer able to assume its social obligations, the state was forced to take a number of measures including the elimination of certain benefits to public officials, the liberalization of the marketing of cash crops, the double declining wages 1993 of about 65%, etc. All these measures have contributed to the deterioration of living conditions of the population.

In recent years there has been in Cameroon to instability in rainfall with negative consequences on climate change thus causing disruption of the agricultural calendar and a decrease in productivity. These climate changes are strongly felt in the Sahelian zone resulting dryness of streams. This is the case for example of Lake Chad whose progressive desiccation pushes people to migrate. These unplanned migration are causing tensions and conflicts between herders and farmers. In areas of the western mountains, there is dryness of the surface water. This likely impact on agricultural production. In the coastal area, with the rising water flooding is a serious threat to cereal production (Fomekong , F. et Ngono, G, 2010).

In the same study, it is said that Cameroon, like most of the world is not immune to climate change. Situation that could degrade the level and quality of life of people in this country or more than 6 out of 10 households are engaged in agriculture (ECAM 3, 2007). This situation is even more marked in the Far North regions (86.5%) and Northern regions or agriculture is by far the main economic activity (respectively 86.5% and 84.4% of households practice this activity). The aggravation of poverty in these regions unlikely to be related to this. Indeed, between 2001 and 2007, these two regions have remained the poorest in the country with levels of poverty incidence falling to 65.9 and 63.7% respectively.

At the meeting of the OECD Council at the June 2009 Ministers, Ministers recognized that "growth" and "environmental concerns" could go hand in hand, and instructed the OECD to develop a Strategy green Growth. Since then, we work with partners representing both governments and civil society to define the framework within which countries can pursue growth and global economic development, and avoiding costly environmental degradation as well waste of natural resources. The effects of climate change are many and they cause enormous imbalances of natural systems entail a risk of sudden effects, very harmful and potentially irreversible. Initiatives launched to identify potential thresholds suggest that some of them have already been crossed-climate change, global nitrogen cycles and biodiversity loss (OCDE, 2011).

However, it should be noted that agriculture is important to the people and let the climate that promotes the deterioration is not understandable. As such, it is essential for food security and

the creation of income. It also has an influence on critical ecosystem services. By 2050, the population consumes 60% more food, which will increase demand and prices of agricultural products (FAO, 2006). Climate change is expected to exacerbate the usual vulnerabilities; Moreover, the geographic distribution of its impacts will certainly have an impact on production and the price of food in different regions, which will result in changes in trade flows internationally.

Agricultural production is declining. One is tempted to think like Fomekong, F. and Ngono, G. (2010), this would be the fact of the negative impacts of climate change on agricultural production, on the deteriorating food security. Moreover, three-quarters of African countries are located in areas where a small reduction in rainfall is likely to produce significant reductions in overall availability.

It is for this reason that Boccanfuso, D. et al. (2014) argue that changes from climate directly affects all branches whether forestry, agriculture or industry, and by the same throughout the economy. Significant climate change are expected, globally, due to the increased concentration of carbon dioxide and other greenhouse gases in the atmosphere. They are likely to have significant effects on forests and forestry (Ciesla, 1997).

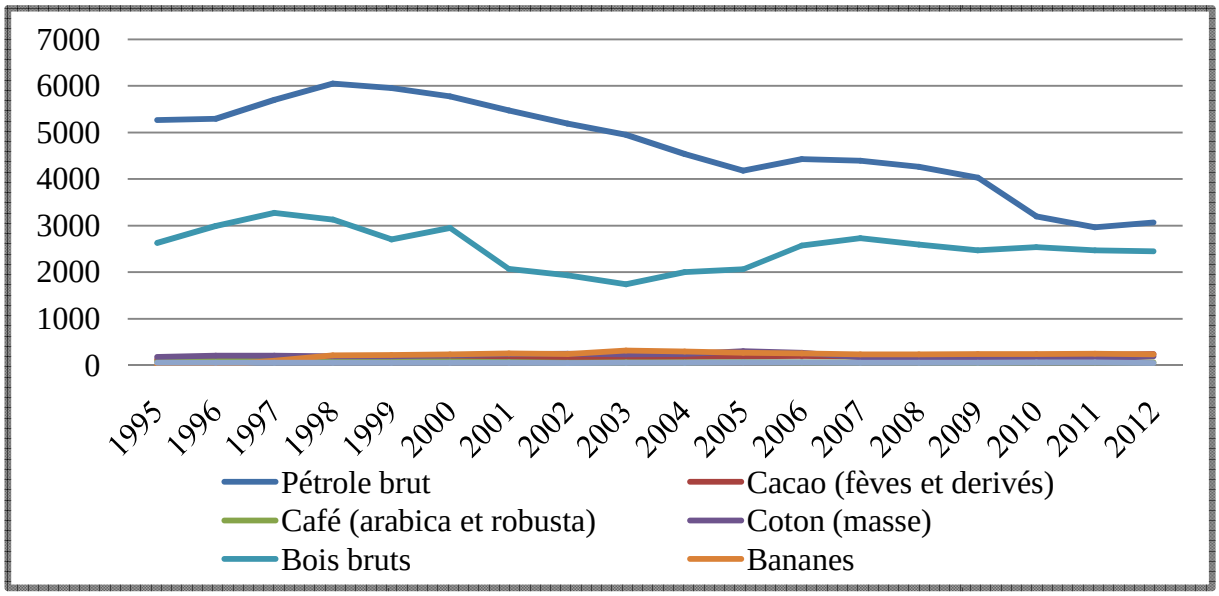
Climate change affects agricultural production in many ways. Thus, for illustrative purposes, the Report on the interaction between cotton, climate change and trade - analyzes the impact of the production and consumption of cotton on climate change and the options and incentives to reduce emissions; also studies the impact of climate change on cotton production and adaptation options. One of the great challenges of development is to ensure food security for poor people around the world while improving the sustainability of production and consumption of food and fiber. Cotton is an important crop for the poor. Exports of these crops from developing countries amounted to $ 2.8 billion E.-U. US dollars in 2009 and 2010 and have thus ensured the income of millions of farmers. The value chain of cotton contributing to climate change while being exposed to the impacts of it. This paper examines the threats posed by climate change for cotton production and the possibilities for mitigation and adaptation for this development.

In the same report, it is said that cotton is the economic engine of rural economies of many francophone countries in West Africa and Central Africa. Unfavorable exchange rate policies are discouraging exports and industry organization and restructuring problems hinder

the growth of cotton production. Higher temperatures are expected due to climate change. The impact on the rate of precipitation is nevertheless poorly determined for this part of Africa.

In terms of agricultural production and trade, Figure 1.1 summarizes the changes in the production of major products that Cameroon mainly exports worldwide.
This is crude oil, cocoa (beans and derivatives), coffee (arabica and robusta), raw wood, rubber, bananas and cotton.

Figure 1.1: Main commodities in thousands of tons.

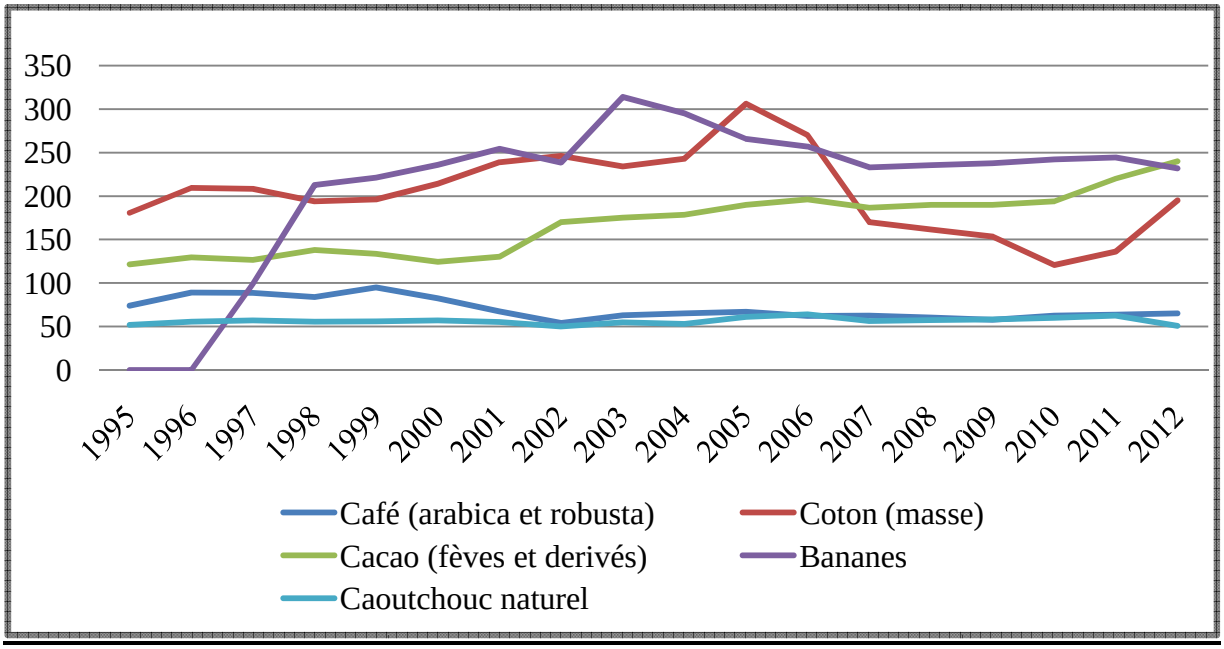


Source: Constructed by the author, based on UNCTAD data.

The production of commodities is essentially dominated by two products, namely crude oil and raw wood. Although the first far exceeds the latter by more than two million tons between 1995 and 2005, timber production remained constant, varying between two and three million tonnes. However, between 1998 and 2005, production of crude oil is decreasing gone from about six million tonnes to four million tonnes. Although we observe a slight increase between 2005 and 2009, it continued its decline until 2012, reaching the bar of three million tons.

As for the other five products during the period from 1995 to 2012, it does not exist in Cameroon a product that has reached the milestone of one million tonnes in production. In short it is the production of bananas trying to position itself at the forefront of such products as rubber meanwhile appears in last position as shown in Figure 1.2.

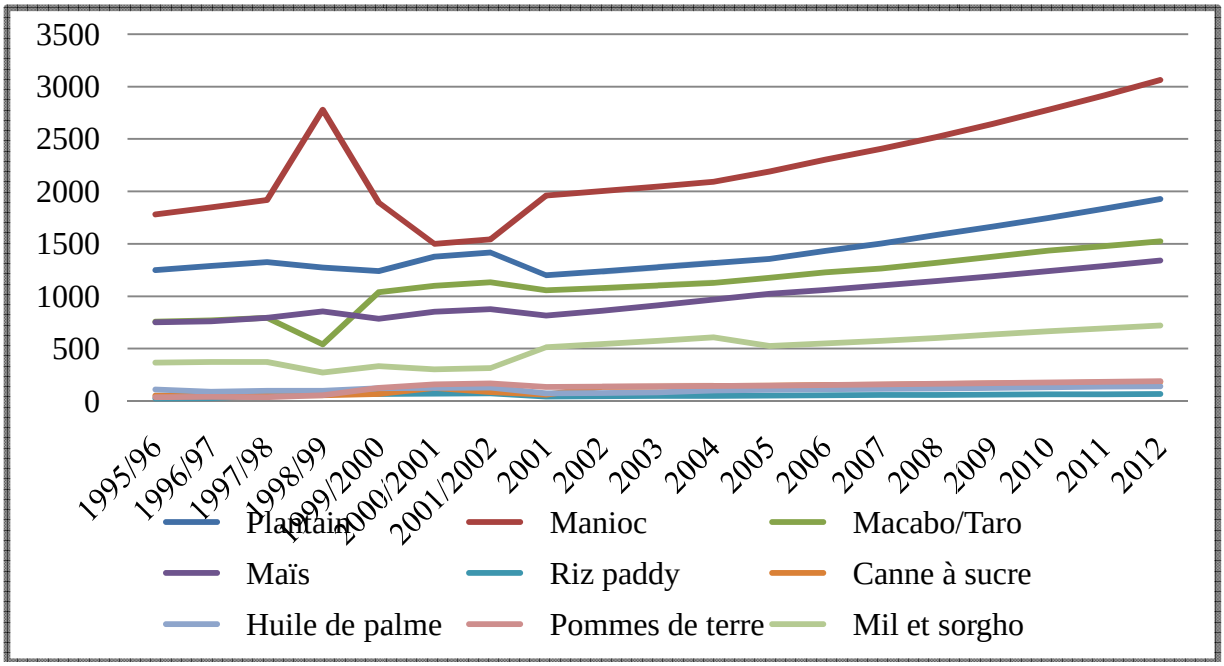
Figure 1.2: Main products without crude oil and crude wooden thousand tonnes.



Source: Constructed by the author, based on UNCTAD data.

The examination of this graph spring growing banana production until 2003. This growth is beginning to lose strength and there is a reversal of the trend until 2012. This curve defined for bananas is almost similar to that of cotton. The only difference is that the output growth of the latter stops in 2005. It decreases until 2010, the year in which it takes the direction of growth. Although cocoa production is not satisfactory, there is a positive trend in production. Coffee production is decreasing while the rubber was stable despite that this product is in last place. However, the Cameroonian soil also produced another category of products. These are the food products which are mainly exported to CEMAC. Figure 1.3 below presents the evolution of key food products.

Figure 1.3: Food crops. Production in thousands of tons.

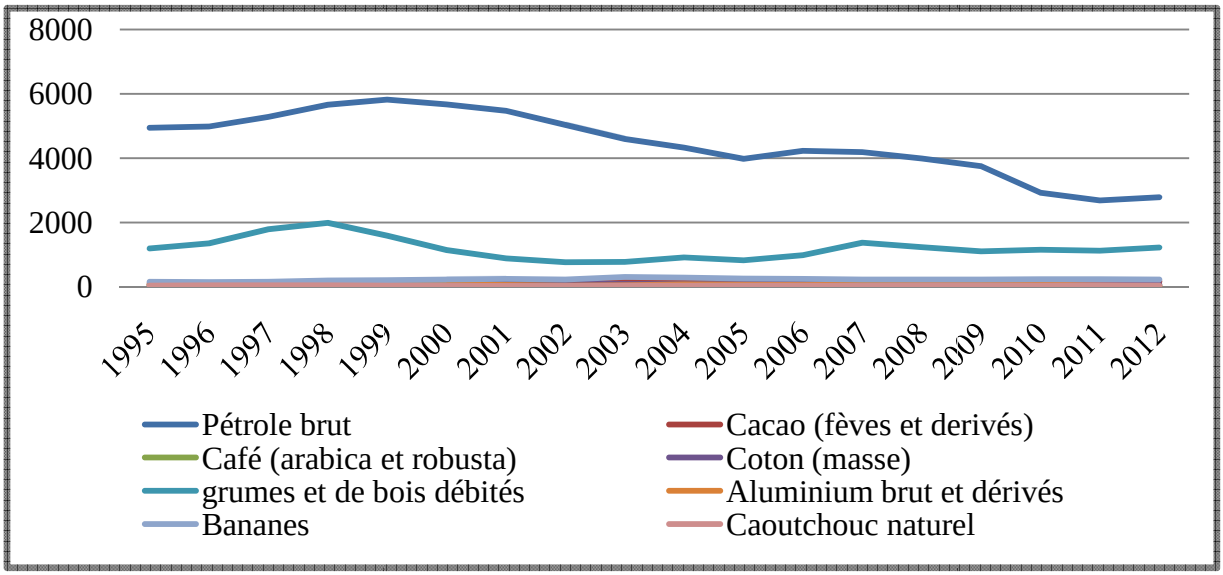


Source: Constructed by the author using data of economic and financial authorities, IMF and BEAC

A review of this graph, we see that only cassava production is around the 3 million tonnes. Products such as plantain, cocoyam / taro and corn followed in production and are below 2 million tonnes. Although there is a growing trend in the production of these food crops, this production does not reach that of the two main commodities listed in Figure 2.1. Note that if we exclude from the sample of commodities oil and wood, while production would be dominated by food products, as other basic products are below 1 million tonnes. After this overview on the production, what about exports?

Cameroon's exports are of two types depending on the destination. In the West and Asia, Cameroon exports the basic products. Food crops for their part are sold inside the continent in general and especially in the CEMAC.

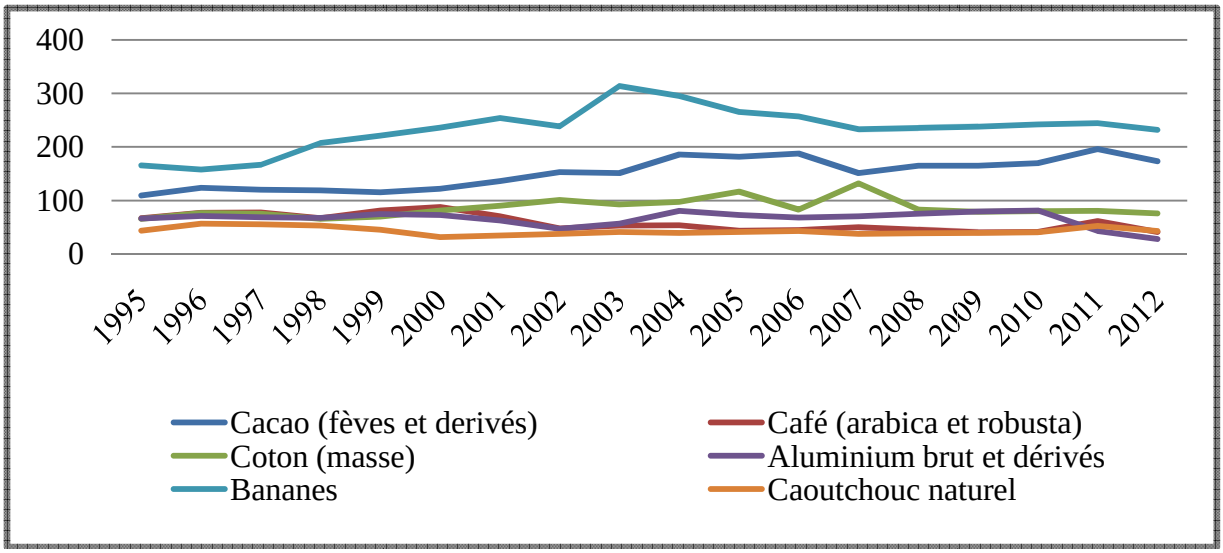
Figure 1.4: Exports of major commodities in thousands of tons.



Source: Constructed by the author, based on UNCTAD data.

We note that the crude oil and raw wood are the two products that dominate exports of Cameroon. These are the same people who are the subject of a high production as shown in Figure 1.1. However, it must be said that exports of crude oil fell largely between 1995 and 2012 while the decline, although it is also observed for the raw wood is not as pronounced. She remained below one million tonnes between 2001 and 2006. As exports of other commodities remained below the bar of one million tonne Figure 1.5 below shows the changes in their exports.

Figure 1.5: Exports of major commodities without crude oil and raw wood in thousands of tons.



Source: Constructed by the author, based on UNCTAD data.

As for the other six commodities exported by Cameroon, it is clear that as the production does not exceed one million tonnes, exports also can not exceed this threshold. Bananas are first.

They are followed by cocoa. Note that the cotton and rubber are the last two products that are exported by Cameroon. Assuming that local consumption is the difference between production and exports, Figure 1.6 shows the quantities consumed between 1995 and 2012. After 2003 and 2004, we find that exports of bananas and cocoa while decreasing remained above those of the period 1995-2003 has (Mougnol à Ekoula, 2015).

In view of the evolution of agricultural production of Cameroon and exports should be the fight against climate change for at least keep the gains. It is therefore necessary to fight against the effects of climate change. Thus According Houde, S. (2005), in the development of a framework for the fight against climate change, economic modeling helps to formulate alternatives and assess to show how the different policies, to judge their effectiveness and to estimate the magnitude as well as the distribution of the economic burden that they generate. In the literature, as well as after the policymakers, computable general equilibrium models have proven business models very popular to formulate and evaluate different policies to fight against climate change.

Thus, again after Houde, S. (2005), the popularity of CGE models to address climate change is based on facts. Thus, Gerard, F. et al. (2002), believe that these effects are found about to affect some basic prices, both in the agricultural sector and the energy sector. One can question the magnitude and direction of these price movements, and their redistributive effects, and ultimately their implications for global growth.

Our goal is to quantify the effects of climate change on agricultural production and on agricultural exports because what is produced is either consumed locally or exported.

Methodology.

Just like Boccanfuso, D. et al. (2014) argue that changes from climate directly affects all branches whether forestry, agriculture or industry, and by the same throughout the economy. It should be noted that the use of CGE models is increasingly done in research centers in developed countries like Canada. But that does not detract from the spirit of research in developing countries such as Cameroon, where there is a particular interest in the use of this model. Indeed, the CGE on climate change has very heterogeneous in their structure and characteristics they consider. For modelers and users of these models, this disparity raises two problems as noted by House (2005). Firstly there is no formal procedure to fit a CGE model to climate change. Secondly it creates a great variability in results between different models. As such Zeyant and Hill. (1999), "noted that for sixteen different CGE model, estimating the marginal cost of abatement Gas Emissions Greenhouse Effect (GHG)

varied by a factor of five. Gerard et al. (2002) had already noted the wide range of CGE models in that the use of a single "climate model" proved to be insufficient to answer the question of whether the "greenhouse effect" corresponded or not a physical reality. If these issues are crucial in our work, we must say that this is the model Decaluwé et al. (2009) taken over by Robichaud et al (2012) that analyze static general equilibrium (PEP-1-1) in the logic of Dervis et al. (1982) which is a static model and the one used by Boccanfuso, D. et al. (2014).

Presentation of static general equilibrium model

The model we present is in the tradition of CGE models initiated by Dervis and Robinson (1982) and taken up by Decaluwé et al. (2009), Robichaud et al (2012) that analyze static general equilibrium (PEP-1-1) and the one used by Boccanfuso, D. et al. (2014).

As in the literature on CGE models, our model is multi-sectoral and static on one country. Four types of economic agents are distinguished in each country: Households, firms (corporations and quasi corporations), the Government and the Stranger. Agricultural exports from Cameroon are formalized. World prices are considered data indeed it is the hypothesis of small country is taken into account.

By against, prices of goods traded bilaterally are endogenous. They are determined by the balance between supply and demand for imports from and to a country in the region. Finally, we assume that all markets are competitive.

The exhibition of the model is made in six (06) blocks.

(1)Production (production technology, demand for primary factors and income); (2) the income and savings (high income); (3) demand (composite demand property); (4) Foreign Trade (differentiation of supply and demand of products); (5) prices and (6) market balance (equilibrium conditions equations for each market).

The production block

Production Technology

We take to block the production process in the standard construction of retaining two CGE assumptions to characterize the production process. This is among other things (01) the assumption of the Cobb-Douglas substitutability between factors of production in a given i in determining the value added in industry i VA_i the assumption of perfect complementarities through branch a Leontief between intermediate inputs (CI_i) and VA_i.

The total production of each branch is determined by a technical production tiered this because of the juxtaposition of different specifications in the production process. And for industries, production is modeled into two levels.

At the first level, the VA_i, t in industry i is obtained from the (consumption) primary factors capital and labor in each branch with a technology type C-D. VA_i value is a C-D function between work (LD_i) and capital (K_i).

$$VA_i = XS_i = AVA_i.[K_i^{\alpha}.LD_i^{(1-\alpha)}] \quad (1)$$

At the second level, VA_i combined consumption (inputs) Intermediate (CI_i) in a Leontief technology that is complementary to factors to produce the composite output XS_i (for the domestic market and for export). Producers maximize their profit on the basis of a concave production function. Inputs for production (VA_i and (CI_i) in industry i are additional factors, so the production technology is Leontief.

$$XS_i = leontief(VA_i, CI_i, v_i, io_i) \quad (2)$$

a.11-Request factors

Intermediate demand factors of production in a given industry i in the economy is obtained as the sum of CI_i these factors of production in this sector. The wage rate that measures the unit hourly wage paid by an employer to an employee in the economy depends on the VA_i in the industry and the demand for labor LD_i, the wage rate w_t ensures equilibrium in the labor market and the price to the value of output.

$$w = PVA_i.\alpha_i VA_i / LD_i \quad (3)$$

The remuneration of the factors of production is such that since VA_i is a function of inputs in a production technique to C-D, sector remuneration of the factors is a function of the VA_i which we subtract one inputs preferably LD_i work since it is moving in the short term and obviously his deputy (the RK_i capital) is determined residually.

$$RK_i = PVA_i.VA_i - w.LD_i \quad (4)$$ PVA_i with is the price of the value added.

a.2- income and savings

a.21- income households

The representative household in each country, with preference C-D draws satisfaction from the consumption of goods. YM_h his income comes mainly from the remuneration of the labor supply (RLM_h), the compensation paid by firms (RKM_h) capital, and transfers from the government and from abroad or the Rest of the World.

$$YM_h = RLM_h + RKM_h \quad (5)$$

The total income of SQS is based on a capital component which is added to the net transfers from the government (TGE). $YE = (1 - \sum_h \lambda k_h) + TGE$ (6)

The returned disposable household h is a function of total household income, tax deductions (flat tax household income $TAXFM_h$) different transfers (transfers from the rest of the world $TROWM_h$ and transfers govern $TRGM_h$).

$RDM_h = (1 - \tau_m) YM_h + TRGM_h - TAXFM_h + (ER) TROWM_h$ (7) with τ_m the income tax rate for households, ER currency conversion factor (nominal exchange rate).

Household income of settlers must use either to consume CM_h or to save SM_h, so the consumption value of household h is a difference between disposable income and savings RDM_h household h. This savings of household h is a function of disposable income. Finally for the total income of all categories of households in our study, just enough to make a sum of the income of each household category.

$SM_h = (PmsM_h) RDM_h$; $CM_h = RDM_h - SM_h$ (8)

Demand of household h for good i is a function of the consumption value of i and the value share of good i in the total value of consumption. Corporate savings SE stems from his income yet on what the salaries paid to households as dividends RSQSM is subtracted, taxes on income SQS (TAXRKE) and transfers of businesses the RDM (TER).

$SE = YE - (TER + TAXRKE + \sum_h RSQSM_h)$ (9)

a.22- income government

Income YG government comes for the most part levies or taxes it imposes on institutional sectors. It receives taxes from households (employees or capitalist), business and international trade. Precisely, this income comes mainly from taxes and levies on other institutions (households, SQS and RDM), on international trade. By deducting from the income of the State consumption (CG) which is determined residually through subtraction of consumption expenditure CG government transfers it to RDM (TGR), households TGM and businesses TGE. As such, Decaluwé et al (2010) think that government expenditures are made in consumer spending and investment and transfer payments to households.

$SG = YG - (CG + TGR + TGE + \sum_h TGM_h)$ (10)

a.3- Foreign Relations

In this section, two assumptions guide our modeling: the "Armington" and the "Little Country". Domestic absorption is an aggregate composed of many locally produced and imported goods, which are imperfect substitutes (Armington assumption).

In terms of commercial relations with foreign countries, as we mentioned above, the first level, the domestic absorption of composite good i is a total CES demand of local well and demand function imports are imperfect substitutes. It must be said to be accurate in differentiating between optimal demand XD_{imp} local products and imported substitutes MX_{imp}.

$$Q_{imp} = b_i^M \left[\delta^M .(MX_{imp})^{-\rho^M} + (1-\delta^M).(XD_{imp})^{-\rho^M} \right]^{-\frac{1}{\rho^M}} \qquad (11)$$

In terms of exports that is to say, the supply on the international market each export sector, they are a function of supply of domestic goods XD_{exp} and exports EX_{exp}, other property is a function of price PD_{exp} domestic and export prices PX_{exp}, the elasticity of transformation of local sales and exports of distributive parameter δ^X about exports and $(1-\delta^X)$ about the part corresponding to the domestic market in production.

$$X_{\exp} = b_i^X \left[\delta^X .(EX_{\exp})^{-\rho^X} + (1-\delta^X).(XD_{\exp})^{-\rho^X} \right]^{-\frac{1}{\rho^X}} \qquad (12)$$

a.4- Measuring Well - being and utility function[2]

In the literature, the measurement of well-being is apprehended through the concept of utility (direct[3] or indirect[4]). The indirect utility is understood as the maximum direct benefits provided by the complex products required by a class of household h for the vector of current prices and consumption compatible with the budget constraint. This notion of indirect utility, it is possible to construct measures of change in well-being expressed in monetary units. The most commonly used of these are the equivalent variation (EV) and compensating variation (CV). EV starting from the baseline as basic measures needed change in consumer income, expressed in prices of the latter, which would allow them to reach the level of indirect utility

[2] -This section draws Decaluwé et al (2001, chapter 10), Véronique Robichaud (2001) and Varian (1992, chap. 7 and 10).

[3]-the direct-use and consider the induced changes in consumption and the nominal income of the population as a result of changes in the environment or economic policy, as a measure of the change in welfare.

[4] -the indirect utility, focuses on changes in terms of changes induced in the utility, comparing the utility level of the affected population, which corresponds to the price of products and quantities consumed in nominal income baseline, corresponding to that of the new situation.

of the new situation. Similarly, the counterfactual situation as a basis measures the change in consumers' income compared to the new situation expressed in prices of the latter, which would allow them to remain at the level of indirect utility of the baseline: it is the VC. IF EV > 0, there is gain of well being and turn to welfare loss, and if CV <0, there is gain of well being and turn to welfare loss.

a.5- The current account

The current account, which identifies the balance of all transactions directly or indirectly related to international trade in goods and services. The balance (in foreign currency) is equal to the difference between all income paid to Rest of World (import MX securities denominated in foreign currencies plus transfers paid by companies to Rest of the World) and all income received (income of export EX currency plus any transfers received from the rest of the world). The peculiarity here is that, since it is located next to the Rest of the World, a positive current account deficit equal to one for the economy, and vice versa. It is saving the Rest of World (ROW revenue-expenditure RDM).

$$BC = \left[\sum_{imp} PWMX_{imp}.MX_{imp} + \frac{1}{E}(\sum_{h} TMR_h + TER + TGR + WEX)\right] - \left[\sum_{\exp} PWEX_{\exp}.EX_{\exp} + TRG\right] \quad (13)$$

With $PWMX_{imp}$ and $PWEX_{exp}$ corresponding respectively to import and export world prices TMR_h transfers from households to Rest of the World, TER, transfers of businesses in Rest of the World; TGR, government transfers to the rest of the world; WEX labor compensation paid to the Rest of the World; TRG, transfers Rest World government currency and E the real exchange rate.

a.6-the Price block

The price system is central to the analysis of the Walrasian general equilibrium. These prices are classified into two categories that is to say, the cost price factors that compensate producers and market prices are those for consumption (Emini, 1998).

a.61-the block of producer price

We can distinguish four types of endogenous producer prices:

-composite producer price (PX_i), producer prices that are specific to exports (PEX_{exp}) prices

tied to production is destined for the domestic market (PXD_i), the price of value added (PVA_i), the composite producer price (PX_i) from the sale of both domestic and foreign markets.

$$PX_{\exp} = \frac{PD_{\exp}.XD_{\exp} + PX_{\exp}.EX_{\exp}}{X_{\exp}} \quad (14) \; ; PVA_i = \frac{PX_i.X_i - \sum_n PC_i CIJ_{\text{in}}}{VA_i} \quad (15)$$

a.62-the block of marcket prices

Here we have four types of awards:

-market prices that are specific to products from a $PD_{i,}$ home production, market prices for imports PM_i, the market price of composite goods PQ_i .

$$PQ_{imp} = \frac{PD_{imp}.XD_{imp} + PM_{imp}.MX_{imp}}{Q_{imp}} \quad (16)$$

a.7-The marckets equilibrium block

The first equation on the macroeconomic equilibrium is that investment I equates to savings S which is the sum of the savings at the national level and rest of world savings converted into national currency.

$$I = SG + SE + \sum_h SM_h + E.BC \quad (17)$$

In the labor market, equilibrium is reached when the amount of labor supplied LS is equal to that required LD $LS = \sum_i LD_i + tc.LS$ (18) with tc the unemployment rate.

Market including market goods and non-tradable goods and for tradable goods, the equilibrium is reached when the total quantity produced Q_{mar} tradable is completely consumed as final consumption C_{mar}, intermediate consumption and demand $CINT_{mar}$ to investment purposes INV_{mar}.

$$Q_{mar} = C_{mar} + CINT_{mar} + INV_{mar} \quad (19)$$

In terms of market goods and non-market services, literature uses Leon (to be developed)[5]. It checks the Walras law on the balance of the nth market.

$$\text{Léon} = Q_{snm} - (C_{snm} + CINT_{snm} + INV_{snm}) \quad (20)$$

[5] Leon is the point simply means that Walras' law holds. Indeed Leon zero at that time. Otherwise the general equilibrium is not reached and it is still run the model.

The relative price change results in a change in foreign demand for agricultural products. The consideration of the effects of climate change on the global market for agricultural products will be made through a decline in world prices. This simulation involves subjecting the Cameroonian economy to a negative shock 40% on the price of wood over a period of fifteen years. This shock is applied to the export prices and import prices of agricultural products.

Interpreting Simulation Results

The impact of climate change is introduced on the basis of pessimistic and optimistic hypotheses drawn from a literature review and expert consultation. The results show that 40% of shock on climate change leads to negative effects on production and agricultural exports. A variation is observed (-7.97)% of agricultural production and (-32.79)% on agricultural exports from Cameroon. It is also noted that agricultural production varies negatively (-10.50)%, this is the same with the value added in the agriculture sector. It varies in the range of (-7.97)%.

We find that the effects of changes negatively affect all variables related to agricultural production, agricultural exports and value added in agriculture.

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